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Invited ViewPoint

Leave no field behind: Future-ready skills for a risky world

Ailsa Holloway [a], Annisa Triyanti [b], Irina Rafliana [c], Soichiro Yasukawa [d], Carinus de Kock [a,*]

[a] RADAR (Research Alliance for Disaster and Risk Reduction), Stellenbosch University, South Africa
[b] UNMGCY (UN Major Group for Children and Youth), (AISSR) Amsterdam Institute for Social Science Research, University of Amsterdam, 166 Nieuwe Achtergracht, Amsterdam 1018WV, the Netherlands
[c] LIPI (Indonesian Institute of Sciences), Jl. Jend. Gatot Subroto 10, Jakarta 12710, Indonesia
[d] UNESCO, Division of Ecological and Earth Sciences (Disaster Risk Reduction), 7 place de Fontenoy, 75352, Paris 07 SP, France

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ABSTRACT

The Sendai Framework, 2030 Agenda (including the SDGs) and Paris Agreements, along with 2016's Agenda for Humanity and New Urban Agenda, collectively underline the urgency for resilience building efforts. This paper probes the need for skill-sets and expertise that are 'fit for purpose' for advancing resilience under conditions of rapid change. It argues for systematic investment in skilled human capital as an integral component of disaster risk reduction and resilience-building, as well as in post-disaster recovery. Yet, the article draws on recent studies of higher education engagement in the disaster risk and resilience domains. These suggest persisting disciplinary fragmentation in teaching, as well as published research in these fields, along with a continuing conflation of the disaster risk discourse with emergency and disaster management. It argues that meaningful disaster risk reduction efforts require higher education to stimulate a more inclusive range of fields than currently engaged.

Contents

1. Introduction

The landmark agreements of 2015, the Sendai Framework for Disaster Risk Reduction [42], 2030 Agenda for Sustainable Development [36] and Paris Agreement on climate change [40], reflect the collective intent to re-chart the course of global development. Recognising cross-cutting urgencies to address accelerating environmental pressures and entrenched structural inequalities, the three interlinked compacts, along with Agenda for Humanity [37] and New Urban Agenda [38] have set a unifying global course to 2030 that seeks to enhance prospects for sustainable and equitable development.

Both implicit and explicit in these 2015 and 2016 blueprints is a collective imperative to stabilise and reverse accumulating global pressure on natural resources. They also articulate a shared, protective vision to counter a complex amalgam of climate change, socio-economic inequality, and fast-paced urban growth - unfolding under conditions of increasing global interconnectedness. In this context, the landmark agreements foreground

* Corresponding author at: RADAR (Research Alliance for Disaster and Risk Reduction), Stellenbosch University, AI Perold Building, Victoria Street, Stellenbosch 7602, South Africa.
E-mail addresses: ailsaholloway@sun.ac.za (A. Holloway), annisa.triyanti@childrenyouth.org (A. Triyanti), s.yasukawa@unesco.org (S. Yasukawa), dekockc@sun.ac.za. (C. de Kock).

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growing concern on the effects of increasingly interlinked shocks on development, also underlining the need to accelerate efforts that integrate risk management and resilience-building as core elements of development.

This paper probes the need for skill-sets and expertise that are 'fit for purpose' for advancing resilience under conditions of rapid change [50]. It argues for greater emphasis on building 'future-ready' skills to embrace the duality of an increasingly risky world as well as the opportunities implicit in the fourth industrial revolution. The paper also explores the role of the higher education enterprise in rising to these challenges – especially in at-risk developing countries. In this context, the paper probes the tension between the rhetoric of integrated, skilled capacity-building to solve 'real-world' problems of risk and resilience, and the reality of a continued bias in favour of siloed, disciplinary learning. It concludes by underlining the merits of resilience/risk management as a non-negotiable, future-ready skill-set for a changing world, and for its accelerated integration across a wider range of fields than is currently the case.

2. Stationarity is dead — risk is dynamic; so are future-ready skills

In their now famous critique, "Stationarity is dead: Whither water management?", Milly and colleagues argued compellingly against the long-held assumption that river systems fluctuated within stable, "unchanging domains of variability" [23]. The authors asserted that pervasive human-induced disturbances of river basins, combined with forces such as climate change had created complex, dynamic conditions that challenged established presumptions of stationarity in favour of increased uncertainty and unpredictability. However, while they stressed the need for new models that would enable optimisation of water systems, the authors also acknowledged such innovations posed a "daunting" challenge. They attributed this to the complexity of the change patterns as well as uncertainties involved, combined with the rapidly changing knowledge base for this field (ibid).

Such shifts in understanding of the complexity of natural and human-induced interactions extend well beyond the field of water resource management. In the case of disaster risk management and reduction, recognition of the endangering potential of nature-society interactions underpinned Press's [29] compelling call for an 'International Decade of Natural Hazard Reduction' [29]. This reflected mounting global momentum to tackle disaster risks developmentally, eventually prompting the International Decade for Natural Disaster Reduction [41] and its successor initiatives, including the Sendai Framework for Disaster Risk Reduction [42].

This 30–40 year evolution in thought is reflected in more critical appreciation of the complexity of disaster risk conditions, including their socio-natural root causes and far-ranging consequences both temporally and spatially. These processes, variously described as a 'new cosmology of risks and crises' [15], 'systemic risks' [11,31], 'natech' crises [19,22] and 'concatenating' 'cascading' and 'compound' disasters [4,5,28] foreground complex, often previously unthinkable, risk-development interlinkages that transgress sectors and geographic scales, with far-reaching effects.

Such interconnections were sharply underlined by the 2008 global energy/food crisis that provoked the "Arab Spring" [4,16,46], the 2011 Tōhoku Earthquake with its intertwined earthquake, tsunami and Fukushima nuclear reactor impacts [19,22] and Thailand's 2011 Chao Phraya floods that triggered a global cascade of supply chain disruptions for the automotive and IT industries [10,26]. They were also profiled by the 2013–2016 West Africa Ebola Outbreak that claimed more than 11,000 lives, with cases confirmed in Europe and the United States [48], as well as the ongoing outbreak in the Democratic Republic of the Congo that threatens to cross borders into Rwanda, Uganda and South Sudan, amplified by unremitting insecurity and conflict in affected areas [47]. The sheer diversity, pace and reach of future risks signalled by these events reinforces calls for new, critical-thinking, and creative skill-sets. As Lagadec notes, "If crises were once a type of severe, dynamic accident, they are now the essential mode of life in our hyper-complex systems. These transboundary crises mark a watershed between mind-sets and tools of the past, and the new strategic landscape that we are now in" ([15], 1).

Strengthened capabilities in critical and creative thinking are also central to social and economic development in an increasingly digital and interlinked world. They are recognised as central ingredients for the knowledge economies that increasingly define the digitally intense Fourth Industrial Revolution [32,33]. In one response to rapid current (and future) technological change, the 2019 World Development Report, underlines the need for three skill-set clusters that are "future-fit" for changing workforce demands These include higher-order cognitive and complex problem-solving skills, as well as socio-behavioural capabilities such as teamwork, perseverance, collaboration and empathy, and "skill combinations that are predictive of adaptability such as reasoning and self-efficacy" ([49], vii, 3).

The confluence of a world characterised by increasing risk complexity with rapidly changing workforce demands has direct implications for the skill-sets needed to advance resilience and risk reduction. It highlights the urgency for skilled human resources that embrace and integrate the duality of an increasingly risky world as well as the evolving opportunities implicit in the fourth industrial revolution.

3. Higher education and disaster risk reduction — future ready or not?

Access to skilled capacity that simultaneously seizes technologically-driven opportunities and manages new, unexpected risk configurations is a function of a robust, engaged tertiary education enterprise. For instance, Salmi has vigorously argued that our aspirations of resilient infrastructure and strengthened climate risk management remain unrealistic "without the participation of scientists and well-trained professionals and the application of leading edge research for finding appropriate solutions to the big challenges faced by mankind" ([32], 12).

Yet, this calls for the higher education sector to become far more involved in addressing contextually relevant, "real-world" problems. It also profiles a greater transdisciplinary emphasis, regarded as crucial for tackling current and future development imperatives [9,14,17,20]. However, like sustainability science and other applied, cross-disciplinary fields, the disaster risk domain has been slow to achieve recognition as a legitimate focus of contemporary scholarship [12,51]. Its complex, dynamic and cross-disciplinary reach, as well as expansive scope of application have long posed theoretical, disciplinary and practical challenges to tertiary institutions.

For instance, in David [1] critique of the then-engagement of academia in the disasters field, he noted that "disciplinary training imposes a viewpoint and represents a barrier to holistic forms of understanding". … "This has led to domination of the field by the technocratic disciplines — engineering, geophysics, hydraulics, meteorology and so on" ([1], 297). He further argued that such an outcome was partly attributed to the "failure of a coherent academic field to emerge from the welter of disciplines that have had a hand in the study of disasters" (ibid).

Remarkably, more than 20 years later, and despite wide-ranging scholarship in risk reduction and resilience, the higher education enterprise has only recently embraced these fields as credible scholarship domains. For instance, a review of 59 DRM masters degree programmes in western Europe and Scandinavian countries conducted under the aegis of the European Union's Erasmus project *Knowledge for Resilient Society (K-FORCE)* indicated that most courses had been introduced within the previous five years [24]. Moreover, 30 and 18 of the courses offered were respectively geared towards either professionally-oriented disaster and emergency management or geo-technically-aligned natural hazards (ibid). Similarly, the ANDROID Disaster Resilience Network's survey of European universities cited in the *Disaster Resilience Education and Research Roadmap for Europe 2030* revealed few disaster resilience-related academic programmes across Europe, with a preferential emphasis on engineering courses [3,27].

Such conclusions echo recent findings on capacity building for a more resilient health sector workforce [18]. This review of published literature indicated limited evidence of interdisciplinary, let alone transdisciplinary

education related to resilience-oriented skill-sets for the health sector. The authors noted well-established training collaborations within narrow professional bands, such as between schools of social work and public mental health departments. Recognising that this confining scope of engagement offers limited promise for advancing future resilience capacity, they urged more inclusive cross-disciplinary involvement. This included, as one example, greater integration of "health sciences with urban planning and engineering education" (ibid, 8).

Evidence of persisting disciplinary fragmentation in the field is also signalled in published research. A 1999–2013 review of peer-reviewed disaster risk journal articles yielded publications from a diverse array of disciplines [8]. Yet, it also foregrounded persisting fragmentation between fields, as well as limited transdisciplinary application. Despite evidence of strong multi-author collaboration, study findings cautioned that "more than 40% originate from a singular disciplinary background" (ibid). They also noted hesitance in disaster risk research that integrated perspectives from divergent fields, with 36% of multi-authored articles involving only two similar disciplines, "such as climatology and meteorology or geography and environmental studies" (ibid).

4. Discussion — "de-silo-ing" disaster risk beyond conventional fields

Despite at least three decades of policy advocacy and debate exhorting the scholarly value of the disaster risk domain [2,6,45], the field has only recently gained institutional traction in higher education. This slow uptake is not merely due to its silo-ing by discipline; it is also due to the disaster risk domain's tenacious conflation with emergency and disaster management that, both conceptually and developmentally, confines its scope of scholarship and application.

Contrary to popular perceptions, disaster risk management is primarily a *developmental* field of scholarship and practice, not one delimited by preparedness and response. Its defined focus emphasises "*disaster risk reduction policies and strategies to prevent new disaster risk, reduce existing disaster risk and manage residual risk, contributing to the strengthening of resilience and reduction of disaster losses*"([39], 15).

Both explicitly and implicitly, this conceptualisation is developmentally-oriented, extending well beyond disaster management's more confined focus on "*the organization, planning and application of measures preparing for, responding to and recovering from disasters"*(ibid, 14) which gears itself towards strengthened preparedness and management of disaster events, rather than that of disaster risks.

The domain's growing credibility as a developmental discourse holds promise both for tertiary education sector and for enhanced societal resilience. This is due to both its conceptual scope that accommodates complex risk processes, and its aptitude for revealing skill-sets that manage rapid change. The field also represents a particularly 'tight-fit' with a *developmental model* of contemporary university engagement, where course offerings are closely aligned with societal needs for human resources, research is directed "towards applied areas of need", and where "advisory services" are provided to government and communities ([21], 513). Fig. 1 suggests both the logic and implications for university engagement in the disaster risk domain.

The field's growing scholarly and trans-generational value has been underscored by high profile conferences and events. For instance, the 2016 UNISDR Science and Technology Conference on the Implementation of the Sendai Framework for Disaster Risk Reduction 2015–2030 led to both a UNISDR Science and Technology Roadmap and UNISDR Science and Technology Partnership network [34,43]. This forum also catalysed the establishment of a young scientists' platform on disaster risk reduction within the United Nations Major Group for Children and Youth [44].

The ground-swell in interest by young and emerging scientists and professionals in the field is particularly evident in the Global South. It is materially reflected by the Indonesia-based initiative, *U-Inspire* (Youth and Young Professionals on Innovation, Science, and Technology Platform for Resiliency), that views "Indonesian youth and young professionals as the generator of innovation in science, engineering, and technology for disaster resilience at national and global level" [35]. Already, this energetic collaboration has organised a Regional Asia and Pacific Workshop in Jakarta together with LIPI (Indonesian Institute of Sciences) and UNESCO, attended by nearly 60 participants. It has also stimulated a partner platform for young scientists and young professionals in Pakistan, and prompted similar initiatives in Malawi.

In a second example from Africa, over the past decade, thousands of young people have enrolled in disaster risk-related academic programmes [30]. In countries like Ethiopia and Madagascar, their post-graduation employment trajectories have begun to transform the national disaster risk workforce profile, enhancing prospects for greater resilience [7,12,13,25].

5. Conclusion: future-ready skills for reducing risk — leave no field behind

Skilled human capacity in the risk and resilience domains is key for progress towards the Sustainable Development Goals. In this context, the disaster risk domain provides a critically relevant and socially responsive frame for responding to an increasingly risky world. Yet, the field's full potential in integrating knowledges from a diversity of disciplines and practice domains remains largely unrealised. This is, in part, due to its persistent "silo-ing" within single disciplines (such as engineering or environmental science) as well as tendencies to "shoe-horn" the field within emergency and disaster management.

Tertiary education is tasked with cultivating the new knowledges for increasingly complex risks. Not only does this presuppose a more vigorous university engagement to step beyond established disciplinary boundaries

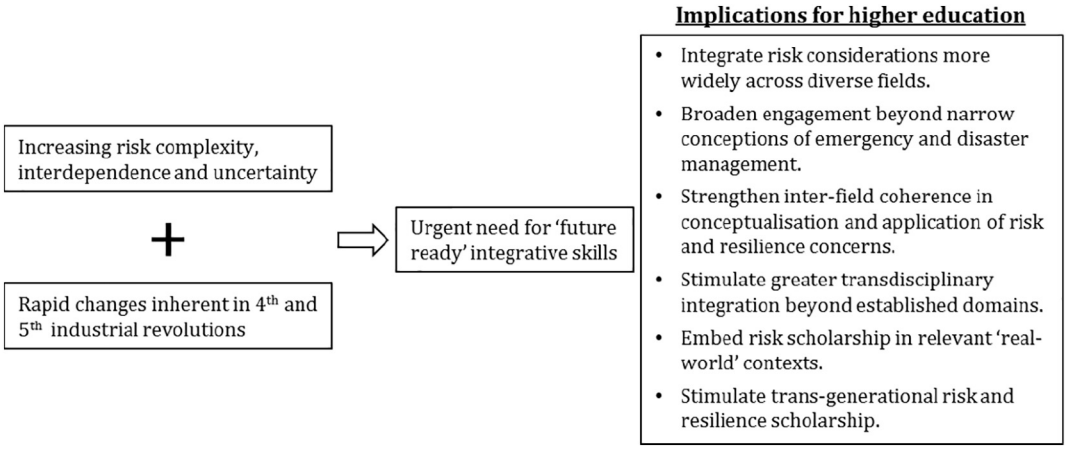

Fig. 1. Rationale for higher education involvement in disaster risk and resilience domains.

in real-world risk contexts; more important, it is a call to leave no field behind.

Declarations of interest

None.

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References

[1] Alexander D. The study of natural disasters, 1977–1997: some reflections on a changing field of knowledge. Disasters 1997;21(4):284–304. https://doi.org/10.1111/1467-7717.00064.

[2] Alexander DE. A survey of the field of Hazard and disaster studies. J Civil Eng Arch 2013;7(68):841–53.

[3] Amaratunga D, Faber M, Haigh RP, Indirli M, Kaklauskss A, Lill I, et al. ANDROID Report: disaster resilience education and research roadmap for Europe 2030. Tulsa, Oklahoma, USA: Disaster Resilience Network; 2015.

[4] Biggs D, Biggs R, Dakos V, Scholes RJ, Schoon M. Are we entering an era of concatenated global crises? Ecol Soc 2011;16(2):27 http://www.ecologyandsociety.org/vol16/iss2/art27/.

[5] Cutter SL. Compound, cascading or complex disasters: what's in a name? Environ Sci Policy Sustain Dev 2018;60(6):16–25. https://doi.org/10.1080/00139157.2018.1517518.

[6] Cutter SL, Ismail-Zadeh A, Alcántara-Ayala I, Altan O, Baker DN, Briceño S, et al. Global risks: pool knowledge to stem losses from disasters. Nature 2015;522(7556):277–9. https://doi.org/10.1038/522277a.
This article calls for improved disaster risk management for sustainability. It stresses the need to increase interdisciplinary collaboration among researchers and scientists. The authors highlighted the drawbacks of focusing on one natural hazard in science-policy advocacy. They also stress the need for coherent science-based assessment to advance progress towards disaster risk management, climate change, and sustainable development targets.

[7] Francioli A. Periperi U annual report 2018: 26 may 2017-25 may 2018. Stellenbosch, South Africa: RADAR http://www.riskreductionafrica.org/assets/files/PPU%202017-2018%20Annula%20Report_%20Public%20Version.pdf; 2018, Accessed date: 10 February 2019.

[8] Gall M, Hoan K, Cutter SL. Integrated research on disaster risk: is it really integrated? Int J Disaster Risk Reduct 2015;12:255–67. https://doi.org/10.1016/j.ijdrr.2015.01.010.

[9] Gibbons M, Limoges C, Notwotny H, Schwartzman S, Scott P, Trow M. The new production of knowledge. The dynamics of science and research in contemporary societies. London, UK: Sage; 1994. https://doi.org/10.4135/9781446221853.

[10] Haraguchi M, Lall U. Flood risks and impacts: a case study of Thailand's floods in 2011 and research questions for supply chain decision making. Int J Disaster Risk Reduct 2015;14(2015):256–72. https://doi.org/10.1016/j.ijdrr.2014.09.005.

[11] Helbing D. Globally networked risks and how to respond. Nature 2013;497(7447):51–9. https://doi.org/10.1038/nature12047.

[12] Holloway A. Strategic mobilisation of higher education institutions in disaster risk reduction capacity building: experience of Periperi U. Global Assessment Report (GAR) on disaster risk reduction 2015. Geneva, Switzerland: UNISDR; 2014. https://doi.org/10.13140/RG.2.1.5014.8081.

[13] Holloway A, Fortune G. Beyond fragility: advancing skilled human capital for disaster risk reduction and resilience in Africa. Contributing paper, global assessment of risk; 2019 [in press].

[14] Horlick-Jones T, Sime J. Living on the border: knowledge risk and transdisciplinarity. Futures 2004;36:441–56. https://doi.org/10.1016/j.futures.2003.10.006.

[15] Lagadec P. A new cosmology of risks and crises: time for a radical shift in paradigm and practice. Rev Policy Res 2009;26(4):473–86. https://doi.org/10.1111/j.1541-1338.2009.00396.x.

[16] Lagi M, Bertrand KZ, Bar-Yam Y. The food crises and political instability in North Africa and the Middle East. Cambridge, MA, USA: New England Complex Systems Institute; 2011. https://doi.org/10.2139/ssrn.1910031.

[17] Lotz-Sisitka H, Wals AEJ, Kronlid D, McGarry D. Transformative, transgressive social learning: rethinking higher education pedagogy in times of systemic global dysfunction. Curr Opin Environ Sustain 2015;16:73–80. https://doi.org/10.1016/j.cosust.2015.07.018.

[18] Madrigano J, Chandra A, Costigan T, Acosta JD. Beyond disaster preparedness: building a resilience-oriented workforce for the future. Int J Environ Res Public Health 2017;14(12):1563–77. https://doi.org/10.3390/ijerph14121563.
This reviews the literature for advancing a resilience-oriented workforce, focusing on organizational structures, training, education, and leadership models. It discusses the importance of a resilience-oriented workforce and community partnerships in building resilience. The authors argue that both postgraduates and ongoing professional education are crucial in the interdisciplinary field to enhance the environmental public health workforce.

[19] Masys AJ, Ray-Bennett N, Shiroshita H, Jackson P. High impact/low frequency extreme events: enabling reflection and resilience in a hyper-connected world. Procedia Econ Finance 2014;18(2014):772–9. https://doi.org/10.1016/S2212-5671(14)01001-6.

[20] Max-Neef MA. Foundations of transdisciplinarity. Ecol Econ 2005;53:5–16. https://doi.org/10.1016/j.ecolecon.2005.01.014.

[21] McCowan T. Universities and the post-2015 development agenda: an analytical framework. High Educ 2016;72(4):505–23. https://doi.org/10.1007/s10734-016-0035-7.

[22] Miller DS. Public trust in the aftermath of natural and NA-technological disasters: hurricane Katrina and the Fukushima Daiichi nuclear incident. Int J Sociol Soc Policy 2016;36(5/6):410–31. https://doi.org/10.1108/IJSSP-02-2015-0030.

[23] Milly PCD, Betancourt J, Falkenmark M, Hirsch RM, Zbigniew W, Kundzewicz ZW, et al. Stationarity is dead: whither water management? Science 2008;319. https://doi.org/10.1126/science.1151915 [5863, 573-574].

[24] Nielsen L, Faber MH. Survey and design of master level programs in disaster risk management. 1st international symposium K-Force: knowledge for resilient society. Novi Sad, Serbia: Higher Education Technical School of Professional Studies, Serbia and University of Novi Sad, Faculty of Technical Sciences, Department of Civil Engineering and Geodesy; 2017; 230–46.
This chapter within the symposium proceedings discusses findings from a survey on 59 DRM masters programmes conducted in 11 countries from Europe and Scandinavia under the European Union's Erasmus project Knowledge for Resilient Society (K-FORCE). It reported that more than 50% of the programmes are offered by the UK. It also revealed that most programmes still focus on natural hazards rather than disaster risk management.

[25] Ofir Z, Mentz M. Periperi U phase III summative evaluation. Stellenbosch, South Africa. http://www.riskreductionafrica.org/assets/files/PPU-Phase-III-Evaluation-Report-FINAL.pdf; 2015.

[26] Okazumi T, Nakasu T. Lessons learned from two unprecedented disasters in 2011 — great East Japan earthquake and tsunami in Japan and Chao Phraya River flood in Thailand. Int J Disaster Risk Reduct 2015;13(2015):200–6. https://doi.org/10.1016/j.ijdrr.2015.05.008.

[27] Perdikou S, Horak J, Halounová L, Palliyaguru R, Lees A. The capacity of European higher educational institutions to address threats imposed by natural hazards. Nat Hazards 2016;81:1447–66. https://doi.org/10.1007/s11069-015-2139-2.

[28] Pescaroli G, Alexander DE. A definition of cascading disasters and cascading effects: going beyond the 'toppling dominos' metaphor. Planet@Risk 2015;3:1.

[29] Press F. Role of science and engineering in mitigating natural hazards. Keynote address delivered to the eighth world conference on earthquake engineering. Proceedings of the eighth world conference on earthquake engineering, San Francisco, California. Post-conference volume; 1984. p. 13–24.
This keynote address at the Eight World Conference on Earthquake Engineering foregrounded natural hazards, as well as the role of scientists and engineers in hazard mitigation, and the role of the government. It also proposed the establishment of the 'International Decade of Natural Hazard Reduction' (IDHR), which provided an important stimulus and argument for the International Decade for Natural Disaster Reduction.

[30] RADAR (Research Alliance for Disaster and Risk Reduction). A risk education network: extending connections, reinforcing resilience. Stellenbosch, South Africa. http://www.riskreductionafrica.org/assets/files/PPU%20brochureWEB1_Oct17.pdf; 2017, Accessed date: 15 January 2019.

[31] Renn O. Systemic risks: the new kid on the block. Environ Sci Policy Sustain Dev 2016;58(2):26–36. https://doi.org/10.1080/00139157.2016.1134019.

[32] Salmi J. Tertiary education and the sustainable development goals: in search of a viable funding model. New York, New York, USA: The International Commission on Financing Global Education Opportunity; 2016.

[33] Schwab K. The fourth industrial revolution. World economic forum; 2016 [Cologny, Switzerland].

[34] Trogrlić RŠ, Cumiskey L, Triyanti A, Duncan MJ, Eltinay N, Hogeboom RJ, et al. Science and technology networks: a helping hand to boost implementation of the Sendai Framework for disaster risk reduction 2015–2030? Int J Disaster Risk Sci 2017;8(1):100–5. https://doi.org/10.1007/s13753-017-0117-x.

[35] U-Inspire. Youth and young professionals on innovation, science, and technology platform for resiliency. Available at: https://www.facebook.com/uinspire.indonesia/; 2018.

[36] United Nations. Transforming our world: the 2030 agenda for sustainable development. New York, New York, USA: United Nations General Assembly; 2015.

[37] United Nations. One humanity: shared responsibility. Report of the secretary-general for the world humanitarian summit. A/70/709. New York, New York, USA: United Nations General Assembly; 2016.

[38] United Nations. New urban agenda. A/Res/71/256. New York, New York, USA: United Nations General Assembly; 2016.

[39] United Nations. Report of the open-ended intergovernmental expert working group on indicators and terminology relating to disaster risk reduction. New York, New York, USA: United Nations General Assembly; 2016.

[40] UNFCCC. Adoption of the Paris agreement (FCCC/CP/2015/L.9/Rev.1); 2015 [Paris, France].

[41] UNGA. International decade for natural disaster reduction (A/Res/44/236). New York: New York, USA; 1989 http://www.un.org/documents/ga/res/44/a44r236.htm, Accessed date: 10 January 2019.

[42] UNISDR. Sendai framework for disaster risk reduction 2015-2030. New York, New York, USA: UNISDR; 2015.

[43] UNISDR. The science and technology roadmap to support the implementation of the Sendai framework for disaster risk reduction 2015–2030. http://www.preventionweb.net/files/45270_unisdrscienceandtechnologyroadmap.pdf; 2016, Accessed date: 20 January 2019.

[44] UNMGCY. Young scientists platform on disaster risk reduction. http://www.preventionweb.net/files/47816_47816conceptnoteyoungscientistsplat.pdf; 2015, Accessed date: 8 January 2019.
[45] Van der Waldt G. Disaster risk management: disciplinary status and prospects for a unifying theory. Jàmbá J Disaster Risk Stud 2013;5(2):1–11. https://doi.org/10.4102/jamba.v5i2.76.
[46] Von Braun J. Food and financial crises: Implications for agriculture and the poor. D.C., USA: International Food Policy Research Institute Washington; 2008.
This paper examines the phenomenon of a food crisis due to high food prices from 2007 to mid-2008. The author described the impact of the food crisis on food and nutrition, economic and political stability. The 2007–2008 food-energy crisis highlighted the high levels of interconnectedness and prospects for global transfer of shocks and their impacts.
[47] WHO. Emergencies preparedness, response Ebola virus disease – Democratic Republic of the Congo. https://reliefweb.int/report/democratic-republic-congo/ebola-virus-disease-democratic-republic-congo-disease-outbreak-35; 2019, Accessed date: 31 January 2019.
[48] WHO Ebola Response Team. After Ebola in West Africa – unpredictable risks, preventable epidemics. N Engl J Med 2016;375(6):587–96.
[49] World Bank. World development report 2019: the changing nature of work. Washington, DC, USA: World Bank; 2019. https://doi.org/10.1596/978-1-4648-1328-3.
The report emphasizes the impact of rapid technology on future jobs and expected skill sets for human capital. It underlines the required 'technical know-how' as well as soft skills such as perseverance, collaboration, and empathy. The report also describes the human capital index which measures the negative consequences in lack of investment in human capital in terms of the lost productivity of the next generation of workers.
[50] World Economic Forum. The global human capital report 2017: preparing people for the future of work. Cologny, Switzerland: World Economic Forum; 2017.
[51] Yarime M, Trencher G, Mino T, Scholz R, Olsson L, Ness B, et al. Establishing sustainability science in higher education institutions: towards an integration of academic development, institutionalization, and stakeholder collaborations. Sustain Sci 2012;7 (Supplement 1):101–13. https://doi.org/10.1007/s11625-012-0157-5.