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Profiling Informal Settlements for Disaster Risks

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Abstract

Informal settlements, where mostly the urban poor reside, tend to be located in hotspots of natural hazards such as floods, fire, earthquakes and tsunamis. The devastating impacts of these natural hazards on such settlements can be attributed to the higher levels of physical, economic, social and environmental vulnerability in conjunction with inadequate and poor level of disaster preparedness. Conceptualizing a detailed risk profile, in the context of informal settlement characteristics presents a starting point to which the impacts posed by environmental hazards can be addressed effectively. This paper develops a theoretical framework through literature review coupling the concepts of "disaster hazards", "vulnerability" and "informal settlements". The findings suggest that the policy environment (environmental/land use planning and communication) impacting the informal settlement characteristics (demographic, financial, social/poetical and locational/environmental) is key to managing disaster risk profile in informal settlements. The paper concludes by identifying five theoretical propositions that can assist in disaster preparedness.

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Keywords: Informal Settlement; Vulnerability; Disaster Risk Reduction; Resilience; Policy Environment

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1. Introduction

Informal settlements are dwelling places of around a billion people in the world. In other words, one-seventh of the world's population and one-third of the world's urban population live in slums respectively [25]. The population transformation projections based on the current rate of world's urban population growth suggest that an estimated 66 percent of the population will live in urban areas by 2050 from 54 percent in 2014 [28, 29]. Literature suggests that urban population growth rate occurs primarily in small and medium sized cities [33] where informal settlement expansion occurs in hazard prone areas such as flood plains, valley, marshy areas and watercourses [7, 22]. High population density coupled with deprived locations of informal settlement as a result of urban growth compounds

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existing vulnerability. Risk is seen as a function of disaster hazard, vulnerability and exposure [14]. Vulnerability defies a precise and objective definition but for the purpose of this paper, vulnerability is defined as the susceptibility of a system to disaster hazards due to its inherent characteristics. Also, exposure refers to degree and extent to which a system is wide-open to disaster hazards. The level of vulnerability in informal settlements has made it imperative to assess, analyze and present its risk profile to facilitate effective hazard risk management.

Risk assessment, mitigation, and evaluation are the three major embodiments of hazard risk management [30]. Risk assessments provide a strong basis to commence the process of reducing the negative consequences posed by natural hazards and involves hazard identification and associated risk impacts. The negative effects posed by hazards require prioritization, implementation, and maintenance of appropriate hazard risk-reducing measures recommended from the risk assessment process. The recommended actions to mitigate the risk from assessment are then evaluated to ascertain its effectiveness after implementation.

However, hazard risk management in informal settlement has received little attention in literature potentially due it problematic nature [36] and also, these settlements are located outside the planning schemes of urban areas. Moreover, the informal settlements are exposed to high levels of vulnerability with limited coping capacity. Against this backdrop, this paper constructs a theoretical framework, through a literature review, coupling the concepts of "disaster hazards", "vulnerability and "informal settlements" to develop better understand disaster risk management in informal settlements.

2. Methodology

This paper is based on extensive search and review of relevant articles necessary for the study. A total of 193 published articles on hazard vulnerability and informal settlements were downloaded from high standard databases such as Scopus, Science Direct and Environment complete. The database publishers indicate that these databases are among the high standard databases that provide high quality articles in sciences, social sciences and arts and humanities. Selection of articles for inclusion in the study was manually done and was based on three major criteria: 1) the article's relevance to the study 2) the article's applicability to disaster hazards or informal settlements and 3) downloaded articles have citations and references of authoritative scholars in informal settlements, hazard vulnerability and resilience. Downloaded articles were then reviewed and sorted using the set criteria.

3. Informal Settlements: Hazard Vulnerability Perspective

Informal settlements, slums, squatter settlements, unplanned towns and shantytowns are terms that are used interchangeably in literature. Conversely, the definition of the term informal settlement is arguable and subject to much academic debate [18]. Informal settlements are places built outside land-use scheme and without planning permission. They are composed mainly of makeshift houses that deviate from the standard building regulations. More so, areas marked as informal settlement have inadequate access to safe water and sanitation facilities, irregular supply of electricity and road for emergency access. Similarly, they are an overcrowded population and an insecure tenure of stay [37].

Over the world, the location of informal settlement on hazard risk areas has been discussed extensively in literature [17, 7]. In this paper, vulnerability of informal settlements to natural hazard is categorised into four areas namely: physical, economic, environmental and social vulnerabilities. The location of informal settlements (flood plains, marshy areas, low-lying areas and river courses) coupled with high population growth, poor planning and quality of housing [12, 7] and unpredictable strike of natural hazard renders them vulnerable to natural hazards.

Dwellers of informal settlements, mostly in-migrant, have low economic capabilities [10] that seriously impact upon their ability to prepare adequately for an impending natural hazard. A high percentage of in-migrants are low-income earners or unemployed rendering them incapable of renting a house or room in a properly laid out residential area. Their economic position pushes them to rent apartments in informal locations, as they have cheaper residential opportunities. In addition, the low-income characteristics of such people inhibit their ability to invest in structural mitigation measures to reduce hazard impacts.

Expansion in terms of population and industry in informal settlements triggers an increase demand for natural resources such as land for both residential and industrial development reasons. This in turns results in natural vegetation destruction in these areas to accommodate the rising construction activities, which increases settlers' susceptibility to different types of natural hazards. Changes in land-use patterns are another phenomenon that arises in the course of urban population increase. The predominant changes usually occur in agricultural land-use to residential or industrial land-use [27]. Features of urban construction such as paving of surfaces reduce infiltration, and permeability of run-off water through the soil.

Inequality among humans, countries and communities give rise to social vulnerability, which shape, the susceptibility of various groups to natural hazards. The vast differences in susceptibility levels result in differences in preparation and resilience rate. Informal settlement are characterised by low access to political power, poor levels of education together with culturally and linguistically diverse minority groups. Low level of literacy in informal communities hinders their capability to decipher warning information and access to preparatory and recovery information [5]. The diverse culture and ethnic structure of informal settlements may make communication of risk an arduous task as risk message needs to be communicated in several languages to pave way for effective communication response.

4. Effects of Informal Settlements Characteristics on Vulnerability

Reducing vulnerability is a direct way and proactive approach of mitigating disaster impacts. Vulnerability to disaster hazards is context specific, which requires stringent assessment and analysis of characteristics of a given area to reduce disaster consequences. Characteristics of informal settlements have strong linkages with vulnerability to disaster hazards [17, 23].

Informal settlements are heterogeneous in nature and mainly made up of in-migrants from different background and culture. People who reside in informal settlements are generally with no or little educational qualification to work in the formal sector of the economy [16, 12]. Majority of the inhabitant are engaged in low-income related activities such as production of handicraft products, small-scale commercial activities (sale of grocery) and agriculture. Inhabitants have limited source of income and unstable livelihood making them incapable of re-building their houses let alone bouncing back to normal business operation when struck by a disaster hazard.

Most informal settlements before major growth were left as vacant areas of urban environment due to their inherent risk to various forms of disaster hazards [2, 8]. The demarcation of such areas explains why informal settlements are associated with poor zoning and planning, inadequate infrastructure, poor environmental conditions and insecure tenure. Frequent threat of eviction of informal settlers by city authorities [34] and low-income levels reinforces settlers' behaviour of constructing housing of low quality. Dwellers residing in these settlements perceive that spending huge sum of money building houses is not rational as they may be demolished during eviction. Moreover, the insecure tenure characteristics induce the construction of low quality housing less resistant to disaster hazards [32].

Urban authorities have side-lined planning in informal settlements based on the perception that they are problematic and lie outside the planning area. As a result, informal settlements are characterized by inadequate access to infrastructure such as storm drains. Inadequate access to storm drains and lack of maintenance of the available storm drains coupled with poor waste management reduces ability of run-off water to move swiftly. Similarly, behaviours of dwellers to use available storm drains as refuse areas [19] exacerbate their vulnerability and impacts of environmental hazards.

High percentage of urban population growth occurs in informal settlements [33]. The immediate consequence of high growth in population is degradation of land for residential and industrial construction purposes. Paving of land surfaces during construction is indispensable, which reduces infiltration and increases run-off water channelled through the limited drains in informal settlements. This increases the susceptibility of informal settlement to flooding as well as increased devastating impacts. Social resilience to disaster depends highly on the strong social cohesion between community members and authorities [15].

Figure 1: Disaster Risk in the Context of Informal Settlement

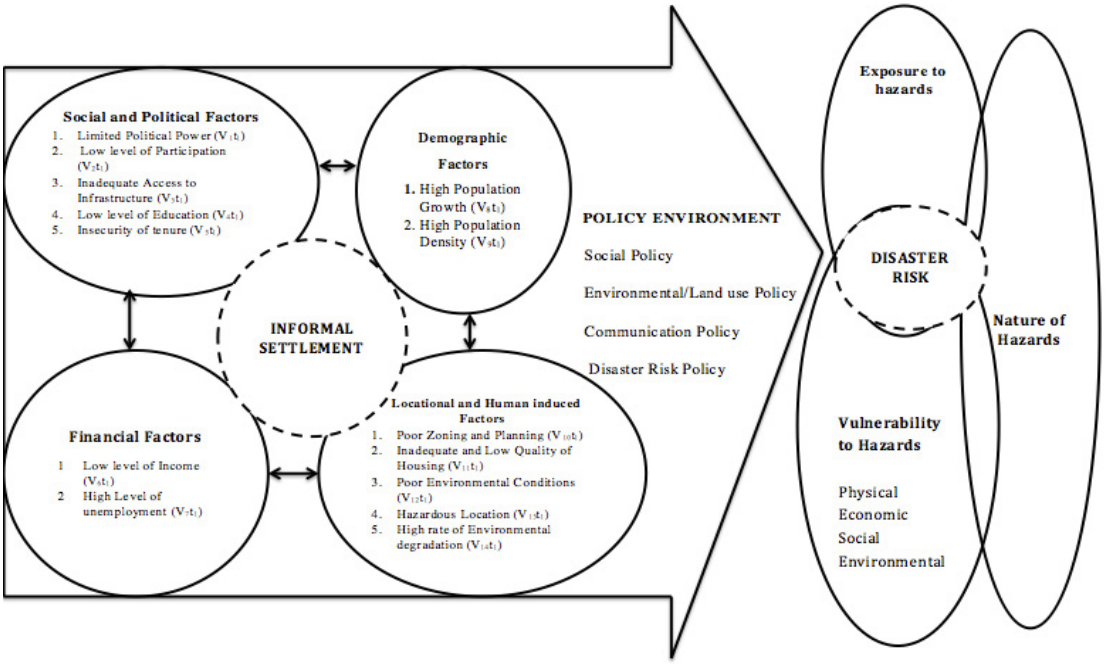
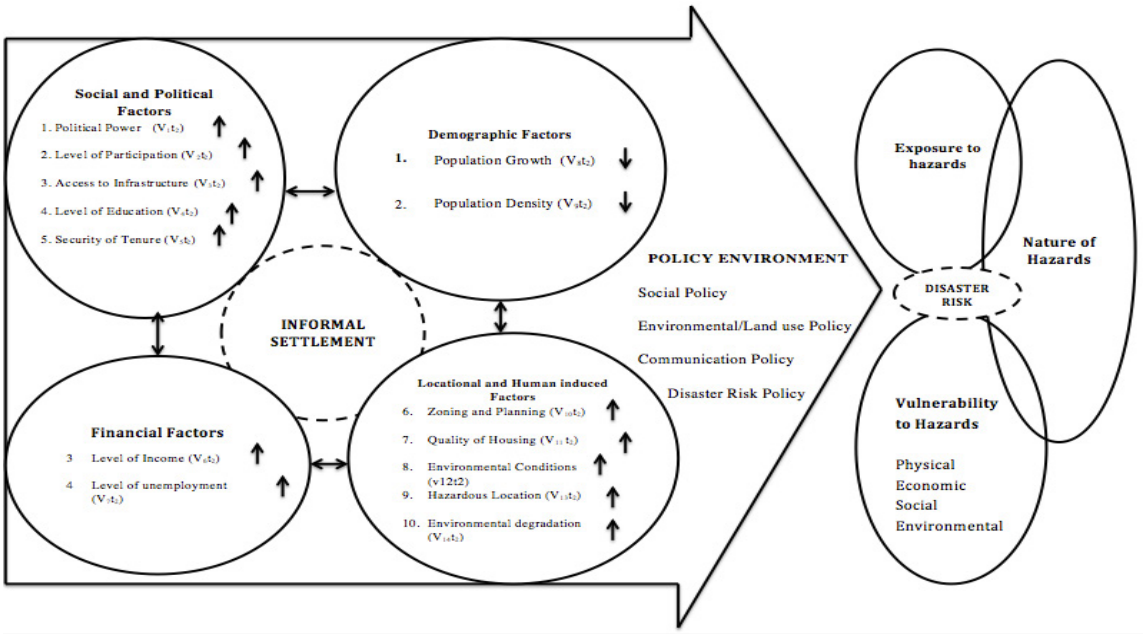


Figure 2: Sound Policy Environment and Disaster Risk in Informal Settlement

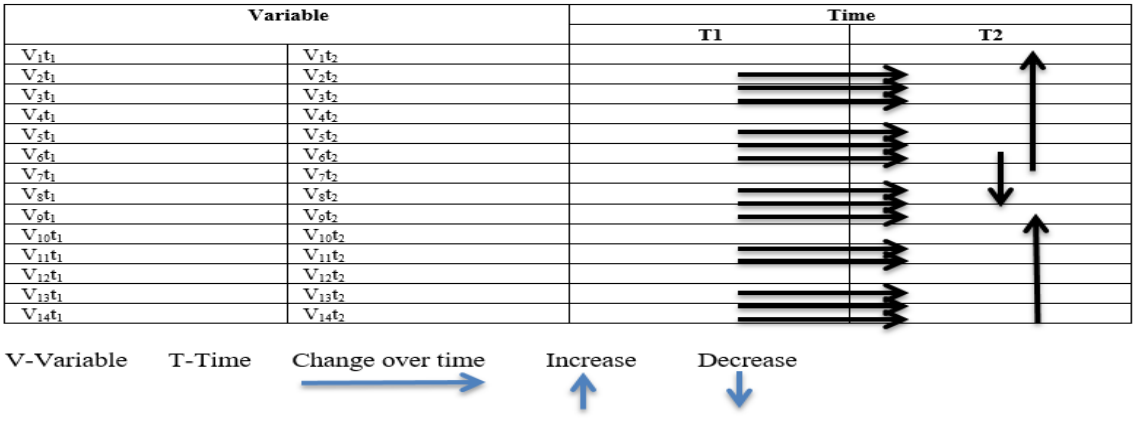


6. Contextualizing Informal Settlement Characteristics through the Policy Environment

The growing demographic characteristics of developing countries have increased and continue to increase disaster vulnerability and exposure particularly in informal settlements. The merging together of towns and cities as a result of urban population expansion connote wide spread levels of vulnerabilities and exposure within and between neighbouring areas. Moreover, the projected hike in the frequency of natural hazards strike and interactions with increased disaster vulnerability levels and degree of exposure impedes the achievement of sustainable development. Literature suggests that nothing can be done to prevent the emission of disaster hazards but vulnerability and extent of hazard exposure can be eradicated or reduced drastically to decrease disaster impacts**.** With this underlying fact, the importance of policies cannot be overlooked if disaster risks are to be reduced significantly.

Figure 1 presents the view that; the characteristics present in informal settlements increase hazard vulnerability and exposure. The interaction of hazard with existing informal settlement characteristics (vulnerability and exposure) and ineffective existing social, environmental/land use, disaster risk and communication policies make settlers of informal settlements depressed and victims of underdevelopment. The aversion of the growing disaster consequences requires massive financial investment and human resource development. The development of human resources equips people with necessary skill and expertise to draft sound policies (social, environmental/land use and communication), which form one of the basic foundations to disaster risk reduction. The effective implementation of sound social, environmental/land use, disaster risk and communication policies alter informal settlement characteristics and reduce vulnerability and degree of exposure, which invariably reduces disaster risk. In other words, the implementation of these policies by well-equipped institutions shrinks the extent of vulnerability and exposure as well as prevents interaction between the three major risk components as seen in figure 2. For instance, while the implementation of social policies provide infrastructure facilities (storm drainage, sanitation facilities, housing, schools and hospitals) and control population expansion, environmental/land use policies improve security of land tenure, environmental sanitation, order and regulate land use in an efficient and ethical way as well as provide the geographical expression of infrastructure development. Social policies to enable robust informal settlements free from disaster consequences should motivate actions towards resettlement/relocation in highly vulnerable and hazard prone areas to safer areas and upgrade existing settlements where the extent of understanding, the resulting efforts and strategies to reduce public vulnerability and exposure to natural hazards. These policies become mere fantasies and meaningless without financial support and assistance from both public and private organisations. Financial investment and commitment are the lifeblood of policy implementation and the achievement of policy goals. For the purpose of this study, social policy encompasses actions and programs aimed at improving the living conditions of the population. Also, while environmental policies refer to actions and decision to reduce locational vulnerabilities, communication policies are geared towards informing people about the specific risk and actions to resolve it. More so, disaster risk policy involves all actions and programs that enhance disaster risk reduction in the community [20, 31]. Figure 3 also summarises the variables in figure 1 and 2 and the changes over time.

Figure 3: Changes in Vulnerability and Resilience over Time



7. Theoretical Propositions

The authors suggest three theoretical propositions based on an extensive review of literature on hazard risks, vulnerability and informal settlements. Although firmly anchored by literature, empirical studies is required to support, modify or refute the propositions.

Proposition 1: Increasing population density increases hazard vulnerabilities in informal settlements

Most megacities and medium size cities around the world especially in developing countries have been acclaimed to be hotspots of disasters [4]. Megacities are characterized by high population growth and density, which contributes to environmental degradation and low quality housing [23]. Urban land size is generally fixed and composed of habitable and inhabitable areas [6]. With the Influx of people into such restrictive areas without guided planning, population density increases, distorts physical planning systems and increases hazard vulnerabilities in the short run. Stated differently, when the carrying capacity on the habitable lands reaches optimum, the inhabitable areas such as flood plain, river courses and marshy areas are encroached upon to take care of the growing population. Continuous growth without proper planning and governance produces slums and exacerbates vulnerabilities to all forms of natural hazards in urban informal settlements. However, more research is needed to ascertain which characteristics of informal settlements have the highest impact on vulnerability.

Proposition 2: Vulnerability reduction should be the centre of policies and strategies for building resilience in informal settlements

The poor, mostly located in informal settlements [22] has been and continue to be the hardest hit by disaster hazards in the world [3]. Literature suggests that increased vulnerability among residents in informal communities is a major facilitator to the rising devastating impacts [9]. Furthermore, changes in climate, whether and environmental related factors have also been indicated as another cause of an upsurge in disaster impacts [26]. Changes in environmental related factors and widespread vulnerability do not adequately explain the escalated consequences of disaster hazards. Also, the inability of informal settlement dwellers to monitor and predict accurately the changing weather pattern is another explanation to the rising impacts of disaster hazards. Winayanti and Lang [35] support this assertion by stating that, impacts of disaster hazards in neighbouring communities in the city of Kuala Lumpur is explained by lack of modern technology for monitoring and predication of whether. Policies and strategies to enable resilience in informal settlements should have vulnerability reduction as an integral part and at the centre. Methods to build resilience in informal settlements that relegates vulnerability issues against the background may fail to achieve its established purpose. Though several studies abounds in the area of vulnerability reduction in general but research to reduce vulnerability specifically in informal settlement are lacking. It is proposed that, an in-depth study should be embarked upon to bring forth a holistic and encompassing approach to deal effectively with vulnerabilities in informal settlements.

Proposition 3: Disaster risk communicated by a team of experts and community leaders increases positive reception from receivers in informal settlements.

Communication of disaster risk is envisaged to create awareness, educate people about disaster hazards and motivate people to take possible actions to prevent or reduce the impact posed by flood hazard [20]. The purpose of risk communication has not been fully achieved mainly due to lack of credibility and trust in communication team [14]. However, Aldoorey et al [1] suggest that communication of disaster risk and vulnerabilities should emanate from a team of experts, credible government officials, reputable organisations and familiar and respected personalities. Similarly, collaborative mechanisms that functionally integrate existing local social structure and institutions increase positive reception from risk message receivers. In the informal settlements, respect for local institutions (paramount chiefs, queen mothers and opinion leaders) will also serve as an additional incentive to eradicate the problem of mistrust and ensure adherence to communicated messages. This presupposes that communication of disaster risk in informal settlements could better achieve it intended purpose if the communication team include existing social structures.

7. Conclusion

The growth of informal settlements are very difficult to prevent especially in developing countries where policies to check urban population growth are inadequate and lacking. The upsurge of population density of informal settlement

makes them hotspots to disaster as it directly and indirectly raises hazard vulnerability and levels of exposure. In addition, the interaction of disaster hazards with existing informal settlement vulnerability and exposure serves as disaster traps to the poor mostly residing there. Because the eruption of disaster hazards cannot be prevented, it is therefore imperative to reduce the vulnerability and exposure levels. With regards to this, the policy environment (social, environmental/land use and communication policies) provides a strong foundation to which disaster vulnerability and exposure can be reduced to mitigate disaster risk. The sound implementation of a good social, environmental/land use and communication policies alter informal settlement characteristics and reduce vulnerability and degree of exposure, which invariably reduces disaster risk.

Reference:

1. Aldoory, L., Van Dyke, M.A., The roles of perceived ‘‘shared’’ involvement and information overload in understanding how audiences make meaning of news about bioterrorism. Journalism and Mass Communication Quarterly 83 (2), (2006) pp. 346–361.
2. Alexander, M., ‘Vulnerability to landslides’. In T. Glade, M. Anderson and M. Crozier (eds.) Landslide Hazard and Risk. John Wiley & Sons Ltd., Chichester. 2005, pp. 175 – 198.
3. Blaikie, Piers, Terry Cannon, Ian Davis, and Ben Wisner. *At risk: natural hazards, people's vulnerability and disasters*. Routledge, 2014.
4. Braun, Boris, and Tibor Aßheuer. "Floods in megacity environments: vulnerability and coping strategies of slum dwellers in Dhaka/Bangladesh." *Natural hazards* 58, no. 2 (2011): 771-787.
5. Cutter, Susan L., Bryan J. Boruff, and W. Lynn Shirley. "Social vulnerability to environmental hazards." *Social science quarterly* 84, no. 2 (2003): 242-261.
6. Daily, G. (1997). *Nature's services: societal dependence on natural ecosystems*. Island Press.
7. De Risi, R., F. Jalayer, F. De Paola, I. Iervolino, M. Giugni, M. E. Topa, E. Mbuya, A. Kyessi, G. Manfredi, and P. Gasparini. "Flood risk assessment for informal settlements." *Natural hazards* 69, no. 1 (2013): 1003-1032.
8. Doberstein, Brent. "Post-disaster assessment of hazard mitigation for small and medium-magnitude debris flow disasters in Bali, Indonesia and Jimani, Dominican Republic." *Natural hazards* 50, no. 2 (2009): 361-377.
9. Doberstein, Brent, and Heather Stager. "Towards guidelines for post- disaster vulnerability reduction in informal settlements." *Disasters* 37, no. 1 (2013): 28-47.
10. Durst, Noah J. "Second-generation policy priorities for colonias and informal settlements in Texas." *Housing Policy Debate* 25, no. 2 (2015): 395-417.
11. Goven, Gita. "Green Urbanism-Kosovo informal settlement upgrade case study." In *Holcim Forum for Sustainable Urbanism: Shanghai. Holcim Foundation. April*. 2007.
12. King, R. S., and O. Amponsah. "The role of city authorities in contributing to the development of urban slums in Ghana." *Journal of Construction Project Management and Innovation* 2, no. 1 (2012): 285-313.
13. Klaiman, T., Knorr, D., Fitzgerald, S., DeMara, P., Thomas, C., Heake, G., and Hausman, A., (2010). Locating and communicating with at-risk populations about emergency preparedness: the vulnerable populations outreach model. Disaster Medicine and Public Health Preparedness 4 (3), 246–251.
14. Kron, Wolfgang. "Keynote lecture: Flood risk= hazard x exposure x vulnerability." *Flood defence* (2002): 82-97.
15. Maguire, Brigit, and Patrick Hagan. "Disasters and communities: understanding social resilience." *Australian Journal of Emergency Management, the* 22, no. 2 (2007): 16.
16. Maarman, R. (2009). Manifestations of'capabilities poverty'with learners attending informal settlement schools. *South African Journal of Education*, *29*(3), 317-332.
17. Napier, M. (2007). Informal settlement integration, the environment and sustainable livelihoods in sub-Saharan Africa. Council for Scientific & Industrial Research in South Africa (CSIR).
18. Nguluma, Huba. "Housing themselves: Transformations, modernisation and spatial qualities in informal settlements in Dar es Salaam, Tanzania." PhD diss., Infrastruktur, 2003.
19. Pelling, M. (2003). The Vulnerability of Cities: social resilience and natural disaster. *London: Earthscan*, 212.
20. Revesz, R., and R. Stavins. "Environmental Law and Policy. Resources for the Future Discussion Paper 04-30-REV." (2007).
21. Reynolds, Barbara, and M. A. T. T. H. E. W. W. SEEGER. "Crisis and emergency risk communication as an integrative model." *Journal of health communication* 10, no. 1 (2005): 43-55.
22. Satterthwaite, D. (2011). What role for low-income communities in urban areas in disaster risk reduction. *Background Paper for UN-ISDR Global Assessment Report. See www. preventionweb. net/english/hyogo/gar/2011/en/bgdocs/Satterthwaite_2011.*
23. Taş, M., Taş, N., Durak, S., and Atanur, G. (2013). Flood disaster vulnerability in informal settlements in Bursa, Turkey. *Environment and Urbanization*,
24. Terpstra, Teun, and Jan M. Gutteling. "Households' perceived responsibilities in flood risk management in the Netherlands." *International Journal of Water Resources Development* 24, no. 4 (2008): 555-565.
25. Habitat, U. N. *State of the world's cities 2012/2013: Prosperity of cities*. Routledge, 2013.
26. Habitat, U. N. "Slums Almanac 2015-16." *Tracking Improvement in the Lives of Slum Dwellers. Nairobi* (2016).

27. UNISDR, Drought Risk Reduction Framework. "Practices: Contributing to the Implementation of the Hyogo Framework for Action." *United Nations Secretariat of the International Strategy for Disaster Reduction (UNISDR), Geneva, Switzerland* (2009).
28. United Nations, World Urbanization Prospects: the 2005 Revision, United Nations Population Division, Department of Economic and Social Affairs, CD-ROM Edition – data in digital form (POP/DB/WUP/Rev.2005), United Nations, New York, 2006.
29. United Nations, Concise Report on the World Population Situation. Department of Economic and Social Affairs Population Division, 2014
30. Usamah, Muhibuddin, John Handmer, David Mitchell, and Iftekhar Ahmed. "Can the vulnerable be resilient? Co-existence of vulnerability and disaster resilience: informal settlements in the Philippines." *International journal of disaster risk reduction* 10 (2014): 178-189.
31. Vallabhaneni, S. Rao. *Corporate management, governance, and ethics best practices*. John Wiley & Sons, 2008.
32. Vargas-Hernandez, Jose G., Mohammad Reza Noruzi, and Farhad Nezhad Haj Ali Irani. "What is policy, social policy and social policy changing." *International Journal of Business and Social Science* 2, no. 10 (2011).
33. West, Darrell M., and Marion Orr. "Race, gender, and communications in natural disasters." *Policy Studies Journal* 35, no. 4 (2007): 569-586.
34. Williams, Donald C. *Global urban growth: A reference handbook*. ABC-CLIO, 2012.
35. Winayanti, L., and Lang, H. C., Provision of urban services in an informal settlement: a case study of Kampung Penas Tanggul, Jakarta. *Habitat International*, *28* no. 1 (2004): 41-65.
36. Zahari, R. K., and Ariffin, R. N. R., Risk communications: flood-prone communities of Kuala Lumpur. ProcediaJournal of advanced transportation, 45 no. 2,(2013): 117-128
37. Ziervogel, G., Waddell, J., Smit, W., & Taylor, A., Flooding in Cape Town's informal settlements: barriers to collaborative urban risk governance. *South African Geographical Journal*, *98* no 1, (2016): 1-20.