Tomorrow's CITIES
Urban Risk in Transition

How can cities build resilience through Risk Modelling? Reflections from the COVID-19 experience

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About Tomorrow's Cities

"Our mission is to reduce disaster risk for the poor in tomorrow's cities."

Tomorrow's Cities is the UK Research and Innovation (UKRI) Global Challenges Research Fund (GCRF) Urban Disaster Risk Hub – a five-year global interdisciplinary research hub.

Our aim is to catalyse a transition from crisis management to multi-hazard risk-informed and inclusive planning and decision-making, for cities in low-and-middle income countries.

Globally, more than two billion people living in cities of low-to-middle income countries are exposed to multiple hazards such as floods, earthquakes, landslides, volcanoes and fires, which threaten the cyclical destruction of their lives and livelihoods. With urban areas expanding at unprecedented rates, this number is expected to reach four billion by 2050.

Failure to integrate multi-hazard disaster risk into urban planning and decision-making presents a major barrier to sustainable development, including the single greatest global challenge of eradicating poverty in all its forms.

But this global challenge is also major opportunity: as ~60% of the area expected to be urban by 2030 remains to be built, we can reduce disaster risk in tomorrow's cities by design.

We are one of 12 UKRI GCRF Hubs funded by a UKRI Collective Fund Award, as part of the UK AID strategy, putting research at the heart of efforts to deliver the United Nation's Sustainable Development Goals (SDGs).

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Introduction

Disasters and their associated risks have continued to evolve in complexity, forms, frequencies, and severity. The COVID-19 pandemic has revealed the complexity of disaster risks while exposing the need to plan and prepare for potential risks adequately. Like many other disaster risks, COVID-19 has presented unfamiliar evolution characteristics that have made it difficult to contain. However, risk models and scenarios can be utilized to help understand the dynamics of risks as they interact with populations and the environment, providing useful recommendations for planning for disaster risks with considerable levels of certainty.

The World Economic Forum predicts that one-third of the global population will live in urban settings by 2050, with a majority of this shift expected in developing cities. Rapid urbanization will likely implicate significant transition and transformations on urban risks. The projected increased urbanization rates also point to increased exposure to urban disaster risks and enhanced vulnerabilities to the already struggling developing cities. In order to prepare and build the desired city resilience through improved disaster risk proof development, models can be used to understand the baseline scenarios and the possible future risks and their characteristics. This blog provides some useful insights for African countries on investing in risk modeling to understand future risks and inform preparedness.

Understanding disaster risks

Disaster risk can be defined as the probability of an adverse event to occur that could cause damage to properties and livelihoods, injuries, and death. For example, the COVID-19 has been described as a global disaster whose risks and harmful impacts are currently being experienced in the form of health problems, fatalities, and economic/livelihood deterioration. Disaster risks tend to disorient the accustomed means of livelihood or existence for the larger population. These disaster risks often occur in the context of rapid urbanization, especially in African countries where technological advancement steers the development of complex urban systems consisting of people, institutions, and the built and natural environment. This complexity compounds the potential impacts of disasters (risks). Thus, cities have the imperative to strive to address the apparent risk exposure and plan and prepare for the potential risks that continue to be exacerbated by climate change.

Risk preparedness involves a comprehensive understanding of the baseline characteristics of risks and their impacts. This calls for the understanding of the hazard itself, the level of exposure, vulnerabilities, and coping capacities of the people, environment, and livelihoods exposed - this also provides an overview of the built resilience. Understanding the risks and impacts of disasters is therefore vital in the overall disaster management landscape. Additionally, the preexisting conditions and vulnerabilities of a given society define the impact trajectory for disaster risks on that society. For instance, the global south, especially the African continent, was not adequately prepared to deal with the COVID-19 pandemic in terms of health care systems, financial, as well as information capacities, which led to the adoption of reactive response measures to the pandemic in most countries. This reveals an existing gap that risk modeling and scenario developments could support. Disaster risks can therefore be perceived in advance through indicative factor approaches that facilitate understanding the possible scenarios, evolution, and impacts of disasters that can help plan and prepare for the future.

Scenario Risk modeling and Resilience

Risk modeling entails projecting the nature and magnitude of impacts that a particular disaster might have in the future, based on the current or baseline scenarios. The use of scenario risk modeling allows for an understanding of disaster risks, including the physical hazards and the possible impact of the disasters on people, their livelihoods, and the environment. For instance, the impact of COVID-19 in the next five years could be projected, and its interactions with the other existing or potential risks explored. Using baseline scenarios of the COVID-19 pandemic to project its possible evolution in the near future, its potential impacts in the immediate, medium- and long-term future can inform effective action planning towards building resilience.

Scenario risk modeling also allows the building of disaster risk interrelationships at the conceptualization and calibration stages: the simulation of real situations of risks enables the parameterization of the driving factors and exploration of possible scenarios based on realities and the possible pathways. For instance, the impacts of the COVID-19 pandemic on a given population can be modeled in terms of household income, national GDP, health care system capacity, and the overall fatality rate in the near future. Some of the driving factors to consider in this modeling are the economy's parameters or indicative factors, population, and health. However, the impacts of COVID-19 in the medium- and long-term future could be exacerbated by other disasters or shocks such as floods, other diseases, fires, landslides, or other disaster risks. Furthermore, the magnitude of disasters often varies across different scales of economies and settlement areas. For instance, the impacts of COVID-19 have been felt more adversely within informal settlements in Nairobi city as compared to other formal settlements – this is mainly due to the varying coping capacities and thus different vulnerability scales.

Consequently, single hazard modeling may not give a comprehensive understanding of the disaster risks within a city. The disaster interlinkages and their cascading effects are fundamental factors to consider in risk modeling towards building city resilience. Furthermore, the multi-hazard system thinking in risk modeling for resilience building is critical for comprehensive risk assessment and baseline scenario building – it supports holistic outcomes for overall decision making towards enhancing city resilience. Multi-hazard system thinking and modeling could thus be embraced to inform the formulation of policies and strategies towards improving current and future resilience and sustainable growth in cities.

How does risk modeling support resilience building in cities?

Population growth increases pressure on people's receptive capacity and the environment, further exposing their vulnerability to disasters. In most cases, the risk is exacerbated by the prevailing conditions such as environmental and anthropogenic factors, either internal or external. The underlying state usually portrays a disaster's probability of increasing or reducing, depending on the spatial and temporal variation. Reshaping how disaster risks are approached will provide a better gain in development, supporting the Sustainable Development Goals and the Sendai Framework goals towards reducing deaths caused by disaster by the year 2030.

Disasters can sometimes be difficult to predict. The COVID-19 emergency exposed the world's preparedness to combat such pandemics. Even though it is challenging to have a concise forecast of disasters, improved computing and modeling techniques can minimize uncertainties. However, empirical models that allow the simulation of the prevailing realities and multiple factors can be

used to understand the possible evolution scenarios of disaster risks. Drawing from the lesson learned from COVID-19, applying risk scenarios is essential for informed decision-making. At first, COVID-19 risk modeling was not possible because of the lack of existing data. However, it is imperative to develop scenario modeling to project future impacts.

Further, increasing the availability of temporal and spatial data coupled with the advancement of technologies provides better chances for predicting future scenarios by modeling risk. Developing a framework for assessing multiple problems at a multi-scale level requires a multidimensional approach. As such, quantifying risk scenarios is essential to understanding the dynamics of the system as well as the characteristics of the risks. Past experiences and scenarios are central to building narratives and substantiating the risk characteristics. Understanding the risk characteristics helps develop a defined approach for assessing risk scenarios, which entails a cautious generic screening criteria to estimate the likelihood of occurrence of the risk and its severity.

Way Forward

Risk modeling provides interactive grounds for qualitative and quantitative research inputs, with quantifiable outputs to understand the baseline information for predicting possible risk scenarios to enhance risk preparedness. Joint efforts should be directed towards identifying possible deficiencies in the current hazard management framework. Hazard management strategies should be mainly focused on pre-disaster contingency plans given the recurrent nature of disasters. Policy formulation and implementation also need to focus more on proactive measures rather than reactive when it comes to hazards and disaster risk preparedness and management. This needs to rely on grounded evidence generated through multidisciplinary research and the engagement of multiple stakeholders. Constant assessment of dynamic risk scenarios and emerging vulnerability factors such as urban development plans, population growth, and institutional capacity in disaster mitigation is crucial for risk reduction. However, due to the variation of these factors, disaster tends to change over time. Detailed scenario risk analysis will therefore help improve the perception of disaster and enhance behavioral change among people.

Historical data provides a better insight into future scenarios, which could help decision makers strengthen the existing strategies on disaster risk reduction. Thus, governments need to develop central data repositories for hosting multiple, timely, and relevant information that could be used to enhance a data-driven scenario building, providing a well-informed channel of relaying information between different actors. Besides, the insufficient political attention given to disaster risks in many countries in the global south, especially within cities, has weakened their national disaster management bodies. Therefore, including disaster risk reduction in development planning and allocating funds towards disaster management could further help strengthen resilience to future disaster risks in developing countries.