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The barriers to uptake of disaster risk management science in urban planning: A political economy analysis

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Abstract

There is increasing effort in science to support disaster risk management (DRM) and climate change adaptation in urban environments. It is now common for research calls and projects to reference coproduction methods and science uptake goals. This paper identifies lessons for researchers, research funders, and research users wishing to enable useful, useable, and used science based on the perspectives of research users in urban planning from low- and middle-income countries. DRM-supporting science is viewed by policy actors as: complicated and poorly communicated; presenting inadequate, partial, and outdated information; misaligned with policy cycles; and costly to access and inadequately positioned to overcome the policy barriers that hinder integration of DRM into urban planning. Addressing these specific concerns points to more systematic collection and organisation of data and enhancement of supporting administrative structures to facilitate better sight of human vulnerability and its link to development decision-making and wider processes of urban risk creation.

KEYWORDS
coproduction, disaster risk management (DRM), policy cycle, research uptake, urban planning

1 | INTRODUCTION

Disaster risk and disaster risk management (DRM) is now a clearly established interdisciplinary field of science, with a strong emphasis on the application of concepts and theories to policy and practice, including as an approach for adapting to climate change (Begum et al., 2014). DRM scientists are concerned with how disaster risks can be better managed, and, in particular, how the devastating impacts of natural hazards can be avoided. This is particularly true in cities and urban areas, where exposure to hazards intensifies, and disaster risks accumulate owing to development patterns and decisions, with potentially devastating consequences. Urban planning and master planning processes, and the rules and regulations that exist and should be enforced for good urban development, are critical to ensuring appropriate resilience against disasters, and how disasters can be avoided.

For urban planning professionals and municipal authorities more widely, managing disaster risks with limited financial and other resources is a mounting challenge given increasing rates of urbanisation, intensifying and spreading risk, including from climate change-associated hazards. While studies of disaster risk in urban areas, and responses to it, are being undertaken intentionally to help urban planners make better decisions on dealing with current and future threats, there are a myriad of reasons why DRM knowledge does not translate directly into more effective urban planning decisions. These relate to how research projects are conducted, with limited engagement by urban planners and DRM professionals, the relevance and communicated utility of research outputs, and the kinds of knowledge produced.

The objectives of this study are to uncover these constraints, as well as the conditions and contexts wherein DRM research can do a better job of informing and supporting planning decisions and practices in urban areas and so avoid risk creation (Dickinson and Burton, 2022). Figure 1 summarises these arguments, identifying the persistent challenges that continue to make it difficult for DRM and climate change adaptation researchers to support city-scale risk reduction. Furthermore, it highlights areas of good practices that are now well established but insufficient to break the impasse and four additional priority areas for next-generation DRM/climate change adaptation (CCA) science to consider in advancing the relevance and usability of research.

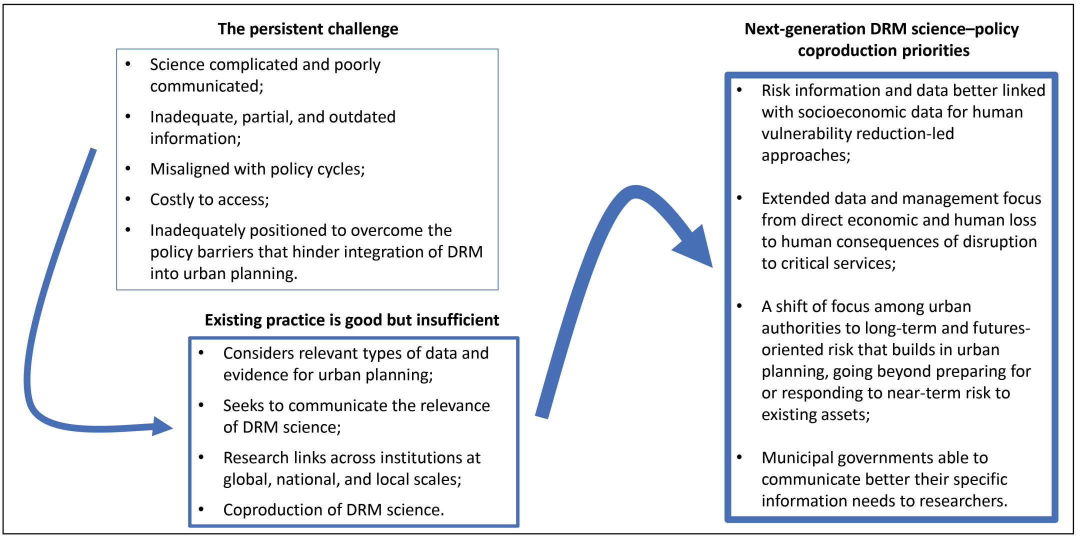

FIGURE 1 The barriers to uptake of DRM science in urban planning and next-generation solutions. **Source:** authors.

2 | DRM SCIENCE AND ITS UPTAKE IN URBAN PLANNING

2.1 | What is DRM science?

DRM science is broadly considered to describe practices and products that aim to produce knowledge, innovation, and technology in relation to the causes and manifestations of disaster risk, and interventions to address it. As a diverse body of work its content is evolving, developing its own vocabulary and accepted terminology (Kelman, 2018). Definitions and interpretations vary (see Table 1), and there is no 'standard' definition of DRM

TABLE 1 Definitions and interpretations of DRM science.

Terms	Meaning/definition/interpretation	Source
Science for DRR	'For disaster risk reduction, science is considered in its widest sense to include the natural, environmental, social, economic, health and engineering sciences, and scientific capacities are interpreted broadly to include all relevant resources and skills of a scientific and technical nature'. The report puts forth that for any scientific research to be fruitful in the field of DRR it must be '*useful, usable and used*' (p. 6). Only then, from the policymaking purview, 'the right information, at the right time, for the right people' (p. 12) will be able to be delivered. The report also recommends that along with science and technology, specific DRR innovations should be developed and incorporated into the policymaking purview.	Southgate et al. (2013, pp. 6)
Disaster science	'Disaster science examines the influence of catastrophic events on natural and built environments in an interdisciplinary context that maintains that "disasters" occur only in populated areas.... It involves the characterization of risk based on a fundamental understanding of natural hazards, as well as an appreciation of causes of vulnerability and exposure, and ways to reduce disaster risks.... Disaster science aims to increase human capacity to prepare for, respond to, and recover from disasters at individual, family, and community levels'.	University of Colorado Boulder (n.d.)
Science for DRM	In this report, the authors "support the integration of science into informed decision making through synthesizing and translating evidence for DRM and strengthening the science-policy and science-operation interface." The report states that the main challenge for DRM lies not in the generation of innovative ideas but rather in their implementation.	Poljansek et al. (2017, pg. 8) (Report)
Disaster risk science	Disaster risk science has in due course of time developed its vocabulary with glossaries. This research paper examines the meanings and interpretations of keywords such as hazard, vulnerability, and disaster risk, and the linkage between DRR and DRM. It notes that as the knowledge base of disaster risk science evolves, the initial meaning of some vocabulary may now be out of date.	Kelman (2018)
	The 2019 *Global Assessment Report on Disaster Risk Reduction* highlights the use of advanced science, technology, and innovation for risk-informed decision-making. This, coupled with increased awareness of and willingness to share data and information, is underscored as enabling all local/urban actors to come together and build a resilient community.	UNDRR (2019)
	'Disaster risk science is the discipline that studies the hazard mechanism, disaster process, dynamics modeling, spatial–temporal patterns of disaster impact (effects and losses), emergency response, and risk governance paradigms of disaster systems. It is a multi-, cross-, and transdisciplinary field'.	Shi et al. (2020, p. 431)

Source: authors.

science. DRM research projects commonly produce outputs aimed at informing DRM policy and practice, including risk assessments and modelling tools, as well as hazard and vulnerability maps. They frequently benefit from interdisciplinary approaches (Revi et al., 2014).

DRM science is generally considered a 'multi-, cross- and transdisciplinary' field of science (Shi et al., 2020, p. 431) with different disciplines taking an interest (see also Ingham et al., 2011; Faisal and Khan, 2018). Earth science/geoscience deals with DRM, in particular, geology, geography, atmospheric science, oceanology, and ecology. Similarly, in basic science, there is significant research on DRM in geomathematics, geophysics, geochemistry, geometrics, and digital earth. Sciences such as biology, medicine, pharmaceutical science, economics, management science, mathematics, physics, chemistry, information science and technology, language and literature, history, philosophy, sociology, political science, and law, all have clear linkages and share common areas of interest with DRM science.

Shi et al. (2020) propose a framework of disaster risk science research with three pillars (disaster science, disaster technology, and disaster governance), nine core areas, and 27 research fields. While these pillars are distinct and help to organise different objects and purposes of DRM research, the framework foregrounds quantitative science and geographical perspectives, largely ignoring social and economic perspectives, such as studies of vulnerability, root cause analysis, resilience, and other dimensions.

Disaster risk science has a close relationship to, and overlaps with, theories and empirical studies within climate change and humanitarian studies. Research on climate change is divided into three distinct branches, which are also the three working groups of the Intergovernmental Panel on Climate Change: climate science, which examines the physical science underpinning past, present, and future climate change; CCA, which assesses the vulnerability of socioeconomic and natural systems to climate change, as well as the negative and positive consequences of climate change and options for adapting to it; and climate change mitigation, which appraises methods for reducing greenhouse gas emissions and removing greenhouse gases from the atmosphere. CCA has the strongest overlaps with social science work on DRM and is sometimes seen as a subset of DRR (focused only on responses to climate-related hazards) (Kelman, Mercer, and Gaillard, 2017), although the broader body of research on climate change is much larger than DRM science.

Empirically, DRR research is grounded in previous experience and local knowledge. There is considerable overlap with CCA work and frequent use of extreme events to comprehend climate change impacts and adaptation. More distinctly, CCA tends to emphasise a longer-term, foresightful perspective, placing attention on understanding processes of vulnerability and adaptation over time and in relation to future climate shocks, stresses, and uncertainties (Twigg, 2015). As one DRR scientist put it:

> *The one most useful lesson that CCA has got to offer is a generous approach to time and the notion that there is no going back, that change is a constant and the most prudent approach is transformation* (Ben Wisner, quoted in Kelman et al., 2017, p. xxix).

Humanitarian studies is dominated by social sciences, arts and humanities—principally, international affairs, political science, philosophy, history, and anthropology—with the object of study being primarily the humanitarian impacts of disasters and conflict, humanitarian action, and the 'aid industry'. It is more narrowly defined than disaster risk science but shares a focus on the drivers and political economy of vulnerability and of the humanitarian response (see, for example, Sen, 1982; Middleton and O'Keefe, 1998), as well as the technical aspects of aid delivery. However, there are many more academic papers on conflict-induced and protracted crises than natural hazards-related disasters, reflecting the bulk of attention and aid flows within the humanitarian system.

2.2 | Evolution and recent developments in DRM science

As an applied field of study, the thematic focus and practice of DRM science have been informed by international policy frameworks, and in turn have influenced the focus of those agreements. The International Decade for Natural

Disaster Reduction (IDNDR) 1990–99, for example, was most influenced by improvements in flood and earthquake engineering, and so concentrated on what were considered 'technocratic' solutions, receiving criticism from scholars that such solutions do little to address the socioeconomic and political factors making people vulnerable (Cannon, 1994; Hewitt, 1995; Bankoff, 2004). According to experts, the IDNDR ignored the political processes that shape how issues get on to the policy agenda and how policies are implemented (Burton, Kates, and White, 1993; Hays, 1999; Christoplos, Mitchell, and Liljelund, 2001; IFRC, 2002).

By the end of the IDNDR, the view of disaster risk as being (at least partially) socially constructed was gaining traction among academics and some policymakers, with the practical implication that a wider range of policies and plans would be needed to manage risks. The Hyogo Framework for Action 2005–2015 reflected these ideas with the inclusion of a pillar on 'reducing underlying risk factors', and a focus on vulnerability, the spatial distribution of exposure, rapid urbanisation, social exclusion, poverty, unsuitable land use, ineffective building codes, and poor construction practices (UNISDR, 2005). Policy research swelled during this period, with increasing interest in how risk reduction could be mainstreamed across sectors, policies, and plans (UNDRR, 2015). DRM shifted from being a relatively narrow scientific domain of natural hazards experts, within traditional disciplines of natural sciences, engineering, sociology, anthology, and other social sciences, to a broad-based interdisciplinary and trans-disciplinary domain relevant to research on urban planning, risk analysis, public administration, and public health (Peek and Guikema, 2021).

The Sendai Framework for Disaster Risk Reduction 2015–2030 calls for dedicated action to address the underlying drivers of risks, including aspects of poverty, inequality, climate change and variability, unplanned and rapid urbanisation, and poor land management (Kelman, 2015; Tozier de la Poterie and Baudoin, 2015; UNDRR, 2015). It goes further in acknowledging the role played by compounding factors (such as inadequate institutional mechanisms), brings a clear shift in focus from management of disasters to the management of disaster risks (Wahlström, 2015), and calls for the prevention of the creation of new risks, reducing existing risks, and preparing for effective management of residual risks (Tozier de la Poterie and Baudoin, 2015).

The Sendai Framework acknowledges the 'multi-hazard' approach as a prerequisite for effective DRR (UNDRR, 2015, p. 13). During the period of the Sendai Framework, research on multi-hazard and multi-sectoral approaches to DRM has increased. For instance, the number of articles on Science Direct with multi-hazard in the title or text rose from 4,876 in 2014 to 5,347 in 2015 and 12,661 in 2021. Still, in its mid-term review, the UNDRR (2023) notes that fewer than half of the countries reporting vis-à-vis Sendai Framework targets indicate having fit-for-purpose, accessible, and actionable risk information.

Similarly, research on risk analysis and risk governance has also shifted from single hazard domain risk and direct losses to 'systemic risk', with an interest in the movement of risk and impact between and across sectors. As explained in a recent briefing note, the UNDRR reports that:

> Systemic risk is associated with cascading impacts that spread within and across systems and sectors (e.g. ecosystems, health, infrastructure and the food sector) via the movements of people, goods, capital and information within and across boundaries (e.g. regions, countries and continents). The spread of these impacts can lead to potentially existential consequences and system collapse across a range of time horizons (Sillmann et al., 2022, p. 4).

Cascading and compound events such as the COVID-19 (Coronavirus disease 2019) pandemic showed that the conventional risk management and governance approach is insufficient and there is an urgent need for more research on the complex and systemic nature of risk (UNDRR, 2019; UNDRR and AP-STAAG, 2020; Pelling et al., 2022). These and other disasters prompted an increased focus among interdisciplinary research and studies on global health and supply chain risks, CCA, science and technology, sustainable development, human mobility, community participation, and nature-based solutions, to name a few (Busayo et al., 2020; Pelling et al., 2021).

2.3 | DRM science as a tool to guide urban planning decisions

Rapid urbanisation creates complex environmental and social conditions that can concentrate disaster and climate change risks and reveal a need for better urban policy and planning (Bai et al., 2010; Revi et al., 2014; Avis, 2016). Urban planning as a process and product can help to reduce disaster risk and create safe, sustainable, and resilient cities, but experts have recognised that integrating these *global* environmental concerns into *national* and *local* urban policy processes and governance poses challenges, not least because of the inherent temporal, spatial, and institutional scale mismatch between how issues are framed and prioritised at the global scale and how they are confronted and understood at the local scale (Bai et al., 2010). While international policy has taken up recommendations from interdisciplinary science for work on the underlying causes of risk and vulnerability and the complex, cascading, and systemic nature of risk-producing processes, these approaches have not yet translated easily into practical and policy change in national or urban planning departments. DRM frameworks do not routinely have quantifiable targets or other guidance mechanisms to help address 'how' or 'why' DRM gets on to the political agenda in any given context (Wilkinson, 2012), including the role played by the private sector in urban development.

Concerns have been raised in relation to climate and DRM science regarding the lack of attention paid to the political, economic, sociological, and institutional factors that help explain whether and how 'physical science' and information are translated into action (Nightingale et al., 2020). There is a small but growing literature, for example, on the political economy of DRM, which examines the barriers to assigning resources and implementing more proactive measures to manage disaster risks (Collinson, 2003; Scott and Tarazona, 2011; Wilkinson, 2012; Jones et al., 2013; Islam, Chu, and Smart, 2019; Islam et al., 2021). Authors find that formal and informal institutions can inhibit policy reforms, including where local governments are charged with managing risks but have unfunded mandates and face electoral cycles or limited political accountability (Wilkinson, 2012). These studies do not, however, look explicitly at why or how DRM research can be influential or can fail to inform policy decisions. Little has been written about the 'barriers' that stem from the research process itself, or from the legitimacy of findings guiding policy choices.

Another important debate within contemporary DRM science concerns the nature of disasters and the construction of disaster risk—in essence, the relationship between natural/physical/material and human/social/unnatural elements. Disasters are now commonly understood to be 'not natural', but nonetheless having a material geophysical or hydrometeorological hazard element (Donovan, 2017; McGowran and Donovan, 2021). This matter is addressed in the literature on DRM and assemblage theory, which conceptualises disasters as dynamic, complex 'geo-events' that are the result of non-linear human–nature interactions, and which are shaped by, and shape, power relations (Shaw, 2020). Thus, if DRM research is to be useful in guiding urban policy and practice, it will need to look more at these complex systems and interactions, examining 'how place-specific, uneven, socio-material relations emerge across space-time in both contingent and unpredictable ways' (McGowran and Donovan, 2021, p. 1611).

Through techniques of coproduction, DRM science is increasingly seeking to bridge the gap between science and policy, scientific and local knowledge, and populations at risk and risk managers, as well as among researchers (Scolobig and Pelling, 2016; Bremer and Meisch, 2017; Muñoz-Erickson, Miller, and Miller, 2017; Busayo et al., 2020; Few, Armijos Burneo, and Barclay, 2022). This opens up DRM science to the possibility of multiple ways of knowing and understanding risk and innovative research methods (Hulme, 2011; Barnes et al., 2013; Shah, 2020; Schipper, Dubash, and Mulugetta, 2021). Researchers' understandings of disaster will be different from those living with these risks and relationships every day; not recognising this can lead to misinterpretations (Gaillard, 2019). Coproduction can describe how DRM science is already used in society, how it is at once shaped by and shaping social concerns and representations of risks. It can be normative, undertaken with the intention of building collaborative partnerships between the scientific community and other social groups, ranging from public education to empowering marginalised groups, building adaptive institutions, delivering public services, producing more useable science, or even achieving more fundamental reorganisation of scientific inquiry (Bremer and Meisch, 2017).

Other parallel trends in DRM research focus more explicitly on decolonisation of knowledge production (Andrabi, 2021), whereby countries and populations in the Global South are considered key actors in the creation of DRM science (Pyles, 2016; Siddiqi and Canuday, 2018). Decolonisation of DRM research and narratives means different groups and sectors of society in the Global South, especially marginalised groups, playing an instrumental role in the research process (Andrabi, 2021). To what extent urban planners are involved in processes of coproduction, and how successful these are in enabling two-way communication between science and policy, remain at the heart of evidence-based risk reduction.

3 | DATA AND METHODOLOGY

This study uses a political economy analysis framework to identify barriers to the uptake and use of DRM science in urban planning decisions. Several studies (see, for example, Scott and Tarazona, 2011; Bussell and Fayaz, 2017; Islam, Chu, and Smart, 2019; Few, Armijos Burneo, and Barclay, 2022) have previously employed a political economy framing to understand the interaction of political, economic, and social factors and interests, posing challenges to effective DRM. Political economy analysis offers a suitable analytical framework to examine the functions, influence, commitments, opportunities, and bottlenecks encountered by urban actors in using DRM science to inform urban policy and planning decisions. The study looks explicitly at the interface of research and policy, rather than decision-making cultures and processes inside different organisations responsible for DRM. Similarly, the focus is on formal science and research relations with policy actors. We acknowledge that many other forms of knowledge are important in the final development, deployment, and critique of urban disaster risk interventions, including Indigenous and local knowledge and citizen science (Gupta and Barman, 2020), but these lie outside the scope of this paper.

The analysis presented here is based on a review of the literature and qualitative research, with data collected through 15 key informant interviews (KIIs) (see Table 2) with senior urban planners/government stakeholders (eight) and regional and international DRM experts who engage directly with urban planning

TABLE 2 List of key informant interviews.

Affiliation	Professional role/expertise
United Nations Office for Disaster Risk Reduction	DRR and DRM specialist
UN Habitat	DRM and resilience specialist
United Nations Development Programme	DRM specialist—disaster risk information and application
United Nations Development Programme	DRR and CCA specialist
Pacific Islands Forum Secretariat	DRM policy and strategic planning
Asian Disaster Preparedness Center	Disaster and climate resilience
Istanbul Metropolitan Municipality, Turkey	Urban planning—resilience and climate change
Istanbul Metropolitan Municipality, Turkey	Urban planning—masterplans and upscale urban planning
Ethekwini Municipality, South Africa	Urban planning—sustainability and resilience
Municipality of Quito, Ecuador	Urban planning—land use and strategic planning
Municipality of Quito, Ecuador	Urban planning—territorial planning
Climate Resilience Execution Agency for Dominica	Urban planning—development management and resilience
National Disaster Management Authority, India	DRM and climate resilience—national strategic planning
Disaster and Emergency Management, Nairobi City, Kenya	Urban planning—DRM
Nepal Urban Resilience Programme, Kathmandu	Urban planning—strategic planning and resilience

Source: authors.

professionals through advisory or technical assistance work (seven). The KIIs were semi-structured and conducted between June and August 2022. The seniority of respondents meant limited time was available; semi-structured interviews were deployed in preference to more ethnographic methodologies. The interviewees were identified using purposive sampling. Additional interviewees were also identified during the survey through snowball sampling and contacted.

All of the urban planners and DRM professionals interviewed for this study were from, or have worked in, cities in low- and middle-income countries. Interviewees (particularly DRM professionals) were selected through purposeful sampling of those engaged in multi-year applied research projects in urban contexts in developing countries. They are therefore both familiar with research methods and products and city-level policy and planning processes. The average professional experience for the sample was more than 15 years.

Interviewees were also selected to represent a range of urban planning contexts, including those working with smaller cities and cities situated in low- and middle-income countries. The urban planners were working in seven middle-income countries, namely, Dominica, Ecuador, India, Kenya, Nepal, South Africa, and Turkey. This was particularly relevant to identify differences in how urban planners have engaged with DRM science across different settings.

The KIIs were conducted virtually using a semi-structured questionnaire, with questions designed to elicit and compare views from urban planners and DRM professionals on the definition and purpose of DRM science, how research projects are implemented, how results are communicated, and the challenges that planners face in utilising DRM science in decision-making, and in particular territorial, spatial, or land use planning. The questionnaire instrument was validated through expert scrutiny and piloted before being finalised.

Results from the questionnaire were coded and analysed using qualitative and descriptive statistical assessment of the recorded responses. The results of the analysis are presented in the next section.

4 | RESULTS

This section presents the key findings in relation to understandings of DRM science and critical challenges in the use of DRM science in urban planning decisions.

4.1 | Understandings of DRM science and its practical use

When asked whether they rely on science generally in urban planning decisions, the majority of urban planners (62 per cent) reported that scientific evidence played only a partial role in urban planning, and that even here, science findings are used rather infrequently. For example, one urban planner noted:

> … the document we prepare [based on science] is not always used for decision-making. Science is there in the plan but not in practice. Science based on data and tools of urban planning like a geographical vision using GIS [geographic information system]; local planning/ urban design/architecture and civil engineering is used. The social science and anthropological engagement is lacking (Respondent 13).

As discussed in the second section, diverse terminologies and interpretations are attached to DRM science with contrasting understandings among different stakeholders. To comprehend research user perceptions of DRM science, respondents were asked to confirm if this included findings of direct support for DRM decisions (for instance, new understandings of risk and its relationships to development), innovations in risk modelling and forecasting, scientific tools such as early warning systems or remote sensing, or all of these areas of contribution.

Participating DRM professionals and practitioners felt that DRM science has provided inputs to policy across this spectrum, including GIS data, census data to help identify vulnerable populations, and hazard models, including climate projections, to aid DRM planning processes. Conversely, urban planners had a much narrower experience and expectation of the kinds of science that were useful. As Table 3 shows, urban planners had already engaged with science on questions of risk modelling and forecasting, but less so on applied research tools, and not at all on wider questions of risk and development. This has implications for the types of trusted relationships that exist between urban planners and scientists, the language of science that is recognised by urban planners, and expectations of the role that science plays. The lack of engagement with more fundamental science shows a very focused and incremental relationship with science that may make difficult the communication of information that frames or innovates within risk reduction.

4.2 | Barriers to the uptake of DRM science in urban planning

Respondents were asked to choose three to four of the most important barriers to the uptake of DRM science in urban planning from a list of constraints identified in the literature review. They were also asked to explain their choices and highlight any additional factors that might be missing from the list provided. Figure 2 presents the respondents' choices.

TABLE 3 Urban planners' understanding of DRM science.

Understanding of DRM science	Percentage of interviewees that selected this definition
Scientific research findings that can be used to support DRM decisions.	13
Scientific innovations that can be used to support DRM decisions (such as risk modelling and forecasting).	25
Scientific tools and technologies that can be applied to support DRM (such as early warning systems and satellite images)	25
all above	37

Source: authors.

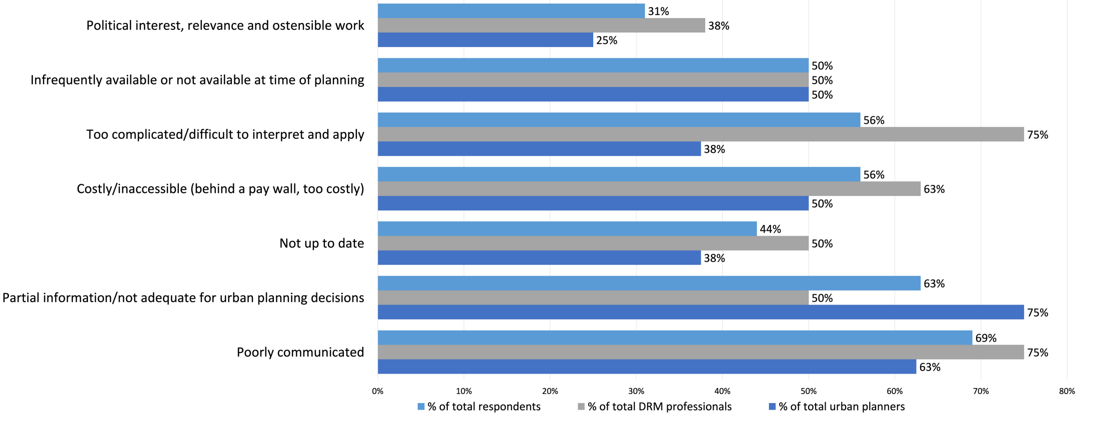

FIGURE 2 Key barriers to the uptake of DRM science in urban planning: respondents' perspectives (percentages). **Source:** authors.

4.3 | DRM science being complicated and poorly communicated

Many respondents (56 per cent) commented that applied science is 'complicated' and not easy to communicate, especially to the end users. It is hard even for policymakers who are native English speakers to grasp information explained in English using scientific terms. Since most urban planners converse in their vernacular, it is challenging for them to communicate scientific models and outputs effectively. Communicating science in non-technical language should be a common goal. Similarly, municipal governments also find it difficult to communicate their need for information to DRM scientists. Furthermore, communicating risk and uncertainty, which are common features of DRM science outputs, is even more challenging as urban planners believe that this can hamper end-users' confidence in scientific facts and evidence over time (van der Bles et al., 2020). Respondents noted that this creates an obstacle to building a 'common understanding' of DRM science among stakeholders and adversely affects its uptake and implementation in policies.

In addition to being complicated, many respondents (75 per cent) mentioned that DRM science is poorly communicated to urban planners. They highlighted that there is a 'disconnect' between the conveyed utility of the scientific models and outputs and their real-world application. As highlighted in a few previous studies (see, for example, Walsh, Dicks, and Sutherland, 2014; Cartwright et al., 2016; Bednarek et al., 2018), international scientific research often does not cater to country-specific needs and political and social contexts, making it difficult for city-level policymakers to understand and appreciate the utility of scientific findings. One of the respondents underscored that:

> … the interface of science, policy, and people is not coherent. It is mostly one way. On the one hand, the DRM scientists convey their research or knowledge products to policymakers without fully considering their needs and capacity. On the other hand, policymakers denounce the efforts by the scientific community (Respondent 8).

Some respondents highlighted that different understandings and interpretations of risk and resilience could be a reason for the disconnect between DRM scientists and urban planners. As one DRM professional explained:

> … people who work at the urban planning level and people who work on DRM science, their terminologies are different. The two do not connect well with each other… people working at local [city] government level, they sometimes can't articulate their challenges and then a DRM scientist articulates it for them which does not necessarily resonate with them, and they are not able to comprehend the solutions also (Respondent 2).

4.4 | Inadequate, partial and outdated information

Almost two-thirds of the respondents (63 per cent) pointed to inadequacy of disaster-related information and evidence as one of the main barriers to the uptake of DRM science in urban policy decisions. Some urban planners mentioned that in the absence of more comprehensive risk information, they had often relied on many different sources of data to compile a relevant spatial and socioeconomic dataset. Many interviewees also commented on DRM scientific outputs generally being at a level of abstraction and not specific (mostly partial) for a city context, which is not useful for urban planning decisions. Some even questioned whether 'scientific data' in its current form is useful for decision-making. One respondent noted:

> … sometimes there is no scientific data or evidence for the decisions to be made. So, such decisions are not risk informed. This may be because the information provided is not useful, or there is no

> demand or desire by the government. Decisions are made in a rush, especially in [a] post-disaster context (Respondent 3).

Respondents underlined that locally available information on, and evidence of, exposure and vulnerability to and risks of natural hazards are too outdated for city planners to use. Few were aware of or routinely consulted global databases; frequently these were at too coarse a resolution to be useful or required technical skill that was not available in urban planning. One of the city planners mentioned that the lack of dynamic (up to date) information, such as spatial and population data, makes it difficult to accommodate accurately land use changes or an influx of immigrants in the cities in plans for managing disaster risk. Several respondents (44 per cent) echoed this view; one said:

> … [the] nature of cities and the way they are growing have changed; we can't rely on outdated tools and methods to develop policies. For example, population projections need to be dynamic as they are one of the key data inputs any urban planner would have, and most of the planning aspect were derived based on this data. Currently, urban planners are not up to date on many aspects of risks for city planning (Respondent 2).

Another issue identified by stakeholders concerned the lack of confidence in scientific outputs, particularly in the reliability of risk information. Those who were more familiar with risk assessment methodologies noted that scientific outputs are only as good as the underlying data on and assumptions about physical and social processes. These assumptions are rarely validated further down the line using evidence of what actually happened when a disaster occurred. This could limit the reliability of DRM science research and confidence in its ability to model accurately future risk scenarios (see, for example, Fischhoff and Davis, 2014; Chen et al., 2019; van der Bles et al., 2020) or to inform actions that can be taken to avoid losses (Tanner et al., 2016).

4.5 | Misalignment of scientific outputs with cycles of planning and action

A majority of urban planners (63 per cent) pointed out that DRM science products are rarely made available at the time of urban planning exercises (such as urban master planning). Interviewees agreed that when a scientific research finding or application is produced, and then thought is given as to how it should be used, it is unlikely to match the planning cycle of the city. As one government interviewee put it:

> [The risk assessment] should align with the master planning cycles, say, two years before the planning exercise … and once that risk assessment is there, you would use it, and will do some consultation with planning authorities, maybe also do some public consultations…. Sometimes I feel that DRM people who work on risk, they don't do enough to actually make themselves heard in the right places (Respondent 6).

In the interim between masterplans, many more short-term decisions are taken about how to use financial resources for impact, efficiency, and popularity. Almost one-third of respondents (31 per cent) mentioned that city governments generally seek ‘quick wins’ in response to the demands of their constituents, and options that offer good ‘value for money’ when budgets are squeezed. Even where DRM and/or climate risks are considered in the masterplan, or land use plan, they can quickly fall off the agenda if there is no political capital to be gained in the short term (see, for example, Barber, 2013; Bery and Haddad, 2023). In contexts where there is a high turnover of staff in city hall and/or where politicians are inclined to disregard scientific findings, policy inaction on critical developmental issues, such as building safer cities, is more commonplace (McConnell and ‘t Hart, 2019). One interviewee gave an example in relation to earthquake risk:

> … one of the arguments that I came across in a city where there was an earthquake in last five years, was that it is very unlikely that we are going to have an earthquake during the five years of this our term. So, there is this lack of long-term commitments to city planning because you can't get credit for this (Respondent 3).

4.6 | Scientific products being too costly to access

Many respondents (56 per cent) highlighted that DRM science-related outputs and products could be too costly to access, particularly by cities in low- and middle-income and fragile and conflict-affected countries. In such locales, a larger proportion of the population lives in informal settlements and below the poverty line, disproportionately exposed to and affected by disasters (Hallegatte et al., 2020). In these cities (and countries in general), the upfront costs of investing in DRM, and related science, are also much higher (Mechler, 2004, 2016). One of the urban planners from a middle-income city/country said:

> Lower income and smaller cities typically struggle with their finances and do not have a robust revenue model, which makes it difficult for them to even sustain their core operations effectively, let alone investing in DRM or in accessing DRM science products (Respondent 10).

All of the urban planners and DRM professional interviewed for this study were from, or have worked in, cities in low- and middle-income countries. Some respondents were keen to emphasise that smaller cities, especially in low- and middle-income countries, would like to use DRM science but have trouble accessing the studies and data they need. Unlike bigger cities, which are generally more resource-rich and can commission the development of sophisticated risk models, medium and smaller cities struggle with financial and technical capacity constraints on commissioning, interpreting, and using such information (Baker, 2012; Mavhura and Mapuva, 2022).

4.7 | Lack of integration of DRM in urban policy decisions

Integrating disaster risk and resilience considerations into development planning has been a long-standing call for action across major global frameworks for DRM (Assmuth, Hildén, and Benighaus, 2010; Bello, Bustamante, and Pizarro, 2021). While some progress has been made in doing so at the national level, activities to manage disaster risks remain largely 'short-term emergency measures' at the city level, especially in smaller cities in low-income countries (Hofmann, 2021; Sharifi and Yamagata, 2022). This makes it even more challenging for scientific products and solutions to support DRM to be appreciated and utilised in an effective way by urban planners.

Almost 40 per cent of all respondents (including 50 per cent of the urban planners) mentioned that natural hazard-related risk and resilience considerations are not integrated into urban planning. Furthermore, about 70 per cent of all respondents (including 80 per cent of the urban planners) noted that the focus of efforts to deal with disasters in the cities in which they have worked, was on short-term emergency response following a disaster. This was particularly the case with the smaller cities in low-income countries.

Some of the respondents mentioned that disaster risk aspects are often 'hard-wired' in legislation and policy documents. Consequently, there may be instances where long-term planning for a particular hazard is mandated by the law (for example, classification of flood zones in recreational areas), but it is not uniform across large and small cities and does not consider planning for multiple hazards. Most of the respondents (75 per cent) confirmed this and noted that the focus of DRM-related initiatives, especially in smaller cities, is limited to specific hazards (principally floods) and sectors (mostly housing), in contrast to a more comprehensive people-centred, multi-sectoral, or multi-hazard approach to DRM.

5 | DISCUSSION: ENABLERS OF UPTAKE OF DRM SCIENCE IN URBAN PLANNING

The stakeholders interviewed for this study had suggestions on how the research process and its outputs could be improved and used to assist with integrating risk information and management into urban planning. Four key findings can be drawn from the discussion below:

- risk information and data need to be linked with socioeconomic data for human vulnerability reduction-led approaches;
- more of a data and management focus on avoiding impacts that can disrupt critical services;
- a shift of focus among urban authorities to forward-looking and precautionary considerations, going beyond preparing for or responding to risk/loss; and
- municipal governments need to communicate better to researchers their specific information needs.

5.1 | Relevant types of data and evidence for urban planning

Urban planners need comprehensive risk information and data that are, according to one international expert, 'more understandable, usable, and actionable and something that speak to the needs of urban planners' (Respondent 6). Many respondents mentioned that risk information and data need to be linked with socioeconomic data, so planning professionals can see what the outcome of hazards will be—or how risks will materialise and propagate through different systems. Currently, most DRM scientific outputs continue to be hazard maps, and planners find it difficult to take risk-informed decisions using them. As one of the urban planners commented:

> … there are socially, economically, and spatially differentiated areas in our city. Studies can be done in more detail by considering these variables, and field-specific models can be developed instead of general models (Respondent 10).

A few respondents emphasised the need to apply systems thinking in urban risk management. For instance, instead of just considering disaster impacts at an individual asset level, the focus should be on how such impacts on that asset can disrupt critical services and the whole urban system, along with gaining an understanding of the larger socioeconomic ramifications as well as the redundancies in the system. So, while a 'systems approach' in DRM science may be lauded in theoretical and normative debates within DRM science (see, for example, Cavallo and Ireland, 2014; Mai et al., 2020; Galasso et al., 2021; Verschuur et al., 2022), the results of this study suggest that the practice of DRM science falls short on describing and analysing the mechanisms and outcomes of interactions between urban actors engaged in managing disaster risks and how the impacts play out in interruptions to service delivery, and on economic activities (Ward et al., 2022). As one interviewee stated:

> There is [a] need to understand urban risk management in a systemic fashion—meaning we don't just look at an individual asset for example, but look at how impact on that asset can disrupt critical services and the whole urban system, what could be the larger socioeconomic impacts, where are the redundancies in the system, among others (Respondent 2).

A shift of focus among urban authorities is required, from procuring, collecting, and using data for single hazards and/or a specific sector, to a multi-hazard, multi-sectoral approach. This should also accommodate forward-looking and precautionary considerations for managing 'compound risks' as part of urban development strategies. In essence: to consider how disasters can be avoided through urban planning and development, not just prepared for or responded to. Existing risk data and modelling approaches should aim to offer the kind of comprehensive risk information on multi-hazard and compound risks needed to support this approach (Raymond et al., 2020; Modrakowski, Su, and Nielsen, 2022).

5.2 | Effectively communicating the 'value' of DRM science

Clear and effective research communication between DRM researchers and urban planners is key to generating ownership of the results and ensuring alignment with local city-level political processes and sociocultural aspects (Cartwright et al., 2016; Bednarek et al., 2018). Respondents noted that DRM science data can be translated into useful information for urban planning but that this requires researchers being in close contact with the operational, day-to-day work of urban planners. DRM science also needs to be communicated as adding value or solving a problem for planners—providing the data, knowledge, and tools that demonstrate when, where, how, and what kind of DRM is needed for cities (including their poorest neighbourhoods) to prosper in the face of multiple and compounding disaster risks. As one of the interviewees commented:

> We should be able to clearly communicate to cities about the 'value proposition' of DRM science. How is it going to help the cities in reducing human resource cost, time cost, and financial consequences? So, a clear articulation of why a city should spend time and resources on a new technology or research is important … and [the] best way that happens is when another city speaks about it, rather than scientists talking using jargons (Respondent 1).

A number of international experts noted that DRM science communication must place marginalised, economically poor, and more vulnerable groups at the centre of its endeavours. One of the respondents critically viewed DRM efforts (and thereby DRM science outputs) as concentrating on low-income residents as an 'afterthought' and triggered by actual events (viz., when people die or houses get destroyed), and not as a result of DRM science per se or any strategic focus (Respondent 6).

Most respondents noted that municipal governments also need to be better able to communicate to scientists and researchers their specific needs for information. Scientific data and information sharing could save both policymakers and DRM scientists valuable time and effort (see, for example, Shaw, 2020; Valachamy et al., 2022). However, this is challenging when there is no centralised data repository or record of what research has already been conducted, data produced, and other outputs. Planners highlighted that they should be made aware of previous studies and how to trace them.

5.3 | Research links across institutions at global, national, and local scales

Several respondents highlighted the importance of DRM science being focused on the local (community-level) scale, but that in so doing, it might be missing important global–urban and national–urban connections. Global frameworks and national urban resilience policies and national governments can have an important influence on urban planning practices. For instance, they develop the tools for urban and spatial planning and technologies in construction, which are generally adopted by local city-level governments. However, integrating global/national risk management concerns into urban policy processes and governance remains a challenge. This is because of the inherent temporal, spatial, and institutional mismatch between the issues faced on the global and national scale, and those confronted on the local scale (Bai et al., 2010; Revi et al., 2014).

Stakeholders also felt that DRM science needs to be based on a solid understanding of cultural norms and intergovernmental relationships, so that the information and knowledge produced can be used more easily by city governments. One interviewee was very categorical on this point, arguing that urban development plans will only include risk and resilience considerations if national legislation—or other informal norms shaping national–local government relations—encourages them to do so. Where that legislation is absent, urban planning practices are also likely to be limited. The respondent underlined:

> … institutional and legal setups in the country should be encouraging municipalities to use newest available technology, for example in construction of assets and planning in general. This is not the case in most countries. Even if it is … there are many legislative loopholes to avoid in the name of financial limitations or emergency situations. There is no legislation I can recall which says 'build back better' is a must. Of course, they endorse it at a broader policy level, but not enforce it (Respondent 3).

Respondents supported the importance of city university networks, especially in connecting local city-level researchers with municipalities. This is to enable knowledge sharing and help cities to access updated and real-time risk information and data.

5.4 | Coproduction of DRM science

Stakeholders described their interaction with DRM research processes as largely being supply-driven—whereby scientists produce data and information that has not been requested by local governments and/or does not respond to city-specific problems or provide implementable solutions.

In addition to being more involved in the research, local planners also stressed the importance of support to use the information that is produced effectively. In particular, interviewees suggested that DRM research could provide local planners with assistance to apply risk analysis to master planning. One respondent said:

> … when we are talking about DRM science for planning etc., I think the need for capacity development to use it should also come with this. There have to be capacities to use DRM science effectively (Respondent 1).

Overall, despite the rhetoric and recent trends in conceptual and theoretical literature on DRM, the experiences of the interviewees in this study suggest that serious consideration is not yet being given to research methods that are coproduced from the outset and serve to be critical and supportive of research users' needs.

6 | CONCLUSION

Despite research being increasingly couched in the language of coproduction, this was found to be superficial, from the perspectives of urban planners. There was little engagement in research design and implementation by the urban planners and DRM professionals themselves. The consequence is a continuing gap between the priorities of researchers and research users—according to urban planners, research outputs often did not match policy frameworks and planning cycles, and therefore could not be used (however useful, in theory, they could be). This study of DRM research projects in urban areas and the experiences of end users suggests that coproduction has not yet become the norm. DRM science encountered by urban planners and DRM professionals is designed by external actors and not well communicated. As a result, it does not match urban realities—it does not help stakeholders to solve problems, which in low- and middle-income country cities include the disparity between urban government mandates and the level of resources, rapidly changing demographics and risk, and in some cases, a high turnover in local government and changes in political priorities.

This study reveals a number of features of the structure and expectations of DRM science and research users. This is especially among urban planners who help in understanding observed limitations in the ability of DRM science to inform urban planning decisions, and hence contribute to controlling or minimising the construction of disaster risk in cities as it develops. This stocktake is an important step in redoubling efforts among both the science and urban planning communities and towards better communication and clearer understanding of what science can bring to urban decision-making on people-centred risk reduction, and how urban planners might need to work with other professionals to maximise benefits for urban residents.

From the perspective of urban planners and DRM professionals, DRM science is not fully being used to guide urban planning decisions. The urban planners interviewed in this study were all familiar with DRM research projects, but nonetheless found it difficult to apply outputs to their work. This was due to a disconnect between the types of knowledge produced— how it was produced—and the decision-making context.

Recent trends in DRM science suggest an important evolution in thinking within this interdisciplinary research community, including an understanding of the complex, non-linear, systemic, and cascading nature of disasters. This calls for multi-hazard approaches and systems thinking in empirical research; yet, the stakeholders interviewed for this study were unaware of any DRM research projects that considered risks in this way, or produced any outputs that could help them take such risk-informed decisions. Urban planners were most familiar with hazard maps and other tools for modelling and/or forecasting particular hazards and their impacts.

These findings present an opportunity to science that seeks to be impactful. They define specific actions that can be taken to move from talking to, to working with, research users. In particular, research users point to the benefit of more consideration of the following points:

- how to communicate science and in particular set expectations of the kind of information that can be produced;
- better awareness of policy cycles and the positioning of research activity within them;
- strategic positioning of research so that while it might have a ready audience in DRM, it can also reach out to effect urban planning; and
- influencing urban planning requires early engagement.

Academic research already makes a considerable contribution to the way risk management is understood and framed, assessed, communicated, and programmed in urban development and infrastructure deployment. If these questions of coproduction can be tackled head-on, they point to a resurgence of research impact in DRM science, while still allowing the latter to retain its principles of independence, openness, and critique.

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REFERENCES

Andrabi, S. (2021) 'Decolonising knowledge production in disaster management: a feminist perspective'. *Disaster Prevention and Management: An International Journal. 3*(3). pp. 202–214.

Assmuth, T., M. Hildén, and C. Benighaus (2010) 'Integrated risk assessment and risk governance as socio-political phenomena: a synthetic view of the challenges'. *Science of the Total Environment. 408*(18). pp. 3943–3953.

Avis, W.R. (2016) *Urban Governance*. GSDRC Topic Guide. November. Governance and Social Development Resource Centre, University of Birmingham, Birmingham.

Bai, X., R.R.J. McAllister, R.M. Beaty, and B. Taylor (2010) 'Urban policy and governance in a global environment: complex systems, scale mismatches and public participation'. *Current Opinion in Environmental Sustainability. 2*(3). pp. 129–135.

Baker, J.L. (2012) *Climate Change, Disaster Risk, and the Urban Poor: Cities Building Resilience for a Changing World*. World Bank, Washington, DC.

Bankoff, G. (2004) 'The historical geography of disaster: "vulnerability" and "local knowledge" in Western discourse'. In G. Bankoff, G. Frerks, and D. Hilhorst (eds.) *Mapping Vulnerability: Disasters, Development and People*. Earthscan, London. pp. 25–36.

Barber, B.R. (2013) *If Mayors Ruled the World: Dysfunctional Nations*, Rising Cities. Yale University Press, New Haven, CN.

Barnes, J. et al. (2013) 'Contribution of anthropology to the study of climate change'. *Nature Climate Change. 3*(6). pp. 541–544.

Bednarek, A.T. et al. (2018) 'Boundary spanning at the science–policy interface: the practitioners' perspectives'. *Sustainability Science. 13*(4). pp. 1175–1183.

Begum, R.A., M.S.K. Sarkar, A.H. Jaafar, and J.J. Pereira (2014) 'Toward conceptual frameworks for linking disaster risk reduction and climate change adaptation'. *International Journal of Disaster Risk Reduction*. *10* (Part A; December). pp. 362–373.

Bello, O., A. Bustamante, and P. Pizarro (2021) Planning for Disaster Risk Reduction Within the Framework of the 2030 Agenda for Sustainable Development. *Project Document. LC/TS.2020/108. Economic Commission for Latin America and the Caribbean*, Santiago.

Bery, S. and M.A. Haddad (2023) 'Walking the talk: why cities adopt ambitious climate action plans'. *Urban Affairs Review. 59*(5). pp. 1385–1407.

Bremer, S. and S. Meisch (2017) 'Co-production in climate change research: reviewing different perspectives'. *WIREs: Climate Change*. *8*(6). Article number: e482. https://doi.org/10.1002/wcc.482.

Burton, I., R.W. Kates, and G.F. White (1993) *The Environment as Hazard*. Second edition. Guilford Press, New York, NY.

Busayo, E.T., A.M. Kalumba, G.A. Afuye, O.Y. Ekundayo, and I.R. Orimoloye (2020) 'Assessment of the Sendai Framework for Disaster Risk Reduction studies since 2015'. *International Journal of Disaster Risk Reduction*. *50* (November). Article number: 101906. https://doi.org/10.1016/j.ijdrr.2020.101906.

Bussell, J. and A. Fayaz (2017) *The Political Economy of Disaster Preparedness and Risk Reduction in Pakistan*. Research Brief No. 5. May. Robert S. Strauss Center for International Security and Law, University of Texas, Austin, TX.

Cannon, T. (1994) 'Vulnerability analysis and the explanation of "natural" disasters'. In A. Varley (ed.) *Disasters, Development and Environment*. John Wiley & Sons, Chichester. pp. 13–30.

Cartwright, S.J. et al. (2016) 'Communicating complex ecological models to non-scientist end users'. *Ecological Modelling. 338* (October). pp. 51–59.

Cavallo, A. and V. Ireland (2014) 'Preparing for complex interdependent risks: a System of Systems approach to building disaster resilience'. *International Journal of Disaster Risk Reduction. 9* (September). pp. 181–193.

Chen, N., L. Chen, Y. Ma, and A. Chen (2019) 'Regional disaster risk assessment of China based on self-organizing map: clustering, visualization and ranking'. *International Journal of Disaster Risk Reduction. 33* (February). pp. 196–206.

Christoplos, I., J. Mitchell, and A. Liljelund (2001) 'Re-framing risk: the changing context of disaster mitigation and preparedness'. *Disasters. 25*(3). pp. 185–198.

Collinson, S. (2003) *Power, Livelihoods and Conflict: Case Studies in Political Economy Analysis for Humanitarian Action*. HPG Report 13. February. Humanitarian Policy Group, Overseas Development Institute, London.

Dickinson, T. and I. Burton (2022) 'Disaster risk creation: the new vulnerability'. In G. Bankoff and D. Hilhorst (eds.) *Why Vulnerability Still Matters: The Politics of Disaster Risk Creation*. Routledge, London. pp. 192–205.

Donovan, A. (2017) 'Geopower: reflections on the critical geography of disasters'. *Progress in Human Geography. 41*(1). pp. 44–67.

Faisal, A. and H.A.H. Khan (2018) 'Application of GIS and remote sensing in disaster management: a critical review of flood management'. Paper for the International Conference on Disaster Risk Mitigation, Dhaka, Bangladesh, 3–24 September 2017. https://www.researchgate.net/publication/322298808_APPLICATION_OF_GIS_AND_REMOTE_SENSING_IN_DISASTER_MANAGEMENT_A_CRITICAL_REVIEW_OF_FLOOD_MANAGEMENT (last accessed on 3 May 2024).

Few, R., T. Armijos Burneo, and J. Barclay (2022) 'Working with communities on disaster risk research: reflections from cross-disciplinary practice'. *International Journal of Disaster Risk Reduction*. 70 (February). Article number: 102815. https://doi.org/10.1016/j.ijdrr.2022.102815.

Fischhoff, B. and A.L. Davis (2014) 'Communicating scientific uncertainty'. *Proceedings of the National Academy of Sciences. 111*(S4). pp. 13664–13671.

Gaillard, J-C. (2019) 'Disaster studies inside out'. *Disasters. 43*(S1). pp. S7–S17.

Galasso, C. et al. (2021) 'Editorial. Risk-based, pro-poor urban design and planning for Tomorrow's Cities'. *International Journal of Disaster Risk Reduction. 58* (May). Article number: 102158. https://doi.org/10.1016/j.ijdrr.2021.102158.

Gupta, R., and A. Barman (2020) 'How do urban communities perceive climate change? An enquiry on use of indigenous and local knowledge in Silchar, Assam'. *International Journal of Disaster Recovery and Business Continuity. 11*(1). pp. 1836–1843.

Hallegatte, S., A. Vogt-Schilb, J. Rozenberg, M. Bangalore, and C. Beaudet (2020) 'From poverty to disaster and back: a review of the literature'. *Economics of Disasters and Climate Change. 4*(1). pp. 223–247.

Hays, W. (1999) 'Keynote paper: the IDNDR perspective'. In J. Ingleton (ed.) *Natural Disaster Management: A Presentation to Commemorate the International Decade for Natural Disaster Reduction (IDNDR), 1990–2000*. Tudor Rose, Leicester. pp. 267–279.

Hewitt, K. (1995) *Regions of Risk: A Geographical Introduction to Disasters*. Longman, Harrow.

Hofmann, S.Z. (2021) '100 Resilient Cities program and the role of the Sendai Framework and disaster risk reduction for resilient cities'. *Progress in Disaster Science. 11* (October). Article number: 100189. https://doi.org/10.1016/j.pdisas.2021.100189.

Hulme, M. (2011) 'Reducing the future to climate: a story of climate determinism and reductionism'. *Osiris. 26*(1). pp. 245–266.

IFRC (International Federation of Red Cross and Red Crescent Societies) (2002) *World Disasters Report: Focus on Reducing Risk*. IFRC, Geneva.

Ingham, V., J. Hicks, M. Islam, I. Manock, and R. Sappey (2011) 'An interdisciplinary approach to disaster management, incorporating economics and social psychology'. *International Journal of Interdisciplinary Social Sciences. 6*(5). pp. 93–106.

Islam, S., C. Chu, and J.C.R. Smart (2019) 'A political economy analysis of public spending distribution for disaster risk reduction in Bangladesh'. *European Journal of Sustainable Development*. *8*(5). Article number: 358. https://doi.org/10.14207/ejsd.2019.v8n5p358.

Islam, S., K.M. Zobair, C. Chu, J.C.R. Smart, and S. Alam (2021) 'Do political economy factors influence funding allocations for disaster risk reduction?'. *Journal of Risk and Financial Management*. *14*(2). Article number: 85. https://doi.org/10.3390/jrfm14020085.

Jones, L. et al. (2013) The Political Economy of Local Adaptation Planning: Exploring Barriers to Flexible and Forward-Looking Decision Making in Three Districts in Ethiopia, *Uganda and Mozambique*. February. Overseas Development Institute, London.

Kelman, I. (2015) 'Climate change and the Sendai Framework for Disaster Risk Reduction'. *International Journal of Disaster Risk Science. 6*(2). pp. 117–127.

Kelman, I. (2018) 'Lost for words amongst disaster risk science vocabulary?'. *International Journal of Disaster Risk Science. 9*(3). pp. 281–291.

Kelman, I., J. Mercer, and J-C. Gaillard (2017) *The Routledge Handbook of Disaster Risk Reduction Including Climate Change Adaptation*. Routledge, London.

Mai, T. et al. (2020) 'Defining flood risk management strategies: a systems approach'. *International Journal of Disaster Risk Reduction*. *47* (August). Article number: 101550. https://doi.org/10.1016/j.ijdrr.2020.101550.

Mavhura, E. and J. Mapuva (2022) 'Barriers for local authorities to invest in disaster risk reduction: evidence from Zimbabwe'. *South African Geographical Journal. 104*(1). pp. 122–136.

McConnell, A. and P. 't Hart (2019) 'Inaction and public policy: understanding why policymakers "do nothing"'. *Policy Sciences. 52*(4). pp. 645–661.

McGowran, P. and A. Donovan (2021) 'Assemblage theory and disaster risk management'. *Progress in Human Geography. 45*(6). pp. 1601–1624.

Mechler, R. (2004) *Cost–Benefit Analysis of Natural Disaster Risk Management in Developing and Emerging Countries*. Manual. August. International Institute for Applied Systems Analysis, Laxenburg.

Mechler, R. (2016) 'Reviewing estimates of the economic efficiency of disaster risk management: opportunities and limitations of using risk-based cost–benefit analysis'. *Natural Hazards. 81*(3). pp. 2121–2147.

Middleton, N. and P. O'Keefe (1998) *Disaster and Development: The Politics of Humanitarian Aid*. Pluto Press, London.

Modrakowski, L-C., J. Su, and A.B. Nielsen (2022) 'The precautionary principles of the potential risks of compound events in Danish municipalities'. *Frontiers in Climate*. *3* (January). Article number: 772629. https://doi.org/10.3389/fclim.2021.772629.

Muñoz-Erickson, T.A., C.A. Miller, and T.R. Miller (2017) 'How cities think: knowledge coproduction for urban sustainability and resilience'. *Forests. 8*(6). Article number: 203. https://doi.org/10.3390/f8060203.

Nightingale, A.J. et al. (2020) 'Beyond technical fixes: climate solutions and the great derangement'. *Climate and Development. 12*(4). pp. 343–352.

Peek, L. and S. Guikema (2021) 'Interdisciplinary theory, methods, and approaches for hazards and disaster research: an introduction to the special issue'. *Risk Analysis. 41*(7). pp. 1047–1058.

Pelling, M. et al. (2021) 'Synergies between COVID-19 and climate change impacts and responses'. *Journal of Extreme Events. 8*(2). Article number: 2131002. https://doi.org/10.1142/S2345737621310023.

Pelling, M. et al. (2022) 'A climate resilience research renewal agenda: learning lessons from the COVID-19 pandemic for urban climate resilience'. *Climate and Development. 14*(7). pp. 617–624.

Pyles, L. (2016) 'Decolonising disaster social work: environmental justice and community participation'. *British Journal of Social Work. 47*(3). pp. 630–647.

Raymond, C. et al. (2020) 'Understanding and managing connected extreme events'. *Nature Climate Change. 10*(7). pp. 611–621.

Revi, A. et al. (2014) 'Urban areas'. In C.B. Field et al. (eds.) *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press, New York, NY. pp. 535–612.

Schipper, L.F., N.K. Dubash, and Y. Mulugetta (2021) 'Climate change research and the search for solutions: rethinking interdisciplinarity'. *Climatic Change. 168*(3–4). Article number: 18. https://doi.org/10.1007/s10584-021-03237-3.

Scolobig, A. and M. Pelling (2016) 'The coproduction of risk from a natural hazards perspective: science and policy interaction for landslide risk management in Italy'. *Natural Hazards. 81*(S1). pp. 7–25.

Scott, Z. and M. Tarazona (2011) *Study on Disaster Risk Reduction, Decentralization and Political Economy*. Global Assessment Report on Disaster Risk Reduction. https://www.preventionweb.net/english/hyogo/gar/2011/en/bgdocs/Scott_&_Tarazona_2011.pdf (last accessed on 3 May 2024).

Sen, A. (1982) *Poverty and Famines: An Essay on Entitlement and Deprivation*. Oxford University Press, New York, NY.

Shah, H. (2020) 'Global problems need social science'. *Nature* website. 24 January. https://www.nature.com/articles/d41586-020-00064-x (last accessed on 3 May 2024)

Sharifi, A. and Y. Yamagata (2022) 'Smart cities and climate-resilient urban planning'. *Environment and Planning B: Urban Analytics and City Science. 49*(5). pp. 1347–1353.

Shaw, R. (2020) 'Thirty years of science, technology, and academia in disaster risk reduction and emerging responsibilities'. *International Journal of Disaster Risk Science. 11*(4). pp. 414–425.

Shi, P. et al. (2020) 'Disaster risk science: a geographical perspective and a research framework'. *International Journal of Disaster Risk Science. 11*(4). pp. 426–440.

Siddiqi, A. and J.J.P. Canuday (2018) 'Stories from the frontlines: decolonising social contracts for disasters'. *Disasters. 42*(S2). pp. S215–S238.

Sillmann, J. et al. (2022) *Briefing Note on Systemic Risk*. International Science Council, Paris.

Southgate, R.J. et al. (2013) *Using Science for Disaster Risk Reduction*. Report of the UNISDR Scientific and Technical Advisory Group. United Nations Office for Disaster Risk Reduction, Geneva.

Tanner, T. et al. (2016) 'The triple dividend of resilience—a new narrative for disaster risk management and development'. In S. Surminski and T. Tanner (eds.) *Realising the 'Triple Dividend of Resilience': A New Business Case for Disaster Risk Management*. Springer, Cham. pp. 151–172.

Tozier de la Poterie, A. and M-A. Baudoin (2015) 'From Yokohama to Sendai: approaches to participation in international disaster risk reduction frameworks'. *International Journal of Disaster Risk Science. 6*(2). pp. 128–139.

Twigg, J. (2015) Disaster Risk Reduction. *Good Practice Review 9*. Humanitarian Policy Group, Overseas Development Institute, London.

UNDRR (United Nations Office for Disaster Risk Reduction) (2015) *Sendai Framework for Disaster Risk Reduction 2015–2030*. Website. https://www.undrr.org/publication/sendai-framework-disaster-risk-reduction-2015-2030 (last accessed on 3 May 2024).

UNDRR (2019) *Global Assessment Report on Disaster Risk Reduction*. UNDRR, Geneva.

UNDRR (2023) *The Report of the Midterm Review of the Implementation of the Sendai Framework for Disaster Risk Reduction 2015–2030*. UNDRR, Geneva.

UNDRR and AP-STAAG (Asia-Pacific Science, Technology and Academia Advisory Group) (2020) *Asia-Pacific Regional Framework for NATECH (Natural Hazards Triggering Technological Disasters) Risk Management*. UNDRR, Geneva.

UNISDR (United Nations International Strategy for Disaster Reduction) (2005) *Hyogo Framework for Action 2005–2015: Building the Resilience of Nations and Communities to Disasters*. UNISDR, Geneva.

University of Colorado Boulder (n.d.) '*Disaster science: definition*'. Website https://converge.colorado.edu/social-sciences/disaster-science/ (last accessed on 3 May 2024).

Valachamy, M., S. Sahibuddin, N.A. Ahmad, and N.A.A. Bakar (2022) 'Critical success factors for geospatial data sharing in disaster management'. *IOP Conference Series: Earth and Environmental Science*. 1064. Article number: 012038. https://iopscience.iop.org/article/10.1088/1755-1315/1064/1/012038/meta (last accessed on 3 May 2024).

van der Bles, A.M., S. van der Linden, A.L. Freeman, and D.J. Spiegelhalter (2020) 'The effects of communicating uncertainty on public trust in facts and numbers'. *Proceedings of the National Academy of Sciences. 117*(14). pp. 7672–7683.

Verschuur, J., R. Pant, E. Koks, and J. Hall (2022) 'A systemic risk framework to improve the resilience of port and supply-chain networks to natural hazards'. *Maritime Economics & Logistics. 24*(3). pp. 489–506.

Wahlström, M. (2015) 'New Sendai Framework strengthens focus on reducing disaster risk'. *International Journal of Disaster Risk Science. 6*(2). pp. 200–201.

Walsh, J.C., L.V. Dicks, and W.J. Sutherland (2014) 'The effect of scientific evidence on conservation practitioners' management decisions'. *Conservation Biology*. *29*(1). pp. 88–98.

Ward, P.J. et al. (2022) 'Invited perspectives: a research agenda towards disaster risk management pathways in multi-(hazard-)risk assessment'. *Natural Hazards and Earth System Sciences*. *22*(4). pp. 1487–1497.

Wilkinson, E. (2012) *Transforming Disaster Risk Management: A Political Economy Approach*. Background Note. January. Overseas Development Institute, London.

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