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100 Resilient Cities program and the role of the Sendai framework and disaster risk reduction for resilient cities

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ABSTRACT

The Rockefeller Foundation launched 100 Resilient Cities (100RC) in 2013 to build worldwide urban resilience. The 100RC program aims to implement urban resilience under the Sustainable Development Goals of the UN 2030 Agenda for Sustainable Development and the Sendai Framework for Disaster Risk Reduction 2015–2030. These frameworks link disaster resilience and disaster risk reduction to issues of vulnerability, climate change, livelihoods, rebuilding, and equity. Achieving disaster resilience and risk reduction requires more than building back better, or bouncing back from disaster: social equity, participation and livelihoods must also be advanced. Using a pathways approach related to narratives of disaster vulnerability and risk, this paper analyzes the resilience policies developed to support disaster risk reduction under the program. Evaluating member city Resilient Strategies plans using directed and summative content analysis, this research assesses whether the 100RC program emphasized vulnerability and risk narratives in its disaster risk reduction approaches. These results reveal the differences produced among member cities – and from expectations of advancing social equity, livelihoods and participation – due to the role of actors and power expressed in the policy design and implementation. The paper concludes with recommendations to support urban disaster resilience using the Sendai Framework.

1. Introduction

Launched in 2013 by the Rockefeller Foundation, 100 Resilient Cities (100RC) has invested $100 million in the pursuit of urban resilience worldwide. 100RC brings together cities, experts, and public and private organizations through its Platform Partners, sponsors a Chief Resilience Officer and offers innovative financing and technology for members. The aim of the program was to create a network for best practices, share in lessons learned, and connect with other experts in an effort to assist in the scaling issue of identifying urban resilience challenges, finding solutions and implementing policies for those facing similar problems. Members participate in a resilience strategy process engaging with stakeholders and partners to identify resilience priorities, shocks and stress, and establish initiatives to create a City Resilience Strategy (CRS). It is estimated that over $1 million was allocated through training, partnerships, and other non-monetary services to each member city. The program ended in 2019, but continues to operate as a platform for members and partners to share best practices, reports, strategies, and tools under its successor, Adrienne Arsht Center for Resilience [1].

This research seeks to answer whether the 100RC program emphasized vulnerability and risk narratives using disaster risk reduction approaches in the successive member Resilient Strategies. This is done by applying a directed and summative content analysis of plan evaluation, based on the "31 City Resilience Strategies" developed by Fitzgibbons and Mitchell [2]. This paper uses a pathways approach related to narratives of disaster vulnerability and risk. This approach analyzes resilience policies developed to support disaster risk reduction. Resilience is seen as the reactive policy response to disaster events able to resist, adapt or recover in a timely manner. Reducing vulnerability and lowering risk are seen as interconnected, resulting in enhanced livelihoods, contributing to sustainable development and strengthening communities linked to disaster risk reduction strategies. Here a resilience system refers to a 100RC resilience strategy. This paper focuses on narratives centered around community vulnerability and risk in these resilience systems. Narratives are analyzed revealing treatment of such issues: how resilience policies understand, define, and identify disaster risks, vulnerabilities, vulnerable populations or marginalized persons; determining what processes create or contribute to overall disaster risks; what role vulnerable stakeholders play in disaster resilience governance; whether their voices are heard and counted; whether they had a role in the development of the planning, its implementation or in future policy; whether investments are made to help them; who benefits from this collaboration; and what strategies are used for disaster recovery planning?

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2. Resilience and disasters

The current global undertaking of disaster resilience is being pursued in the hopes of reducing disaster impacts and strengthening communities [1,3]. The United Nations led the first call in the 1990s to address international disaster risk policy with the creation of the Yokohama Strategy. The Strategy focused on international cooperation and implementation of disaster risk reduction (DRR) by providing guidelines for prevention and mitigation. This was later followed up in 2005 by the Hyogo Framework for Action, shifting focus on managing capacities and risk preparedness interventions. The Sendai Framework for Disaster Risk Reduction 2015–2030 (SFDRR) was created in 2015 as an attempt to broaden and enhance responses to disasters and allow for resilience measurements [4]. SFDRR reflects the notions of reducing disaster risk and building resilience as an integral part of the 2030 Agenda for Sustainable Development and its Sustainable Development Goals (SDGs). These initiatives are interrelated in an effort to build overall resilience. Disasters affect a wide range of the SDGs through poverty, food insecurity, urbanization and climate change, but SDGs specifically target disaster risk resilience. SDGs link disaster resilience and DRR through issues of vulnerability, climate change, livelihoods, rebuilding, and equity [4]. Achieving disaster resilience requires communities and households to transform in light of shocks and stresses. Hence, resilience is more than building back better, or bouncing back from a disaster: disaster resilience and DRR planning are designed to advance social equity and livelihoods. SFDRR has four priority areas: understanding disaster risk; strengthening disaster risk governance; investing in DRR for resilience; and enhancing disaster preparedness for effective response by utilizing 'Build Back Better' in recovery, rehabilitation and reconstruction. SFDRR was one of the first major agreements established from the agenda as a way to influence and complement the goals and targets by outlining seven global targets. SFDRR indicators also contribute to the measurement of SDGs [4]. 100RC program aims to develop resilience under SFDRR, SDGs and DRR.

The UN's approach encourages pursuit of resilience policies as a prescribed remedy, incorporating notions of mitigation, preparedness, resistance and recovery in order to deal with future uncertainties [5]. Resilience has taken on several different definitions within the field of hazards and disaster research. Natural disaster resilience is defined as "the ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions" [6]. When discussing a community or a city's ability to withstand disasters, researchers often refer to the term 'resilience' [7]. Resilience is generally known to be a property of a range of systems that are able to remain stable when facing shocks and stresses, recover following an event, and adapt to new circumstances [4]. Much emphasis is placed on recovery and resilience after disasters [8]. One city's recovery or resilience is not the same as another's, due to its unique attributes and inherent ability to rebound based on political and economic factors [9].

Resilience has emerged in urban planning and research to provide insights into managing disaster issues in complex socio-ecological systems [10–12]. Urban resilience is "the capacity of a city to rebound from destruction" [13] using three mechanisms: persistence (systems resisting disturbance), transition, and transformation [14]. Strengthened resilience is seen as the pathway to help mitigate immediate deaths, injuries, and economic losses from disasters by utilizing four methods: (1) systematic assessment and monitoring of risks associated with disasters in order to improve understandings of risks by the public and government; (2) establishment of a culture and system of incentives promoting accountability by stakeholders for planning and preparation for response to and recovery from disasters; (3) the use of long-term planning through investments and use of existing measures; and (4) international cooperation with the aid and support of research and evaluation [15].

Disaster resilience strategies have gained attention among practitioners and researchers seeking to build resilient societies by focusing on urban,

socioeconomic, and business resilience [16]. Disaster resilience is a concept shared by many disciplines making it difficult for a common definition. The most frequent definition used for disaster resilience is the speed with which people, communities and societies are able to recover from hazards, shocks or stresses without compromising long-term development [17,18]. Disaster resilience can be described both as desired outcome(s) and a process leading to desired outcomes [19]. Core elements of disaster resilience include context (whose resilience is being built), disturbances (shocks and stresses), capacity to respond (ability to manage shocks/stresses), and reaction (bounce back better) [17]. However, under careful examination, revealed resilience after a disaster may or may not actually result in pre-disaster states. Therefore, true resilience is revealed when it is manifest as action that can be observed as a process [20].

Disaster resilience is directly linked to disaster risk reduction (DRR) [17]. DRR is broadly defined as the development and application of policies, strategies and practices to reduce vulnerabilities by managing risk arising from interactions between people, environment and hazards. DRR is seen as a pathway to improved security and safety providing vital support and opportunities for households, communities, societies and governments to undertake initiatives that improve well-being, strengthen livelihoods and contribute to sustainable development. DRR is considered as a vital aspect of resilience building [21]. Moreover, the usage of DRR and disaster resilience can contribute to the overall urban resiliency of cities.

Disaster risk and vulnerability are closely related to resilience [19]. Vulnerability is defined as the characteristic of those affected in terms of the ability to anticipate, cope, resist, manage and recover from the natural hazard [22]. Vulnerability is conceptualized and applied within DRR in multiple ways and different contexts. Vulnerability is both a phenomenon and a concept, with practical applications in DRR. Therefore, both quantitative and qualitative approaches are relevant in order to understand the entire dimensionality of vulnerability [23]. Disaster risk is defined as the possibility of loss, injury, death or any other consequence resulting from the natural disaster [22]. How disaster risk and vulnerability are conceptualized, measured and mitigated is vital to understand relationships between physical, social, political and economic factors [24], that directly impact who and what is affected by the disaster and empowered by the recovery, who is vulnerable, and who is resilient. People within communities and cities are vulnerable often due to their migration patterns, access to resources and the likelihood of a natural disaster event occurring [25]. Vulnerability is both a biophysical and social response [26]. Increasing exposure and vulnerability of urban areas to natural disasters is becoming more important to the field of hazards research since it is related to both uneven economic development and to declining infrastructure as well as a need to invest in better infrastructure to avoid rising risk [27–31]. Vulnerability as a concept provides crucial insights and knowledge in understanding disaster risks for communities. Vulnerability is also an important indicator for measuring and monitoring for DRR as well as influencing urban resilience policy developments. Therefore, identifying, assessing and reducing risk and vulnerability are vital for disaster resilient societies. DRR efforts are linked to holistic and integrative vulnerability perspectives [32].

It is also important to consider critiques of resilience as it relates to both the urban and disasters. Resilience in the context of urban development is focused on adaptation to disturbances, or shocks and stresses. This turns attention to managing and adapting to current shocks and stresses, rather than attempting to address existing political and economic challenges contributing to the problem formation [33]. Davoudi [34] calls attention to how resilience has just as much influence shaping how challenges are perceived as it does in shaping how to respond to them. Resilience is dynamic, relational, and deeply political [35]. Critics of urban resilience argue that programs, such as the Rockefeller Foundation's 100 Resilient Cities program, should be confronted with the following questions [33]: Who determines what is desirable? Whose resilience is prioritized? Who is included/excluded from the system? Is the resilience of some prioritized over others? Does enhanced resilience reduce resilience elsewhere? To date, few studies exist that seek to provide answers to these questions [33].

In disaster studies, Tiernan et al.'s [4] resilience definition and usage may be appropriate, however lacks the specificity of the other approaches, and is potentially in conflict with them. Generally, resilience is often understood as a property of a system that is related to an appropriate system model. In contrast, economic geographers tend to understand this to be a potential property of a regional or sectoral economic system [36,37], while development scholars understand resilience as either a property of a social system or as a narrative [38,39]. In hazards research the system is considered to be a society, and how well it deals with environmental and hazards risks [35]. Repositioning the concept of resilience emphasizes the growing interest in a 'pathways approach' in an effort to address governance challenges posed by dynamic and complex multi-scale systems [40]. Here resilience denotes a broader approach in thinking about change and societal responses dependent on context and perspective. Leach et al. [40] are concerned with system-framings (different ways of understanding and characterizing a system) and narratives. These narratives pertain to issues created by specific actors, networks or institutions. They can be used to justify particular kinds of actions, strategies or interventions. When these narratives are supported by institutional and political processes and by governance, they define and shape pathways in particular. In turn, such narratives can silence other narratives, so that they are never to be manifested, remaining silenced, marginalized or forgotten. Consequently, narratives are able to influence pathways through assumptions about temporality of change and styles of action [40].

Leach et al. [40] constructs a typology of policy responses using a matrix relating two styles of actions ('control' or 'respond' to change) to temporality of change ('shock' or 'stress') to achieve four possible sustainable scenarios: stability (control action to counter shock), resilience (response to shock), durability (control action to counter stress), and robustness (response to stress). They recognize that a policy response might vary or have different impacts depending on whom is being studied, at what scale, in what space and context, as well as the varying degrees of sustainable values being considered in relation to specific goals [40]. This adds a reflexive dimension to resilience thinking by recognizing the analysis is based on specific framings with different outcomes. At the same time, it redefines resilience as a narrative of response to shock while highlighting alternative narratives. Thus, this framework can assist in the understanding of how 'resilience' is being used in the 100RC program and SFDRR: resilience is not defined as a property of a system, but rather as a narrative related to a DRR that will likely vary from city to city.

Ultimately the benefits or the burdens of urban resilience policy making and planning are rooted in power, politics and conflict [34,41]. Davoudi [34] argues the power-laden nature of urban resilience highlights what values must be identified, choices made and identification of political pathways. Treating a city in separate parts or sectors (e.g. political, economic, social) without a holistic approach undermines resiliency and is a catalyst for long-term disaster losses and casualties [42]. Torabi et al. [41] highlight the importance of examining urban resilience pathway dimensions by addressing city policies that are often rooted in power and politics. Lasa et al. [43] stress a city's commitment to DRR should also consider an actor's (political) ability to understand risk, resilience, governance, policies, and bureaucratic processes. Potentially, scholars in urban and cities studies can contribute a theorization of policy mobility to urban resilience research. Policy mobility describes the movement of a policy from one place to another as it relates to various elements (e.g. institutions, actors, infrastructure) allowing movement. The way in which a policy moves is related to the context from which, through which, and to which it travels [44]. Much of these works are focused on the urban and how cities are not bounded places with specific internal characteristics and processes, but function rather as nodes in relational networks linked to other nodes across various distributions of material and immaterial objects [44]. Often the creation of a policy allows for the remaking of power relations within and between different places. Therefore, policy mobility provides an additional perspective that relations are what constitute a city and the infrastructure that enable policy mobility. This also helps us rethink cities not as singular places, but rather as urban assemblages with multiple

spatialities and temporalities [44]. Furthermore, policy mobility allows for the close study of how implementation can and has shaped why some policies get mobilized. There are important parallels here to thinking on how the manifestation of narratives occurs in a pathways approach.

2.1. Rockefeller Foundation 100 Resilient Cities

The Rockefeller Foundation launched the 100 Resilient Cities (100RC) initiative as a separate nonprofit organization in 2013 to help cities around the world build resilience to the economic, social and physical challenges they will face in the 21st century. To become a member, cities completed an application process and winners were announced in three rounds in 2013, 2014 and 2016. Cities were chosen based on the presence of mayors seeking innovation and change, a track record of establishing and maintaining partnerships, and the ability to work with diverse stakeholders. Sponsored Cities are cities whose membership is underwritten by local funders, separate from the 100RC application process. Under the 100RC initiative, member cities would receive direct funding to hire a Chief Resilience Officer (CRO) to lead the city's resilience efforts for two years. 100RC provides member cities with access to resilience building tools and services supplied by platform partners from the private, public, academic, and nonprofit sectors. It is estimated that over $1 million has been allocated in funding through training, partnerships, and other non-monetary services to each member city. Platform Partners are intended to assist cities understand their needs, build new tools and improve existing ones. The program provided a unique peer support system for member cities to share and assist one another in resource development, problem-solving and networking. 100RC member cities are expected to participate in a 100 RC Resilience Strategy process. This is a roadmap designed over a 6 to 9-month process to develop resilience for the city by engaging with stakeholders, working with strategy partners in order to identify resilience priorities, shocks and stresses, and establishing a set of initiatives to move forward by creating a City Resilience Strategy (CRS) [1].

100RC member cities utilize the City Resilience Framework (CRF) as a strategy development process and method for understanding the complexity of urban systems and the drivers contributing to a city's resilience. CRF is a framework developed by Arup, a private consulting firm, and supported by the Rockefeller Foundation. It emphasizes the 100RC strategy development process as a method for understanding urban resilience by allowing member cities to identify indicators for city resilience, support dialogue between stakeholders, and assist in the design of a city resilience strategy for implementation and oversight. The CRF recognizes that both cities and the way resilience manifests in them are unique, and aims to provide a lens to understand the complexity and nuances of city resilience [1,56].

100RC identifies seven qualities of a resilient system applicable at a city scale as well as individual systems. This formed the basis of their working principle that what was missing was a comprehensive and holistic framework combining physical aspects of cities with less tangible aspects, linked with human behavior in the context of economic, physical and social disruptions. Rather than assessing individual systems within cities to describe a resilient city, the framework is applied at the city scale. Work was further extended to both define functions critical to resilience, and test the framework in order to understand what contributes to resilience in cities, and how resilience is understood from stakeholder perspectives. This resulted in the identification of eight city functions for resilient cities: delivers basic needs; safeguards human life; protects, maintains and enhances assets; facilitates human relationships and identity; promotes knowledge; defends the rule of law, justice and equity; supports livelihoods; and stimulates economic prosperity. Additionally, 12 key themes were identified as factors for improving resiliency [56].

3. Materials and methods

The framework of this paper has been adapted from the SFDRR and the "31 City Resilience Strategies" [2] that applies a directed and summative content analysis of plan evaluation using a formative approach to answer:

Has the 100RC program emphasized vulnerability and risk narratives using DRR approaches in the successive member city Resilient Strategies? Fitzgibbons and Mitchell [2] developed the "31 City Resilience Strategies" as an analytical framework to review all relevant resilience and specific subject areas under evaluation using directed and summative content analysis. The methodology extracts quantitative observations from strategy content and uses a list of indicators to score individual strategies based on strategy content. Qualitative content analysis assists in analyzing text data to understand the content or contextual meaning of policies. Summative content analysis allows for analysis to determine what has been said. Evaluation in planning, more commonly known as plan evaluation, helps determine how effective projects and policies are and whether they have achieved their intended goals and objectives. Conducting such evaluation increases legitimacy, improves decision making, promotes accountability, and fosters learning. Plan evaluation may take place once a policy or program has been implemented to determine intended outcomes (summative) or during the early initiative phases of development and implementation (formative) [2,45,46].

The framework supports urban resilience planning for DRR using the Sendai Framework as the unit of analysis. Two broad categories (Table 1) were identified for criteria: Disaster Resilience; and Open Process. Within these two categories, there are 7 sub-themes (risk and vulnerability; governance; risk reduction investments; recovery; monitoring and evaluation; and transparency and participation) and 58 criteria used for the assessment. Among the 58 criteria developed, 49 were assigned points by a rater, indicating the degree of explicit aims to address disaster risk, vulnerability, resilience, DRR, strategy design (transparency and participation) and evaluation. Each of these 49 criteria are rated depending on how thoroughly each criterion is addressed in the resilience strategy (1 point for persuasive arguments and compelling evidence provided; 0.5 point for casual reference but no additional references; and 0 points for no evidence). Due to the lack of explicit DRR resiliency initiatives, there are multiple possible dimensions of DRR embedded within various plan design methods. Therefore, summative observations were used to capture disaster related issues tied to other initiatives or programs not explicitly meant for such issues. Therefore, the remaining nine unscored criteria were used with summative observations to assess these related DRR issues. These observations were coded and documented using ATLAS.ti software. Atlas.ti is a computer software program that assists analysis of qualitative research data such as document analysis. Only 75 CRSs have been published in English as of March 2020 that were provided by the 100 Resilient Cities Program were used for the analysis. To ensure comparability, some cities (Barcelona, Lisbon, Puerto Rico) have been excluded from the analysis because they chose not to publish an official CRS and instead opted for other policy related publications. The analysis is discussed in the Results and Discussion section of this paper.

To validate ratings, a second external reviewer (rater) was used to rate the same criteria and methods independently of the CRS. Prior to reconciling, the overall average score was 95.57% similar between the two independent raters. Major rating discrepancies (more than 20% difference) occurred in ten CRS, and minor rating discrepancies (10–20% differences) occurred in two strategies. Summative and directed observations were reconciled among the raters, and the new overall average scores between

raters were 99.33% similar. As a result, there were no major or contradictory summative data observations noted between the raters.

The framework provides a structure to assess only explicit DRR within a CRS. This provides an advanced analysis to quantify how cities prioritize disaster risk and resilience, allowing classification of similarities or relationships between cities, and assessment of overall transparency in the planning and monitoring of policies. However, the analysis is limited: examination of actual implementation and ongoing disaster risk and resilience policies from the strategy cannot be readily identified. The approach could be adapted and modified to assess ongoing strategies for performance using a summative plan evaluation. Additionally, the long-term disaster recovery could be used as a metric for a plan evaluation to gain insights into just how resilient a city is against DRR goals, as well as comparable climate change strategies that directly or indirectly address disaster risk, vulnerability and resilience.

4. Findings

The overall findings of the CRS analysis suggest that the 100RC program has not fundamentally addressed issues related to DRR's goal of achieving resilience by focusing on reducing disaster risk and vulnerability (Fig. 1). Many member strategies lacked specificity or clarity as to what disaster risks and vulnerabilities affected vulnerable groups, what processes would be undertaken to reduce such challenges, having collective feedback from vulnerable groups as well as engaging with them in governance and shared responsibilities, and how investments being made from partnerships or external funding sources would be managed and benefit all stakeholders. While disaster risks and challenges were identified among shocks and stresses, these tended to be overlooked when designing and implementing key policies for urban resilience. Instead, policies generally concentrated on urban infrastructure improvements, general disaster management efforts to improve early warning detection systems, improving hazard and urban growth maps, disaster education, or climate change policies. However, some member cities and strategies do report efforts focused on DRR, connected to SFDRR, SDGs or UNISDR, suggesting the decision not to prioritize vulnerability and risk may not necessarily be a result of the 100RC program.

In considering whether some cities were more likely than others to establish narratives centered around community vulnerability and risk in their CRS, the following broader categories of cities and countries are used (Table 2): city classification, location, climate classification, Human Development Index, Unbreakable Resilience Indicator, and Worldwide Governance Indicators. The city classification is based on the OECD-EC approach that identifies small cities between 50,000 and 100,000 inhabitants, medium between 100,00 and 250,000 inhabitants, large between 250,000 and 500,000 inhabitants, extra-large between 500,000 and 1,000,000 inhabitants, extra-extra-large between 1,000,000 and 5,000,000 inhabitants, and a global city of more than 5,000,000 inhabitants [47]. The location of each city is determined using the Global North/South classifications [48]. The Köppen-Geiger Climate Classification system [49] applies five categories to assess whether a city is tropical (Group A), arid (Group B), temperate (Group C), cold (Group D), or polar (Group E). The World Bank and the Global Facility for Disaster Reduction and Recovery (GFDRR) has established the Online Unbreakable Resilience Indicator (URI) database as a means to move beyond traditional metrics to examine how natural disasters affect people's well-being [50]. The Unbreakable report [51] provides a resilience percentage for each country based on drivers such as social protection (ability to access post-disaster financial and social resources), economic (providing financial inclusion), vulnerability (asset vulnerability) and exposure to disasters. The World Bank Worldwide Governance Indicators (WGI) reports aggregate and individual governance indicators using six dimensions: voice and accountability, political stability and absence of violence, government effectiveness, regulatory quality, rule of law, and control of corruption [52]. No data are given for Lebanon, Palestine, Singapore, South Korea, and New Zealand in the Unbreakable report, and data for Palestine is omitted from the WGI database. Therefore,

Table 1
Categories of criteria for directed content analysis.

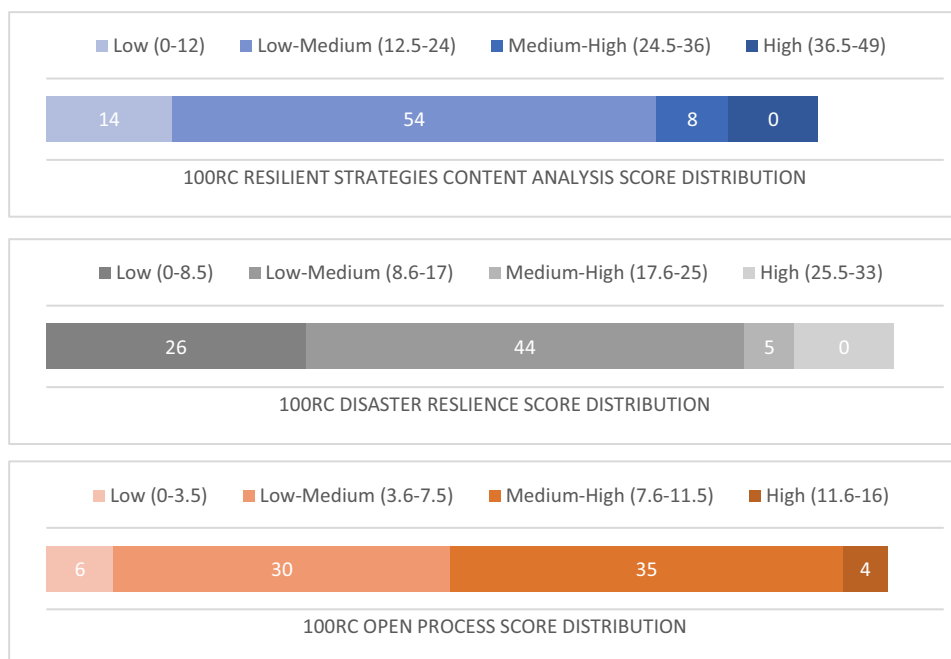| Metric	Total weighted score
Disaster Resilience	
Disaster risk and vulnerability	13
Disaster risk governance	6
Disaster risk reduction investments	7
Disaster recovery	7
Open Process	
Monitoring and evaluation	4
Transparency and participation	12
Total	**49**

Fig. 1. 100RC directed content analysis scoring.

the comparison analyses conducted here do not include ratings for these cities.

The policy evaluations are limited to the 75 members considered for category assessment of member cities (see Table 2). Although the 100RC program has intended to include a wide and diverse range of cities, there was noticeably a strong concentration of members in wealthier countries with higher human Development Index scores. Using the Human Development Index (HDI) to assess country development, notwithstanding economic growth, the analysis included a total of 51 CRS from cities in countries with very high (0.8 to 1.0), 16 with high (0.7 to 0.799), 7 with medium (0.550 to 0.699) and 2 with low (0.350 to 0.549) human development [53]. The sample is overwhelmingly concentrated on cities (88%) having high to very high human development in comparison to low human development cities (2%). Nevertheless, 30 of the cities were located in the Global South, compared with 45 in the Global North [48]. The majority of the cities were classified as extra-extra-large (35%) or global cities (32%) [54]. Ramallah was the only city below the small city classification and therefore received no official city population ranking [55]. Most cities (60%) were located in temperate climates based on the Köppen-Geiger Climate Classification system (KGCC), followed by tropical climates (21%) [49]. This shows how cities located in temperate climates are less likely to suffer from climate change as those in tropical climates.

Using the World Bank Worldwide Governance Indicators (WGI) to assess overall governance, the analysis included a total of 17 CRS from cities in countries with high (85 to 100), 27 with medium-high (71 to 84), 9 with medium (50 to 70), 19 with low-medium (36 to 49) and 2 with low (0 to 35) scores [52]. The sample is overwhelming concentrated on cities (72%) having high to medium governance in comparison to low governance cities (28%). It also appears that cities scoring well on the Unbreakable report (URI) (72% with medium and 22% with high resilience) tend to have higher resilience percentages than on the 100RC score distributions (60% with medium and 1% with high resilience). Here it is noted that cities that appear to have 'barriers' to good governance or "drivers" for resilience tended to develop resilience strategies that failed to incorporate narratives centered around community vulnerability and risk.

The broader categories of cities and countries highlight the distortions between vulnerabilities and risks associated with disasters, and

capabilities to respond. Generally, whether the 100RC resilience strategies incorporated narratives around community vulnerability and risk was not consistently related to city size, climate, or other indicators such as human development, governance and resilience. These patterns of city and country categories are also important in considering the impacts and influence on policy mobility. Changing geopolitical contexts and international relations, such as the case with countries moving from low to medium human development, shape where particular cities will look to in developing disaster resilience policies. The economic context of policy making is also influenced by policy makers, which may differ depending on different relations in global capitalism, with higher human development versus lower human development. Policy mobility is also influenced by the role of stakeholders, emphasizing assumptions and knowledge claims underlying resilience policies implemented in relation to HDI scores. Those with lower scores tended to rely more heavily on 100RC program expertise and subject-matter experts provided by Platform Partners.

Furthermore, there appears to be a focus on disaster threat (shock) narratives that are detailed and discussed for each member city in the program. The top two shocks and stresses are connected to DRR events. Of the top five shocks and stresses (Table 3) identified from each member city only one is related to climate change (sea level rise). The member cities affected by the top five shocks and stresses are diverse in terms of geographic distribution from the Global North and South, population, and climate classification (e.g. tropical and dry). However, the shocks and stresses identified are not necessarily directly converted into a resilience strategy in the resulting CRS. There are 3 primary findings which form the basis of this assertion: (1) the strategies did not offer or provide vulnerable populations or marginalized residents an opportunity to self-identify their needs, priorities, or express their issues for action; (2) many strategies did not attempt to strengthen disaster risk governance by sharing DRR responsibilities between vulnerable stakeholders and government institutions, and (3) few investments were made for social protection, affordable or flexible financial services, or measures to protect assets for vulnerable residents. These findings are discussed in greater detail, followed with potential solutions supporting disaster resilience. (See Table 2).

Table 2
100RC city and country categories.

100RC Member City/Country	City Type	Location	KGCC	HDI	WGI	URI	100RC
Accra (Ghana)	XXL	Global South	Group B: Dry Climates	Medium	Medium	Medium	Medium
Amman (Jordon)	XXL	Global South	Group B: Dry Climates	High	Low-Medium	Medium-High	Low
Athens (Greece)	XL	Global North	Group C: Temperate Climates	Very high	Medium	Medium	Low-Medium
Atlanta (United States)	Global city	Global North	Group C: Temperate Climates	Very high	Medium-High	Medium	Medium
Bangkok (Thailand)	Global city	Global South	Group A: Tropical Climates	High	Low-Medium	Medium	Low
Berkeley (United States)	M	Global North	Group C: Temperate Climates	Very high	Medium-High	Medium	Low
Boston (United States)	XXL	Global North	Group D: Continental Climates	Very high	Medium-High	Medium	Medium
Boulder (United States)	M	Global North	Group B: Dry Climates	Very high	Medium-High	Medium	Low
Bristol (United Kingdom)	XL	Global North	Group C: Temperate Climates	Very high	High	Medium-High	Low
Buenos Aires (Argentina)	Global city	Global South	Group C: Temperate Climates	Very high	Low-Medium	Medium	Low-Medium
Byblos (Lebanon)	XL	Global South	Group C: Temperate Climates	High	Low		Low-Medium
Calgary (Canada)	XXL	Global North	Group D: Continental Climates	Very high	High	Medium	Low
Cali (Columbia)	XXL	Global South	Group A: Tropical Climates	High	Low-Medium	Low-Medium	Low-Medium
Can Tho (Vietnam)	XXL	Global South	Group A: Tropical Climates	Medium	Low-Medium	Medium-High	Low
Cape Town (South Africa)	L	Global South	Group C: Temperate Climates	High	Medium	Medium	Low-Medium
Chennai (India)	Global city	Global South	Group A: Tropical Climates	Medium	Low-Medium	Medium	Medium
Chicago (United States)	Global city	Global North	Group D: Continental Climates	Very high	Medium-High	Medium	Low-Medium
Christchurch (New Zealand)	L	Global North	Group C: Temperate Climates	Very high	High		Low-Medium
Colima (Mexico)	M	Global South	Group C: Temperate Climates	High	Low-Medium	Medium	Low-Medium
Da Nang (Vietnam)	XL	Global South	Group A: Tropical Climates	Medium	Low-Medium	Medium-High	Low
Dakar (Senegal)	XXL	Global South	Group B: Dry Climates	Low	Medium	Medium-High	Low
Dallas (United States)	Global city	Global North	Group C: Temperate Climates	Very high	Medium-High	Medium	Low
Deyang (China)	XXL	Global South	Group C: Temperate Climates	High	Low-Medium	Medium	Low
Durban (South Africa)	XL	Global South	Group C: Temperate Climates	High	Medium	Medium	Low
El Paso (United States)	XL	Global North	Group B: Dry Climates	Very high	Medium-High	Medium	Medium
Glasgow (United Kingdom)	XL	Global North	Group C: Temperate Climates	Very high	High	Medium-High	Medium
Greater Miami and the Beaches (United States)	XL	Global North	Group A: Tropical Climates	Very high	Medium-High	Medium	Medium
Honolulu (United States)	Global city	Global North	Group B: Dry Climates	Very high	Medium-High	Medium	Medium
Houston (United States)	XXL	Global North	Group C: Temperate Climates	Very high	Medium-High	Medium	Medium
Juarez (Mexico)	XXL	Global South	Group B: Dry Climates	High	Low-Medium	Medium	Medium
Kyoto (Japan)	Global city	Global North	Group C: Temperate Climates	Very high	High	Medium-High	Medium
Lagos (Nigeria)	Global city	Global South	Group A: Tropical Climates	Low	Low	Low-Medium	Medium
London (United Kingdom)	Global city	Global North	Group C: Temperate Climates	Very high	High	Medium-High	Low-Medium
Los Angeles (United States)	XXL	Global North	Group C: Temperate Climates	Very high	Medium-High	Medium	Medium
Louisville (United States)	XXL	Global North	Group C: Temperate Climates	Very high	Medium-High	Medium	Medium
Medellin (Columbia)	L	Global South	Group A: Tropical Climates	High	Low-Medium	Low-Medium	Medium
Melaka (Malaysia)	Global city	Global South	Group A: Tropical Climates	Very high	Medium	Medium	Low-Medium
Melbourne (Australia)	Global city	Global North	Group C: Temperate Climates	Very high	High	Medium-High	Medium
Mexico City (Mexico)	Global city	Global South	Group C: Temperate Climates	High	Low-Medium	Medium	Medium
Montevideo (Uruguay)	XXL	Global South	Group C: Temperate Climates	Very high	Medium-High	Medium	Medium
Montreal (Canada)	XXL	Global North	Group D: Continental Climates	Very high	High	Medium	Medium
New Orleans (United States)	XXL	Global North	Group C: Temperate Climates	Very high	Medium-High	Medium	Medium
New York City (United States)	Global city	Global North	Group C: Temperate Climates	Very high	Medium-High	Medium	Medium
Norfolk (United States)	M	Global North	Group C: Temperate Climates	Very high	Medium-High	Medium	Medium
Oakland (United States)	L	Global North	Group C: Temperate Climates	Very high	Medium-High	Medium	Medium
Panama City (Panama)	XL	Global South	Group A: Tropical Climates	High	Medium	Low-Medium	Medium
Paris (France)	Global city	Global North	Group C: Temperate Climates	Very high	Medium-High	Medium-High	Medium
Pittsburgh (United States)	XXL	Global North	Group D: Continental Climates	Very high	Medium-High	Medium	Medium
Pune (India)	Global city	Global South	Group A: Tropical Climates	Medium	Low-Medium	Medium	Medium
Quito (Ecuador)	XXL	Global South	Group C: Temperate Climates	High	Low-Medium	Medium	Medium
Ramallah (Palestine)		Global South	Group C: Temperate Climates	Medium			Medium
Rio de Janerio (Brazil)	Global city	Global South	Group A: Tropical Climates	High	Low-Medium	Medium	Medium
Rome (Italy)	XXL	Global North	Group C: Temperate Climates	Very high	Medium	Medium	Medium
Rotterdam (The Netherlands)	XXL	Global North	Group C: Temperate Climates	Very high	High	Medium-High	Low
San Francisco (United States)	XXL	Global North	Group C: Temperate Climates	Very high	Medium-High	Medium	Medium
Sante Fe (Argentina)	XL	Global South	Group C: Temperate Climates	Very high	Low-Medium	Medium	Medium

City	Size/Type	Hemisphere	Climate Group				
Santiago De Los Caballeros (The Dominican Republic)	Global city	Global South	Group A: Tropical Climates	High	Low-Medium	Medium	Medium
Santiago Metropolitan Region (Chile)	XXL	Global South	Group C: Temperate Climates	Very high	Medium-High	Medium	Medium
Seattle (United States)	XXL	Global South	Group C: Temperate Climates	Very high	Medium-High	Medium	Low
Semarang (Indonesia)	XXL	Global South	Group A: Tropical Climates	High	Low-Medium	Medium	Medium
Seoul (South Korea)	Global city	Global North	Group D: Continental Climates	Very high	Medium-High		Medium
Singapore (Singapore)	Global city	Global North	Group A: Tropical Climates	Very high	High	Medium	Low-Medium
St. Louis (United States)	XXL	Global North	Group C: Temperate Climates	Medium	Medium-High	Medium	Low
Surat (India)	Global city	Global South	Group A: Tropical Climates	Very High	Low-Medium	Medium-High	Low-Medium
Sydney (Australia)	Global city	Global North	Group C: Temperate Climates	Very High	High	Medium	Medium
Tel Aviv (Israel)	L	Global North	Group C: Temperate Climates	Very High	Medium-High	Medium-High	Low
The Hague (The Netherlands)	XXL	Global North	Group C: Temperate Climates	Very high	High	Medium-High	Medium
Thessaloniki (Greece)	L	Global North	Group C: Temperate Climates	Very high	Medium	Medium	Medium-High
Toronto (Canada)	Global city	Global North	Group D: Continental Climates	Very high	High	Medium-High	Medium
Toyama (Japan)	L	Global North	Group C: Temperate Climates	Very high	High	Medium	Medium
Tulsa (United States)	XL	Global North	Group C: Temperate Climates	Very high	Medium-High	Medium	Medium
Vancouver (Canada)	XXL	Global North	Group C: Temperate Climates	Very high	High	Medium-High	Low-Medium
Vejle (Denmark)	S	Global North	Group C: Temperate Climates	Very High	High	Medium	Medium
Washington DC (United States)	Global city	Global North	Group C: Temperate Climates	Very High	Medium-High		Medium
Wellington (New Zealand)	L	Global North	Group C: Temperate Climates	Very high	High		

4.1. Vulnerable and marginalized resident engagement

Many cities collaborated with stakeholders (85%) to identify strategy goals and actions, but often collaboration was limited, especially in terms of engagement with community members, such as those most vulnerable to disaster risks. Only five cities (Atlanta, Colima, Kyoto, Panama City, Toronto) provided any evidence that vulnerable groups were afforded an opportunity to self-identify their needs and priorities. There was a tendency to detail why certain roles for managing resilience programs were to be appointed and overseen by governmental proxies, along with the need for key partnerships (with e.g. Arup, The Nature Conservancy, SwissRe, Arcadis, The Asia Foundation, Microsoft, PwC) to manage policy efforts, rather than engage directly with the community for co-creation and solutions. Conversely, many cities aimed to provide residents with opportunities for public participation for ongoing program monitoring and evaluation, but lacked specificity as to how one could do so.

Calgary recognized the traditional Indigenous territory of the Blackfoot people. Throughout their strategy development process, Indigenous people shared their thoughts, ideas and contributions to shape policies. Elders also came and gave their blessings to continue working and supporting the inclusion of Indigenous people. Toronto acknowledged their strategy was developed on the traditional territory of many nations with a long history of Indigenous people in an effort to develop a shared community vision in collaboration. This resulted in engaging over 8000 Torontonians in face-to-face meetings, telephone conversations, social media engagement, meetings in public events and in residents' homes. They also acknowledged that residents experienced different kinds of vulnerabilities based on various factors. Here, by prioritizing vulnerable populations, resilience was seen as more of a process and investment. Specifically, Indigenous communities and leaders were involved to build further resilience and build upon Indigenous knowledge for resilience actions. This was evidenced in the Indigenous Knowledge and Climate Action Workshop that took place to address climate and environmental issues (flood and water management, green infrastructure, education, and technical and Indigenous expertise). The results from these engagements were further documented and made available publicly through the Toronto Resilience Office website. Overall, Toronto made a strong effort to focus on vulnerable and Indigenous resident engagement throughout the resilience strategy development and implementation process. Vancouver specifically addressed the role of women and other groups such as gender-diverse, two-spirit people, cis women and trans in providing a place in disaster resilience and recovery. They acknowledged the importance they play in other critical roles of social and psychological recovery following disasters and sought to elevate their role in creating a resilient city.

Cape Town had one of the more comprehensive approaches to engaging experts and vulnerable residents living in informal settlements. At the beginning of the strategy planning process over 11,000 face-to-face interviews took place with residents of informal settlements and backyard dwellings. Additional meetings and workshops were held to understand and prioritize the diverse challenges voiced among these communities. Thessaloniki involved more than 40 organizations and 2000 citizens using online questionnaires and workshops, establishing a Resilience Day for the Municipality to engage with citizens, featuring live on-air broadcasts by the municipal television and providing printed Braille material for those visually impaired. Honolulu also engaged more than 2200 residents over 18-months using a grassroots approach to develop the strategy. Chennai engaged over 1800 citizens from over 500 vulnerable communities using citizen surveys. However, other strategies provided an approximate count of engaged stakeholders (e.g. Bristol 1600; Boston 11,000), but did not specify if this included vulnerable groups, experts or other kinds of stakeholders involved in developing action items.

The majority of member city strategies fell between a medium-high range, 7.59 average score (Fig. 1) for vulnerable and marginalized resident engagement. This was most likely due to the standardization of the preliminary assessment process established by Rockefeller at the onset of the program for each member. Almost all strategies (85%) identified key external

Table 3

100RC shocks and stresses.

Shocks/Stresses	Country (number of cities)
Blizzard	Canada, Jordan, United States (3)
Climate Change	Canada, Chile, Denmark, Greece, Italy, Jordan, The Netherlands (2), South Africa, United Kingdom (2), United States (9)
Coastal/Tidal Flooding	Australia, Denmark, Ghana, Indonesia, Italy, Japan, Malaysia, New Zealand, Singapore, Thailand, The Netherlands, United Kingdom, United States (7), Vietnam (2)
Drought	Australia, Brazil, Canada, Chile, Ecuador, India, Indonesia, Mexico, Panama, South Africa (2), Thailand, United States (9), Vietnam (2)
Earthquake	Canada (2), Chile, China, Columbia, Ecuador, Ghana, Greece (2), India (2), Israel, Italy, Japan, Mexico (3), New Zealand, Palestine, Panama, The Dominican Republic, United States (5)
Extreme Cold	Canada (2), Italy, Mexico, The Netherlands, United States (2)
Extreme Heat	Argentina, Australia, Canada (2), France, Greece (2), Italy, Jordan, Mexico, The Netherlands, United States (12)
Fire	Chile, Columbia, Ecuador, Greece, Jordan, Panama, South Africa (2), United Kingdom, United States (5)
Hurricane/Typhoon/Cyclone	Canada, India, Lebanon, Mexico, The Dominican Republic, United States (6), Vietnam
Landslide	Brazil, Chile, Columbia, Ecuador, Italy, Japan (2), Malaysia, Mexico, Panama, South Korea, United States (2)
Liquefaction	Italy, United States
Rainfall Flooding	Argentina (2), Australia, Brazil, Canada (3), Chile, China, Columbia (2), Denmark, Ecuador, France, Ghana, Greece (2), India, Indonesia, Italy, Japan (2), Jordan, Malaysia, Mexico (2), New Zealand (2), Nigeria, Panama, Senegal, Singapore, South Africa (2), Thailand, The Dominican Republic (3), United States (20), Uruguay, Vietnam (2)
Sea Level Rise/Coastal Erosion	Australia, Canada, Denmark, India, Indonesia, Italy, Japan, Malaysia, New Zealand (2), Nigeria, Senegal, Singapore, United States (10), Uruguay, Vietnam (2)
Severe Storms	Canada, Chile, Denmark, United Kingdom, United States (8)
Snowstorms	Palestine
Storm Surge	Mexico, United States (4)
Subsidence	Mexico, United States (2)
Tsunami	Lebanon, New Zealand, United States (2)
Tornado	Chile, Ecuador
Volcanic Activity	Chile, Columbia, Ecuador, Mexico, Vietnam

stakeholders involved for identifying policy processes. A majority also did not describe how information was disseminated to the general public. There also was very little mention as to how vulnerable residents were given opportunities to self-identify and state their needs and priorities. Any information disclosed regarding participatory workshops was used to gauge problem areas of communities typically including key stakeholders (government officials, local authorities, businesses, NGOs etc.). Still, these actors were often chosen representatives on behalf of those managing policy access and resources. Few strategies invited vulnerable community members to participate in discussions or creation of policies. Although vulnerable groups were engaged, such as with the case in Chennai, it is difficult to determine whether, beyond these interviews, any other involvement in planning and strategy implementation took place. Even fewer strategies defined vulnerability and disaster risks, identified who were vulnerable, or specific disaster risks relating to explicit vulnerable groups. Even more lacking was an understanding of how certain DRR benefits were not accessible for vulnerable groups, what impact this may have or any attempts to mitigate these effects. Strategies overall lacked a clear understanding of vulnerability beyond risk exposure.

4.2. DRR governance

Seventeen percent of strategies only attempted to strengthen disaster risk governance by sharing DRR responsibilities between vulnerable stakeholders and government representatives, who were seen as having responsibility and oversight. Further strategies offered no clarity on who or which entity was designated as the responsible party for disaster risk governance. This resulted in a lack of defined roles and responsibilities in 91% of strategies, so that it was not possible to share these with vulnerable persons impacted directly by disaster risk exposure. Generally, there was little consideration of local knowledge (4%) in managing on-going or future disaster risks. Strategies often excluded local knowledge and perceptions of risk. Chennai acknowledged their long history of traditional rain water harvesting methods and Indigenous knowledge from those living on the land. Yet, there was no mention as to how this knowledge would be integrated beyond traditional governance systems. In contrast, Pune focused on strengthening pathways for democratic decision-making and civic participation in local area planning. Other strategies such as those for Can Tho or Singapore, emphasized the strong use of top-down governance

approaches in large part due to cultural differences. Overall, many opted only to use technical and scientific knowledge, data, and assessment methods in order to manage disaster risk exposure for vulnerable groups. This expert knowledge tended to be only held by those holding scientific or professional credentials. This further excluded vulnerable community members and those with indigenous knowledge of the land, history of the space and place in which urban geographies were shaped.

Durban took one of the more innovative approaches and pathways to developing their strategy under the guidance and feedback from vulnerable stakeholders using two 'resilience building options' (RBOs). This involved first developing an exploratory non-paper in order to explicitly define resilience and the role it would play in city development. From this two RBOs were chosen to develop the strategy focusing on collaborative informal settlement actions and integration of a dual governance system (land tenure regime and municipalities). This resulted in a unique pathways approach to manage urban resilience in effort to construct an African conceptualization for transformation. Although these are complex and interconnected challenges for Durban to address, this experience demonstrates the urgent and critical questions needing answers in understanding how one might 'do resilience' differently and in a way that addresses post-colonial urban discourses emerging among scholars.

4.3. Investing in DRR

Overall, 88% of the members benefited from the development of new or expanding public-private partnerships. High profile investments or partnerships were often highlighted in terms of progress and achievement in urban resilience for the city. There were no strategies that identified records of management of funds and resources would be made available for transparency and accountability among agreements. This also applied to the lack of discussion on providing financing terms for better understanding as to just how these investments would benefit or enhance economic, social, environmental, health or cultural resilience for the city. Similarly, only 5% of cities (Chennai, El Paso, Melbourne, Washington DC) offered affordable and flexible financial services such as savings and credit schemes or microfinancing for vulnerable groups affected by disaster risk. Other measures to protect community assets such as disaster insurance (26%) were also limited for those coping with disasters (Christchurch, Honolulu, Houston, Los Angeles, Melbourne, New Orleans, New York, Toyoma, Vancouver, Washington DC,

Wellington). Fewer discussed the potential use of implementing disaster related insurance products in order to fund recovery efforts (Cape Town, Chennai, Da Nang, Medellin, Miami, Quito, Ramallah, Rotterdam).

New York City secured over $3 billion in funding from FEMA to provide a comprehensive resiliency program for public housing developments, including flood-proofing and upgrading infrastructure. The city also provides a *Build it Back Better* program that also helps protect vulnerable residents from the loss of critical services during disasters. These efforts are also done in part to address neighborhoods not built to flood construction and insurance requirements in an effort to increase the number of households with flood insurance. This also includes other endeavors from the city to align zoning and building codes with the National Flood Insurance Program (NFIP) and changes to flood insurance maps. Generally, almost all members made investments for critical infrastructure and basic services to reduce vulnerability to disasters. These investments often were tied to other Rockefeller approved vendors (e.g. CDM Smith, CEMEX, Cisco, Deltares, RMS, Siemens, The Nature Conservancy, The World Bank). Overall, investments for DRR were limited mainly to critical infrastructure improvements or new systems for the city municipal services (e.g. flood control, land-use planning, mapping and risk modeling for NFIP).

5. Results and discussion

The paper utilizes a pathways approach to explore policy mobility that provides a reflexive dimension in understanding how 'resilience' is being used in the 100RC program and SFDRR. This analysis is focused on observable plan content documented within the strategy, not policy implementation. These scores allow us to identify signals of potential risks, disproportionate impacts, vulnerabilities and inequities related to disasters that otherwise would not be evident. Overall, strategies received higher scores when they acknowledged criteria and attempted to mitigate vulnerabilities and risks associated with disasters, such as when they sought to develop disaster insurance, housing resettlement programs, engage vulnerable groups as stakeholders or in active participation in policy making and implementation.

100RC member cities did not all use the same format for the CRS publications, resulting in varying degrees of information and transparency on such matters as to how stakeholders were chosen, strategies were developed, accountability for programs, funding sources, partnerships or actors providing resources, and just who could participate in ongoing monitoring and evaluation. The metrics used in the framework to assess whether or not the objective of the 100RC program to design more urban resilient cities did reveal that this did occur when there was transparency, monitoring, evaluation, and participation within the design and implementation of these strategies. This assessment is only an approximation and more detailed analysis would be needed to determine equity of resilience strategy planning and implementation among member cities. There was also a considerable amount of cross marketing of other member cities and highlighting specific programs or policies throughout various strategies. The promotion of the 100RC was prominent in the structure and design of each strategy. It may have been more beneficial to have had more historical urban development, socio-economic challenges, and information related to structural problems needed to address urban and disaster resilience, rather than the promotion of the Rockefeller Foundation and its partners.

Approaches to identifying disaster risks, vulnerabilities and vulnerable groups often ignored explicitly defining these terms. Historic and structural reasons as to why such problems exist and why some DRR benefits may not be accessible to vulnerable stakeholders were seldom addressed. In some cases, risk would be defined (Melbourne, Melaka) and related to disasters but not in terms of vulnerabilities. Instead, various types of risks (e.g. cyber, biohazard, financial, crime) were discussed in numerous forms. Santiago de los Caballeros was the only city to specifically define risk in the context of disasters, and this was done in accordance with the UNISDR official definition. The city also defined vulnerability and in relation to physical, social and man-made vulnerabilities. Definitions of vulnerable groups, vulnerabilities, and vulnerability only occurred overall in four strategies (Mexico City, Miami, Santiago de los Caballeros, Quito), whereas most discussed various forms of vulnerabilities with no specific terms or definitions applied.

As previously emphasized by the 100RC program, each member city provided one or more shocks and stresses related to natural hazards and disasters. Yet, the analysis showed there were three strategies (Durban, Rotterdam, Tel Aviv) that did not identify any disaster related shocks and stresses, a finding resulting in no policies addressing disaster resilience and risk reduction. There were only four cities (Panama City, Seoul, Toyoma, Vancouver) specifically identifying and targeting DRR policies. A few strategies identified relevant SDGs and cross referenced specific SDG goals among policy actions (Athens, Bristol, Chennai, Juarez, St. Louis, Kyoto, Lagos, Pune, Melaka, Sydney). Fewer strategies identified SFDRR (e.g. Santiago Metro, Sydney), or were crossed referenced (e.g. Chennai, Toyama, Vancouver). Chennai and Colima, only made reference to SFDRR, containing no specific priority action reference from the framework, whereas Toyoma provided specific references to SFDRR priorities. Some strategies, like Buenos Aires, made initial references to the use of SDGs and UNISDR (United Nations Office for DRR), but nothing more. Few (e.g. Mexico City, Sydney) mentioned UNISDR, and intentions to address goals related to disaster management with no exact details. Most strategies either identified general disaster management policies (e.g. Atlanta, Berkley, Boulder, Chennai, Chicago, Colima, Dallas, Deyang, Honolulu, Juarez, Lagos, Medellin, Melbourne, Santiago Metro, Semarang, Sydney and Wellington,), or instead focused on climate change initiatives (e.g. Athens, Boston, Bristol, Buenos Aires, Cape Town, Houston, Miami, Paris, Pittsburgh, Pune, St. Louis, Surat, and Toronto), despite having, and detailing significant disaster related shocks and stresses. Although Bangkok focused on climate change policies, they also applied some DRR strategies. However, there were some strategies that did not denote disaster or climate change related goals or actions (Cali, Dakar, Melaka, Norfolk, Thessaloniki), but still identified approaches to reduce disaster related risks (e.g. flooding, land-use management, storm water infrastructure, and disaster relief funds).

Chicago provided a unique action template providing a list of key implementation partners, potential key indicators to measure and track the success of actions, and equity impacts for vulnerable residents affected by the proposed actions, in order to address the interconnected nature and geographies of race, economics, hazards and vulnerabilities. However, the strategy did not provide additional information beyond these elements to gauge quantitative methods to measure and track the indicators or equity impacts. Key partners were only listed in name, and did not specify what roles were held by each stakeholder, or disclosures of financial arrangements. The use of such a template may provide further guidance for future action assessments implemented in Chicago to determine overall benefits and challenges.

Additionally, some strategies were embedded among existing policies, or incorporated into other strategies previously developed by local, regional or national governments. This made it difficult to distinguish which disaster resilience and DRR plans were the result of the 100RC program, or effected in any way by the 100RC initiative. Furthermore, the role of collaborators and partnerships, such as Arup, is difficult to discern among preexisting city resilience strategies, as well as new schemes developed from the CRS. The influence of these collaborators and partnerships designed through the 100RC program is difficult to untangle. This is not to say that a city is not able to design a resilience strategy without such resources, but the extent of their influence is indeterminable to measure in the framework. There were further ways in which stakeholder involvement was limited in the monitoring and overall program evaluation, since cities chose instead to largely work with particular stakeholders and other partners to develop such indicators of success or failures. This again often excludes vulnerable members of the community in determining the value of voices, and narratives captured and included throughout the policy design and output. Few cities disseminated policy information to non-participants using general public communication (Atlanta, Glasgow, Juarez, New York, Quito, Sante Fe, Toronto).

The 100RC has curated a list of technical and expert resources made available directly through the strategy development process and implementation.

There were numerous strategies benefiting from the 100RC program and Platform Partners system, such as the use of pro-bono or consultancy services. Many cities (e.g. Buenos Aires, Can Tho, Mexico City) identified the use of 100RC Platform Partnerships, but often did not provide details of such agreements, and how much involvement took place among external stakeholders from the Rockefeller Foundation. Those that did include this information (Bristol, Boulder, Da Nang, Juarez, Norfolk, Medellin, Melbourne, Panama City, Pittsburgh, Santiago Metro) provided the names of each partner corresponding to applicable goals or policies. Lagos chose only to identify and name five relevant partners in the public and private sectors for each initiative with no other information provided. Aside from the development of the 100RC Platform Partnerships, some member cities, as with the case of Rotterdam, were able to develop an additional network in order to export services from their local private sector partners. Rotterdam reported that private sector companies such as Deltares, Arcadis and TNO were actively involved in partnerships with other cities located in Denmark, India and the USA. The program has encouraged member cities to come together in order to network share lessons, and support one another in their resilience efforts. This is evidenced by the creation of a Counter-Terrorism Preparedness and Societal Resilience as a network focused on counterterrorism and launched by London in collaboration with Barcelona, Manchester, Paris, Rotterdam, and Stockholm. Athens developed the 100RC Global Migration Network Exchange (Amman, Los Angeles, Medellin, Paris, Montreal, Ramallah, Thessaloniki) to share recent migration experiences in order to provide lessons and collaborations for others facing similar situations. Other cities benefited in other ways. In Bristol, $5 million in funding was made available for 100RC Platform Partners in the form of pro bono city tools and services for development and investment programs. Melbourne and Santiago de los Caballeros identified the use of pro-bono contributions and services provided by 100RC Platform Partners, but did not specify details as to how this would happen, or provide any additional information beyond the initial disclosure statement. 100RC ensured financing of up to $5 million for Platform Partners services in Mexico City until 2020 in an effort to support resilience efforts. This commitment culminated in a formal declaration signing by the Mayor of Mexico City at an 100RC sponsored event. There may be other cases of financial incentives provided through 100RC program in general that have not been disclosed by members. This also contributes to our understanding of how are these funds and programs monitored, evaluated and adapted to meet the most important needs of vulnerable populations. Overall, without more information it is difficult to discern the extent of financial and economic benefits gained or how these relationships were developed with other private sector companies having access to the 100RC program.

The strategy development process and the 100RC program itself are embedded within disaster resilience at multiple scales. For members, this involved the self-identification of disaster shocks and stresses, using the 100RC preliminary assessment framework and plan development in partnership with Arup. Strategy content alone was not enough to determine whether embedded actions would improve disaster resilience of vulnerable populations. Further assessment may help identify specific targets achieving certain goals managing vulnerability. This could be shown through financial analysis of budget spending in accordance with direct program outcomes (e.g. temporary housing programs, housing improvements or new building code programs). Unexpected consequences were more likely to appear in the strategies as to how vulnerable groups were potentially marginalized further, by created programs benefiting those with existing or easier access to resources and wealth. This was most often seen with the use of digital technologies (e.g. Disaster preparedness related Apps as seen in Sydney or Vancouver), and Smart Cities initiatives designed for new infrastructure projects (e.g. Montreal). These programs tend to assume equitable access for internet or wireless connectivity, good purchasing power for digital devices, lack of mobility restrictions, accessible transportation, and proper communication or training and learning made available for such services. Examples include the development of smartphone apps, such as in Norfolk to help support vulnerable residents during emergencies and disasters. Chicago attempted to address this issue by providing more equitable public network access and basic digital literacy training.

However, these actions fall short of addressing inequitable access to and with computers, laptops or mobile phones. Overall, there is little attention given to those unable to access or afford these digital technology infrastructure investments.

6. Conclusions

Disasters can be seen as a social process or a natural event. When disasters are seen as a social process where mitigation and recovery efforts are the responsibility of the community, a participatory approach is adapted to managing policies and resources. Alternatively, when viewed as a natural event, control of resources is often deemed necessary for policies designed by governments and institutions. These perspectives shape and influence what role urban resilience has in managing DRR. Recent initiatives such as the Sendai Framework, SDGs and 2030 Agenda highlight efforts to connect vulnerability and risk by prioritizing DRR in support of urban resilience. Yet, it remains unclear how disaster resilience planning should be undertaken. Disaster resilience is linked directly to DRR and DRR is considered a critical component of overall resilience building and practices for cities. This paper examined how cities' disaster resilience approaches varied among the 100 Resilient Cities (100RC) program. It identified whether member cities emphasized disaster resilience initiatives in their programs by assessing their efforts focused on reducing disaster risk and vulnerability. The paper applied a framework allowing careful consideration as to how DRR is utilized to manage disaster risk and disaster resilience for 100RC resilient strategies. This framework was used along with directed and summative content analysis to assess whether 75 of the Resilience Strategies developed under the 100RC program were designed to promote overall DRR. The findings suggest that efforts to address vulnerability and disaster risk across member cities have been fragmented with only superficial signs of focus detectable.

Overall, this research stresses opportunities for urban disaster resilience research using the Sendai Framework. This framework involves actively identifying disaster risks and vulnerabilities, engaging with external and vulnerable stakeholders, by providing them an active role to engage in policy making and implementation, sharing in knowledge and expertise, and investing in measures to protect those unable to cope in a disaster or protection from hazards. The findings revealed very little attention was given to vulnerable communities (as participants, stakeholders, objects of inquiry, or action targets) in the 100RC member strategies, thus revealing a lack of follow-through by the 100RC program on the Sendai Framework for Disaster Risk Reduction. These results suggest real limits to policy mobility, both in the sense of the constraints on the mobility of the Sendai Framework through the 100RC program, and in terms of the lack of any core representation to the city programs developed under the 100RC program. Significantly, the analysis reported in this paper reveals that the 100RC program produces different results in each city. This is because of the specific configurations of actors and power assembled in each city around the 100RC program, and the effects they have on institutions, infrastructures and networks. Power is expressed in these structures through decisions on who participates and where participation occurs, as well as who has the authority to communicate and receive information. The analysis has shown that the disaster resilience narratives among member strategies have no consistent relation between community engagement and city characteristics, therefore policy mobility followed no consistent pattern. To achieve its policy mobility goal, the 100RC program must be flexible enough to cope with specific local power relations, but the form of mobility achieved falls short of achieving urban disaster resilience using the Sendai Framework. Crucially, if it were to achieve urban resilience under that Framework, the 100RC program must bring together not only policy makers, but also diverse stakeholders. Future research of the 100RC program, and its successor should aim to identify in what ways mobile policy addresses where urban and disaster resilient policies came from, how they were mobilized, and what happened to them along the way.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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