



Final Report

Planning for Resilience and Reducing Risk: Lessons for Mexico City

Ruta Cívica Capstone

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EXECUTIVE SUMMARY

Introduction

Disaster risk management (DRM) has never been as essential to Mexico City as today. Three years ago, the city was hit with its largest earthquake in over 30 years. It killed 219 people, caused billions of dollars in infrastructure damages, and left a vibrant city in disarray. While Mexico City and its surrounding communities continue to recover, the aftermath of the earthquake confronts its residents, businesses, and local leaders daily.

A year prior to the earthquake, the city underwent a shift in its political arrangement and government power, gaining the status of state, rather than federal district. That change brought the opportunity to remake its governing institutions. As the 2017 earthquake occurred while many institutions were in transition or not yet in place, it challenged the CDMX government and illuminated the importance of establishing robust risk management strategies.

Ruta Cívica, as a local nonprofit, grassroots organization in Mexico City, works with citizens and other partners to push for citizen participation in urban issues and governance, and it has a special focus currently on risk management in the city. To aid Ruta Cívica in its efforts, the Bush School of Government and Public Service's Ruta Cívica Capstone Team conducted research on local governance of risk management in four cities that face comparable natural hazards--Christchurch, Miami, San Francisco, and Santiago-- provide international perspectives on governance for disaster risk management.

This report includes a review of relevant literature, the research design and methodology, summaries of the four case studies, findings and analysis, and conclusions and lessons learned.

Literature Review

The literature provided an in-depth understanding of elements that academic sources found necessary for the successful implementation of plans to improve public safety. The team reviewed research in the areas of Governance and DRM and the roles/relationships among stakeholders. This literature review does not represent the complete scope of the multitude of elements involved in good governance. However, it enhances the understanding of critical components needed for strong DRM and governance.

Bevir (2012) defines governance as revealing that there are formal and informal government arrangements that guide how norms, laws, and policies are implemented in different situations, such as during a crisis. Identifying types of formal and informal government arrangements opened the door to understanding disaster theory and the DRM cycle. There are four phases in the cycle: preparedness, response, recovery, and mitigation. Preparedness pertains to the creation of preventative measures and systems to protect people from a disaster. Response highlights the actions aimed to secure citizens and provide them with immediate assistance and life-saving strategies during and shortly after a disaster. Recovery is the long-term process to re-establish a

healthy, functioning, and sustainable community (Becker, 2009). Lastly, mitigation focuses on key steps to minimize the harmful effects of a future disaster.

Within each of the phases, there are three important elements that enable effective governance: collaboration/coordination, information sharing, and communication. Collaboration typically focuses on organizations in long-term relationships co-creating policy solutions to issues, while coordination is about organizations being mobilized to tackle one specific problem in the short-term. Information sharing is about communicating vital pieces of information with various stakeholders to gain an understanding of the situation at hand. Communication explores how vital information is relayed to key decision-makers and the public.

Conceptualizing the phases of DRM and the important elements that foster effective governance within these phases led the team to conduct further research on the roles/relationships among stakeholders, focusing on how local government interacts with nonprofits, the private sector, and experts. Nonprofits tend to promote citizen engagement and spread awareness while acting as an avenue of communication to bolster support and promote a grassroots approach to the legislative process. The private sector supplements government action, invests in continuity and vulnerability reduction, and ensures the delivery of goods and services in the wake of a disaster. Experts offer information, data, and resources to assist with risk assessment and mitigation planning.

Research and Methodology

The framework guides the analysis and divides the information gathered from each city into six components: city context, legal and policy context, organizational structure for DRM, coordination, information, and communication.

The team employed qualitative research methods to fill out the components across the case studies. A review of various online sources provided specific information for each city in regard to disaster risk management and its governance. The interviews were used primarily to supplement and corroborate the information gathered from the content analysis. The research team found various organizational bodies that were involved in disaster risk management and reached out to affiliates of those organizations. The research in this report includes information given by respondents from governmental organizations, nonprofits, universities, and other institutions. Once the elements of the analytical framework were complete, the team examined and analyzed the data collected from each city.

Case Study Summaries

Christchurch

Christchurch, New Zealand, operates under a unitary government that allows for integrative and consistent DRM practices to flourish. The region's direct plans and strategies for addressing DRM are managed by its Civil Defence and Emergency Management Plans, which are divided between national and regional guidance. Coordination is achieved through the use of a series of

inter-related organizations and committees that allows government agencies, nonprofits, business leaders, and citizens to participate. Christchurch promotes information and communication tools by placing strong emphasis on open source material online, public meetings/forums, and education campaigns. These key areas speak strongly to Christchurch's ability to invest in its community and build trust to ensure credible, applicable, and effective DRM methods are put into action.

Miami

The city of Miami is susceptible to hurricanes and flooding resulting from sea level rise. To mitigate these risks, the county and city Offices' of Resilience along with supporting actors coordinate to carry out DRM. The formal and informal networks in place promote coordination and result in the creation of an array of plans, programs, and tools to better support and protect its residents. These resources are primarily found online, and include information about the risks the area faces. While it is beneficial to have this information available to residents it is often communicated in a highly technical, complex manner, which limits its useability. In an attempt to address this limitation, the Offices' of Resilience are partnering with local nonprofits to better communicate risks to communities. This has proven to be a beneficial strategy more Miami. Overall, Miami's decentralized structure allows for intergovernmental and cross-sector collaboration which increases multi-lateral communication channels and the amount of information being disseminated.

San Francisco

San Francisco operates under a decentralized, federal system, giving the local government autonomy over its DRM. The city faces a number of hazards, but there is considerable government attention and resources dedicated towards earthquake mitigation due to the city's history and the potential for future occurrences. To mitigate the effects of future earthquakes and climate changes, San Francisco has developed a significant number of plans, programs, and tools through its relationships with the private, nonprofit, and academic sectors.

Additionally, these resources are accessible to the public via websites, apps, and other mobile platforms. San Francisco's cross-sectoral relationships have not only resulted in a more well-rounded understanding of the risks, but it has also enabled the city to be more transparent about what needs to be done in order to prevent deaths and structural damages in the face of them. These resources and the transparency of mitigation mechanisms are useful to Mexico City, given its similar goal to mitigate the effects of earthquakes and climate changes.

Santiago

Similar to Mexico City, Santiago de Chile not only faces the threat of natural hazards caused by sitting on the ring of fire, but also floods, landslides, droughts, and wildfires. Santiago operates under a unitary government, which means that the framework for DRM stems mainly from national-level plans. However, municipalities have the power to develop their own DRM plans and dedicate funds towards prevention and mitigation activities, yet the degree to which they do

so varies. The System provides an integrated framework through which public, private, and nonprofit actors can collaborate on disaster prevention and mitigation efforts. As a whole, Santiago has a myriad of information available to the general population to improve decision-making through education and transparency. However, there seems to be limited useability due to the complex nature of the webpages and data sets.

Finally, the centralized nature of the country characterizes much of its communication. National plans state that “inclusive participation that is non-discriminatory and accessible” is a guiding principle. Multiple channels of communication are available to stakeholders and community members in Santiago as well including conventional methods such as print and broadcast media, and online communications such as through social media platforms and official websites. Chile’s DRM practices generally have preserved traditional approaches to DRM, focusing primarily on emergency management. More recent events have led Chile and Santiago to shift the focus towards risk reduction.

Analyses and Findings

Taking into account the challenges identified in Mexico City, this section analyzes the main aspects of disaster risk management governance: coordination, information, and communication while also including city context, policy and legal, and organizational structures. The purpose is to identify the range of approaches utilized in these cities and identify approaches and innovations that may provide insights relevant for Mexico City.

Understanding the context of the different cities is important because how cities address disaster resilience is affected by the context within which they operate. We looked specifically at population size, income level, social vulnerabilities, natural risks, and government structure of the case study cities. All the cities, except for Christchurch, are part of major metropolitan areas. Miami and Santiago are the closest to Mexico City with populations of over 5 million. The U.S. and New Zealand are wealthy countries, and among the Latin American countries, Chile is an upper middle-income country like Mexico. Populations with low incomes or living below the poverty line were a concern for most case study cities, with significant poor communities in both Santiago and Miami. This affects resources available to governments and to citizens. Finally, in terms of government structure, New Zealand and Chile are both unitary systems, while the United States, like Mexico, is a federal system. These different government structures impact how policy is created. Consolidated plans and policies are created under a unitary system, while a Federal system creates multiple plans and policies.

Coordination. The complexity of coordination depends substantially on whether the local government is part of a unitary or federal system. Those under a unitary system seem to have fewer coordination issues amongst stakeholders; however, the system also appears to limit non-formal membership participation of stakeholders. Meanwhile, in the federal system, it seems that coordination amongst all the stakeholders is more of a struggle. However, this struggle can give way to interesting and innovative coordination arrangements in Miami and San Francisco. The cities under a federal structure are similar to Mexico City, so the experiences and approaches are likely to be more relevant.

Information. A common theme throughout information was the availability of information online. All case studies have a robust online presence and many different technical tools, such as risk maps or a building registry, available in this medium. This robust online presence, however, left all case studies one-dimensional on the dissemination of risk, especially to marginalized communities. The creation of these tools and information, local governments relied on themselves, as well as a plethora of other stakeholders from universities to nonprofits.

Communication. Ensuring effective communication is an essential dimension of governance for risk management. As the analysis indicates there are a variety of different communication structures that could be implemented to ease in the flow of communication. Tools such as forums or 311 call centers can aid in the flow of information between both local government and its citizens. Meanwhile, different top-down or bottom-up techniques, such as citizen education or multiple languages used for information sharing, are implemented.

Conclusions and Lessons Learned

In this concluding section of the report, we seek to draw out key learning from the study. We found three sets of factors that were important in shaping DRM and its governance: economy and inequality, size and heterogeneity of population, and government structure. Miami and Santiago are the closest to Mexico City in size, Santiago is more of a peer on income level. All the cities except Christchurch face similar challenges of vulnerable populations due to low-income and socio-economic vulnerability. The U.S. cities have the same overarching government structure of federalism, which we found to be a major influence on DRM governance, suggesting that the approaches adopted by Miami and San Francisco may be of particular relevance to Mexico City.

For each of the areas of governance—coordination, information sharing, and communication—we considered what the case studies had shown to be the major challenges in the area, with particular reference to prevention and mitigation of disaster. We then identified what came out of the experiences as good practices that helped address the challenges.

Coordination. In our case studies, we found that vertical coordination was generally addressed fairly comprehensively in the unitary systems, while national-local coordination in the U.S. cities was often a matter of a mix of funding as incentives for policy change at the local level. Coordination across the local level was also more planned and controlled in the unitary systems. It was more complex and messy in the federal systems, especially in Miami, but essentially functional. We found, though, that the issue of engaging with key stakeholders was both important and one of the most difficult aspects of coordination. Establishing inclusive decision-making bodies, developing meaningful relationships, and building social capital are highlighted as good practices aimed at increasing coordination.

Information. Our studies showed that every city had risk-related information available for decision makers. The main challenges were not there, but were instead with making needed information available for citizens and communities. San Francisco most adequately addressed the

challenge of making risk related information available and usable for communities. They provide various examples of cross-sector collaboration resulting in the creation of information tools intentionally designed with community members as targeted users.

Communication. The case studies showed there are major challenges associated with effectively communicating risk-related information with the public in a way that is easily accessible, usable, and reliable. The cities also struggled to communicate with marginalized communities, which are often in more vulnerable or risk-prone positions than the public at large. Diversifying communication channels, utilizing a bottom up approach, and partnering with nonprofits were good practices illustrated throughout the cases.

RESUMEN EJECUTIVO

Introducción

La gestión del riesgo de desastres (DRM) nunca ha sido tan esencial para la Ciudad de México como hoy. Hace tres años, la ciudad sufrió el mayor terremoto en más de 30 años. Mató a 219 personas, causó miles de millones de dólares en daños a la infraestructura y dejó una ciudad vibrante en desorden. Mientras que la Ciudad de México y sus comunidades aledañas continúan recuperándose, las secuelas del terremoto enfrentan diariamente a sus residentes, empresas y líderes locales.

Un año antes del terremoto, la ciudad cambió en su disposición política y poder gubernamental, ganando el estado de estado, en lugar del distrito federal. Ese cambio trajo la oportunidad de rehacer sus instituciones de gobierno. Como el terremoto de 2017 ocurrió mientras muchas instituciones estaban en transición o aún no estaban estabilizadas, desafió al gobierno de CDMX e iluminó la importancia de establecer estrategias sólidas de gestión de riesgos.

Ruta Cívica, como organización local sin fines de lucro y de base en la Ciudad de México, trabaja con ciudadanos y otros socios para impulsar la participación ciudadana en los asuntos urbanos y la gobernanza, y actualmente tiene un enfoque especial en la gestión de riesgos en la ciudad. Para ayudar a Ruta Cívica en sus esfuerzos, el Equipo de Ruta Cívica Capstone de la Escuela de Gobierno y Servicio Público de Bush realizó una investigación sobre la gobernanza local de la gestión de riesgos en cuatro ciudades que enfrentan peligros naturales comparables: Christchurch, Miami, San Francisco y Santiago -- perspectivas internacionales sobre gobernanza para la gestión del riesgo de desastres.

Este informe incluye una revisión de la literatura relevante, el diseño y la metodología de la investigación, resúmenes de los cuatro estudios de caso, hallazgos y análisis, y conclusiones y lecciones aprendidas.

Revisión de literatura

La literatura proporcionó una comprensión profunda de los elementos que las fuentes académicas encontraron necesarias para la implementación exitosa de planes para mejorar la seguridad pública. El equipo revisó la investigación en las áreas de Gobierno y DRM y los roles / relaciones entre las partes interesadas. Esta revisión de la literatura no representa el alcance completo de la multitud de elementos involucrados en el buen gobierno. Sin embargo, mejora la comprensión de los componentes críticos necesarios para una GRD y una gobernanza sólidas.

Bevir (2012) define la gobernanza como una revelación de que existen acuerdos gubernamentales formales e informales que guían la forma en que las normas, leyes y políticas se implementan en diferentes situaciones, como durante una crisis. La identificación de los tipos de arreglos gubernamentales formales e informales abrió la puerta a la comprensión de la teoría de desastres y el ciclo DRM. Hay cuatro fases en el ciclo: preparación, respuesta, recuperación y

mitigación. La preparación se refiere a la creación de medidas y sistemas preventivos para proteger a las personas de un desastre. Response destaca las acciones destinadas a asegurar a los ciudadanos y brindarles asistencia inmediata y estrategias para salvar vidas durante y poco después de un desastre. La recuperación es el proceso a largo plazo para restablecer una comunidad sana, funcional y sostenible (Becker, 2009). Por último, la mitigación se centra en los pasos clave para minimizar los efectos nocivos de un desastre futuro.

Dentro de cada una de las fases, hay tres elementos importantes que permiten una gobernanza efectiva: colaboración / coordinación, intercambio de información y comunicación. La colaboración generalmente se enfoca en organizaciones en relaciones a largo plazo que crean soluciones de políticas para problemas, mientras que la coordinación se trata de organizaciones que se movilizan para abordar un problema específico a corto plazo. El intercambio de información consiste en comunicar piezas vitales de información con varias partes interesadas para comprender la situación en cuestión. La comunicación explora cómo se transmite la información vital a los tomadores de decisiones clave y al público.

La conceptualización de las fases de DRM y los elementos importantes que fomentan una gobernanza efectiva dentro de estas fases llevó al equipo a realizar más investigaciones sobre los roles / relaciones entre las partes interesadas, centrándose en cómo el gobierno local interactúa con las organizaciones sin fines de lucro, el sector privado y los expertos. Las organizaciones sin fines de lucro tienden a promover la participación ciudadana y a difundir la conciencia mientras actúan como una vía de comunicación para reforzar el apoyo y promover un enfoque de base para el proceso legislativo. El sector privado complementa la acción del gobierno, invierte en la continuidad y la reducción de la vulnerabilidad, y asegura la entrega de bienes y servicios a raíz de un desastre. Los expertos ofrecen información, datos y recursos para ayudar con la evaluación de riesgos y la planificación de la mitigación.

Investigación y metodología

El marco guía el análisis y divide la información recopilada de cada ciudad en seis componentes: contexto de la ciudad, contexto legal y de políticas, estructura organizativa para DRM, coordinación, información y comunicación.

El equipo empleó métodos de investigación cualitativa para completar los componentes en los estudios de caso. Una revisión de varias fuentes en línea proporcionó información específica para cada ciudad con respecto a la gestión del riesgo de desastres y su gobernanza. Las entrevistas se utilizaron principalmente para complementar y corroborar la información recopilada del análisis de contenido. El equipo de investigación encontró varios organismos organizativos que participaron en la gestión del riesgo de desastres y se acercó a las afiliadas de esas organizaciones. La investigación en este informe incluye información dada por los encuestados de organizaciones gubernamentales, organizaciones sin fines de lucro, universidades y otras instituciones. Una vez que se completaron los elementos del marco analítico, el equipo examinó y analizó los datos recopilados de cada ciudad.

Resúmenes de estudios de caso

Christchurch

Christchurch, Nueva Zelanda, opera bajo un gobierno unitario que permite que prosperen prácticas integradas y consistentes de DRM. Los planes y estrategias directas de la región para abordar la GRD son administrados por sus Planes de Defensa Civil y Manejo de Emergencias, que se dividen en orientación nacional y regional. La coordinación se logra mediante el uso de una serie de organizaciones y comités interrelacionados que permiten la participación de agencias gubernamentales, organizaciones sin fines de lucro, líderes empresariales y ciudadanos. Christchurch promueve herramientas de información y comunicación poniendo un fuerte énfasis en el material de código abierto en línea, reuniones / foros públicos y campañas educativas. Estas áreas clave hablan enérgicamente de la capacidad de Christchurch para invertir en su comunidad y generar confianza para garantizar que se pongan en práctica métodos DRM creíbles, aplicables y efectivos.

Miami

La ciudad de Miami es susceptible a los huracanes e inundaciones resultantes del aumento del nivel del mar. Para mitigar estos riesgos, las Oficinas de Resiliencia del condado y la ciudad junto con los actores de apoyo se coordinan para llevar a cabo la GRD. Las redes formales e informales establecidas promueven la coordinación y dan como resultado la creación de una variedad de planes, programas y herramientas para apoyar y proteger mejor a sus residentes. Estos recursos se encuentran principalmente en línea e incluyen información sobre los riesgos que enfrenta el área. Si bien es beneficioso tener esta información disponible para los residentes, a menudo se comunica de una manera altamente técnica y compleja, lo que limita su utilidad. En un intento por abordar esta limitación, las Oficinas de Resiliencia se asocian con organizaciones locales sin fines de lucro para comunicar mejor los riesgos a las comunidades. Esto ha demostrado ser una estrategia beneficiosa más Miami. En general, la estructura descentralizada de Miami permite la colaboración intergubernamental e intersectorial, lo que aumenta los canales de comunicación multilaterales y la cantidad de información que se difunde.

San Francisco

San Francisco opera bajo un sistema federal descentralizado, que le da autonomía al gobierno local sobre su DRM. La ciudad enfrenta una serie de peligros, pero hay una considerable atención del gobierno y recursos dedicados a la mitigación de terremotos debido a la historia de la ciudad y el potencial de sucesos futuros. Para mitigar los efectos de futuros terremotos y cambios climáticos, San Francisco ha desarrollado una cantidad significativa de planes, programas y herramientas a través de sus relaciones con los sectores privado, sin fines de lucro y académico.

Además, el público puede acceder a estos recursos a través de sitios web, aplicaciones y otras plataformas móviles. Las relaciones intersectoriales de San Francisco no solo han resultado en una comprensión más completa de los riesgos, sino que también han permitido que la ciudad sea más transparente sobre lo que se debe hacer para evitar muertes y daños estructurales ante ellos.

Estos recursos y la transparencia de los mecanismos de mitigación son útiles para la Ciudad de México, dado su objetivo similar para mitigar los efectos de los terremotos y los cambios climáticos.

Santiago

Similar a la Ciudad de México, Santiago de Chile no solo enfrenta la amenaza de los peligros naturales causados por sentarse en el anillo de fuego, sino también inundaciones, deslizamientos de tierra, sequías e incendios forestales. Santiago opera bajo un gobierno unitario, lo que significa que el marco para la GRD se deriva principalmente de los planes a nivel nacional. Sin embargo, los municipios tienen el poder de desarrollar sus propios planes de GRD y dedicar fondos a actividades de prevención y mitigación, aunque el grado en que lo hacen varía. El sistema proporciona un marco integrado a través del cual los actores públicos, privados y sin fines de lucro pueden colaborar en los esfuerzos de prevención y mitigación de desastres. En general, Santiago tiene una gran cantidad de información disponible para la población en general para mejorar la toma de decisiones a través de la educación y la transparencia. Sin embargo, parece que la usabilidad es limitada debido a la naturaleza compleja de las páginas web y los conjuntos de datos.

Finalmente, la naturaleza centralizada del país caracteriza gran parte de su comunicación. Los planes nacionales establecen que "la participación inclusiva que no sea discriminatoria y accesible" es un principio rector. Múltiples canales de comunicación están disponibles para las partes interesadas y los miembros de la comunidad en Santiago, incluidos los métodos convencionales, como los medios impresos y de transmisión, y las comunicaciones en línea, como a través de plataformas de redes sociales y sitios web oficiales. Las prácticas de DRM en Chile generalmente han conservado los enfoques tradicionales de DRM, centrándose principalmente en la gestión de emergencias. Eventos más recientes han llevado a Chile y Santiago a cambiar el enfoque hacia la reducción de riesgos.

Análisis y hallazgos

Teniendo en cuenta los desafíos identificados en la Ciudad de México, esta sección analiza los principales aspectos de la gestión del riesgo de desastres: coordinación, información y comunicación, al tiempo que incluye el contexto de la ciudad, las políticas y las estructuras legales y organizativas. El propósito es identificar el rango de enfoques utilizados en estas ciudades e identificar enfoques e innovaciones que puedan proporcionar información relevante para la Ciudad de México.

Comprender el contexto de las diferentes ciudades es importante porque la forma en que las ciudades abordan la resiliencia ante desastres se ve afectada por el contexto en el que operan. Analizamos específicamente el tamaño de la población, el nivel de ingresos, las vulnerabilidades sociales, los riesgos naturales y la estructura gubernamental de las ciudades de estudio de caso. Todas las ciudades, excepto Christchurch, son parte de las principales áreas metropolitanas. Miami y Santiago son los más cercanos a la Ciudad de México con poblaciones de más de 5 millones. Estados Unidos y Nueva Zelanda son países ricos, y entre los países latinoamericanos,

Chile es un país de ingresos medios altos como México. Las poblaciones con bajos ingresos o que viven por debajo del umbral de pobreza eran una preocupación para la mayoría de las ciudades de estudio de caso, con comunidades pobres significativas tanto en Santiago como en Miami. Esto afecta los recursos disponibles para los gobiernos y los ciudadanos. Finalmente, en términos de estructura gubernamental, Nueva Zelanda y Chile son sistemas unitarios, mientras que Estados Unidos, como México, es un sistema federal. Estas diferentes estructuras gubernamentales afectan la forma en que se crean las políticas. Los planes y políticas consolidados se crean bajo un sistema unitario, mientras que un sistema federal crea múltiples planes y políticas.

Coordinación. La complejidad de la coordinación depende sustancialmente de si el gobierno local es parte de un sistema unitario o federal. Aquellos bajo un sistema unitario parecen tener menos problemas de coordinación entre las partes interesadas; sin embargo, el sistema también parece limitar la participación no formal de miembros de las partes interesadas. Mientras tanto, en el sistema federal, parece que la coordinación entre todos los interesados es más difícil. Sin embargo, esta lucha puede dar paso a arreglos de coordinación interesantes e innovadores en Miami y San Francisco. Las ciudades bajo una estructura federal son similares a la Ciudad de México, por lo que es probable que las experiencias y los enfoques sean más relevantes.

Información. Un tema común en toda la información fue la disponibilidad de información en línea. Todos los estudios de caso tienen una sólida presencia en línea y muchas herramientas técnicas diferentes, como mapas de riesgos o un registro de edificios, disponibles en este medio. Sin embargo, esta sólida presencia en línea dejó todos los estudios de caso unidimensionales sobre la difusión del riesgo, especialmente a las comunidades marginadas. La creación de estas herramientas e información, los gobiernos locales se basaron en sí mismos, así como en una gran cantidad de otras partes interesadas, desde universidades hasta organizaciones sin fines de lucro.

Comunicación. Garantizar una comunicación efectiva es una dimensión esencial de la gobernanza para la gestión de riesgos. Como indica el análisis, hay una variedad de diferentes estructuras de comunicación que podrían implementarse para facilitar el flujo de comunicación. Herramientas como foros o centros de llamadas 311 pueden ayudar en el flujo de información entre el gobierno local y sus ciudadanos. Mientras tanto, se implementan diferentes técnicas de arriba hacia abajo o de abajo hacia arriba, como la educación ciudadana o múltiples idiomas utilizados para compartir información.

Conclusiones y lecciones aprendidas

En esta sección final del informe, buscamos extraer el aprendizaje clave del estudio. Encontramos tres conjuntos de factores que fueron importantes en la configuración de la GRD y su gobernanza: economía y desigualdad, tamaño y heterogeneidad de la población y estructura del gobierno. Miami y Santiago son los más cercanos en tamaño a la Ciudad de México, Santiago es más un par en el nivel de ingresos. Todas las ciudades, excepto Christchurch, enfrentan desafíos similares de poblaciones vulnerables debido a la vulnerabilidad socioeconómica y de bajos ingresos. Las ciudades de EE. UU. Tienen la misma estructura general de federalismo del gobierno, que consideramos que es una influencia importante en la

gobernanza de DRM, lo que sugiere que los enfoques adoptados por Miami y San Francisco pueden ser de particular relevancia para la Ciudad de México.

Para cada una de las áreas de gobernanza (coordinación, intercambio de información y comunicación), consideramos cuáles de los estudios de caso habían demostrado ser los principales desafíos en el área, con especial referencia a la prevención y mitigación de desastres. Luego identificamos lo que surgió de las experiencias como buenas prácticas que ayudaron a abordar los desafíos.

Coordinación. En nuestros estudios de caso, descubrimos que la coordinación vertical generalmente se abordaba de manera bastante integral en los sistemas unitarios, mientras que la coordinación nacional-local en las ciudades de los EE. UU. A menudo era una combinación de fondos como incentivos para el cambio de políticas a nivel local. La coordinación a nivel local también fue más planificada y controlada en los sistemas unitarios. Era más complejo y desordenado en los sistemas federales, especialmente en Miami, pero esencialmente funcional. Sin embargo, descubrimos que la cuestión de relacionarse con las partes interesadas clave era importante y uno de los aspectos más difíciles de la coordinación. El establecimiento de órganos de toma de decisiones inclusivos, el desarrollo de relaciones significativas y la creación de capital social se destacan como buenas prácticas destinadas a aumentar la coordinación.

Información. Nuestros estudios mostraron que cada ciudad tenía información relacionada con el riesgo disponible para los tomadores de decisiones. Los principales desafíos no estaban allí, sino que consistían en poner la información necesaria a disposición de los ciudadanos y las comunidades. San Francisco abordó de manera más adecuada el desafío de hacer que la información relacionada con el riesgo esté disponible y sea utilizable para las comunidades. Proporcionan varios ejemplos de colaboración intersectorial que dan como resultado la creación de herramientas de información diseñadas intencionalmente con miembros de la comunidad como usuarios específicos.

Comunicación. Los estudios de caso mostraron que existen desafíos importantes asociados con la comunicación efectiva de la información relacionada con el riesgo con el público de una manera que sea fácilmente accesible, utilizable y confiable. Las ciudades también tuvieron problemas para comunicarse con las comunidades marginadas, que a menudo se encuentran en posiciones más vulnerables o propensas al riesgo que el público en general. Diversificar los canales de comunicación, utilizar un enfoque ascendente y asociarse con organizaciones sin fines de lucro fueron buenas prácticas ilustradas en todos los casos.

1. INTRODUCTION

Mexico City faces environmental, social, and economic challenges to disaster risk management. These challenges are rooted in Mexico City's geographic location and the significant socio-environmental transformations that have occurred over the city's history. Rapid population growth into a former lake bed has exacerbated problems in long-term planning and metropolitan coordination (CDMX Resilience Office, 2016, p. 11).

The City is subject to multiple natural and human-created risks, including droughts, floods, and earthquakes. It also suffers from social and economic inequality that has resulted in unequal access to urban amenities and public services. Furthermore, aquifer overexploitation has resulted in water supply issues as well as increased subsidence in some areas of the city.

The shortcomings of Mexico City's disaster risk management (DRM) efforts were brought to the forefront by the earthquake on September 19, 2017, exactly 32 years after 1985 Earthquake. The 2017 earthquake resulted in 219 deaths and destroyed or damaged 20,000 structures. By 2019, the status of more than 12,000 buildings and homes remained unchanged (ABC News, 2019). These statistics underscore the need for improvement in the way that Mexico deals with disaster risk and vulnerability at all institutional levels (Alcántara-Ayala et al., 2018, pp. 3-5).

According to the Congressional Scientific and Technological Information Office, Mexico's biggest challenge, in terms of DRM, is to make a shift from a reactive disaster management paradigm to a comprehensive DRM paradigm that includes strategic, long-term, and forward-looking measures. Additionally, the Office identified the understanding of disaster risks, prevention efforts, and planning for human protection as areas of needed improvement for Mexico's DRM (Oficina de Información Científica y Tecnológica para el Congreso de la Unión, 2019, p. 6). Mexico's DRM efforts up to this point have primarily focused on emergency response and have neglected the kind of medium- and long-term plans needed to reduce risk vulnerability and exposure (Alcántara et al., 2018, p. 3). This is an important barrier to improved DRM for Mexico City.

In 2016, Mexico City underwent a significant political change and became an official state in Mexico's federation. This change allowed Mexico City to form its own congress, constitution, local government, and fiscal rules. It also provided local authorities with more autonomy from the federal government than under its previous designation as a Federal District (DF). (Rios, 2016). This change provided new opportunities to mitigate disaster risks, promote risk management and resilient institutions, and improve the quality of life for citizens through effective governance.

In light of these needs and opportunities in Mexico City, Ruta Cívica desires to advise local leaders and government officials on effective institutional arrangements. To aid Ruta Cívica in this process, the Bush School of Government and Public Service's Ruta Cívica Capstone Team supported Ruta Cívica's work by providing international perspectives on governance of DRM.

To accomplish this task, the Ruta Cívica Capstone Team conducted research on four cities' arrangements for DRM - Christchurch, New Zealand, Santiago, Chile, San Francisco, USA, and Miami, USA. These four cities were chosen for a variety of reasons, including major, recent natural disasters, geographic location, and perceived cultural similarities.

This report consists of a literature review, discussion of research design and methodology, summaries of case studies, and lessons learned. Full versions of the case studies accompany the report and are located in Part 2. The literature review focuses on governance. It discusses different challenges, such as intergovernmental collaboration and coordination, working with other stakeholders, and the inclusion of vulnerable communities. Special attention was paid to coordination, information, and communication. The literature review guided the focus of our case study research while interviews with government officials, academics, and nonprofits were conducted to provide more context and further corroborate the research findings. Ultimately, the report ends with an analysis of the case studies followed by recommendations and lessons learned.

2. LITERATURE REVIEW

Before conducting the case study research, the team completed a literature review on governance and Disaster Risk Management (DRM). The literature provided an in-depth understanding of elements that academic sources found necessary for the successful implementation of plans to improve public safety.

This section summarizes essential parts of the literature as it relates to governance, institutional arrangements, and the local government's relationship with various stakeholders. These governance frameworks and arrangements were then viewed through the lens of DRM. This literature review does not represent the complete scope of the multitude of elements involved in good governance. However, it enhances the understanding of critical components needed for strong DRM and governance. This research served as a foundation that guided the case studies' analysis.

Governance and Disaster Risk Management

What is Governance?

Generally, governance refers to “all processes of governing, whether undertaken by a government, market, or network, whether over a family, tribe, formal or informal organization, or territory, and whether through laws, norms, power, or language,” (Bevir, 2012, p. 1). It describes processes and social interactions that produce social norms, institutions, and policies within an organization (Huffy, 2011). More specifically, for the research, public governance describes the formal and informal arrangements which guide the way public choices are both made and carried out (Organisation for Economic Co-operation and Development, 2018).

Disaster Risk Management and Disaster Theory

Disasters create large amounts of uncertainty within society after their occurrence. DRM is an approach to community and state development that seeks to holistically protect communities from the impact and from uncertainty after a disaster (Cuthbertson, Rodriguez-Llanes, Robertson, and Archer, 2019, p. 2). DRM theories should help planners and decision-makers understand the lifecycle of a disaster and actions throughout the lifecycle (Herzog, 2007, pp. 587-588).

Phases of Disaster Risk Management Cycle

DRM has a variety of life cycle theories on how disasters occur in society—many of which are broken down into phases. These phases are vital as they help simplify complex situations into phases by identifying critical elements (Nojavan, Salehi, & Omidvar, 2018). Most theoretical and practical models use a combination of preparedness/planning, response, recovery, and mitigation to classify phases (Albtoush et al., 2011; Pelfrey, 2005).

The preparedness stage emphasizes the continuum of planning, training, and evaluating plans. In this stage, there is a focus on creating preventative measures and systems that protect from disasters. Localities, using information based on previous risk analysis, begin planning to reduce hazard impacts. Additionally, one agency begins to coordinate with other agencies to implement new measures to protect the community. Typical actions include logistical readiness to counter natural hazards and the community's willingness to enhance their readiness capacity (Vallance & Carlton, 2015).

The second and third phases of DRM are response and recovery. The response phase covers actions aimed to secure citizens and provide them with immediate assistance and life-saving strategies during and shortly after a disaster (National Voluntary Organizations Active in Disaster, 2012). Meanwhile, the recovery phase is a long-term process and can take months or sometimes years. The aim is to re-establish a healthy, functioning, and sustainable community (Becker, 2009).

Mitigation is the last phase of DRM presented in the literature. This phase is used to decrease the impact of similar disasters that may occur in the future. There are two types of mitigation: hard and soft (Lichterman, 2000). Hard mitigation includes engineered modifications and a focus to withstand natural hazards with little active human involvement. Examples of hard mitigation are flood resistant dams and levees, emergency systems, and power supplies. Soft mitigation techniques are used to eliminate disasters that cannot be reduced by hard mitigation measures. Examples of soft mitigation are search and rescue operations, care and shelter, and first aid. The mitigation phase, along with the entire DRM cycle, involves the implementation of new public policies and plans to reduce the impact of disasters on people and infrastructure.

Important Elements for DRM

The literature related to governance of DRM suggests several major conditions for and characteristics of effective governance. Emphasis has been placed on the importance of local governments and their administrations as the bodies that coordinate the actions and efforts in the areas of prevention, mitigation, and reconstruction (Bollin et al., 2003). At the same time, successful local risk management is based on the advances of national policies, strategies, and legal standards for risk reduction. Various studies, guidelines, and concepts argue the need for widespread involvement of other stakeholders in national and local risk management.

Significantly, the literature identifies three elements of governance that are especially critical for effective disaster risk management: coordination, information sharing, and communication. (Bollin et al., 2003; Comfort, 2007).

Collaboration/Coordination

Collaborative disaster management is one of the most potent methods of mitigation. Local-level institutions (i.e., public, private, and non-governmental) can benefit immensely from collaborative disaster management, however, from an institutional perspective, collaboration rates are not stagnant. The literature points out that the collaboration capability of participants

involved in disaster management also fluctuates during the lifecycle of disasters (Noran, 2014, p. 1034). Noran (2014) also mentions the unique concept of interoperability as an essential piece to understanding the dynamics of collaboration. This term is often used as a measure of cooperation capability. However, Noran defines it as “enabling the use and exchange of information to perform a function on behalf of another entity” (2014, p. 1035).

One study argues that most institutions responsible for delivering emergency response services form a heterogeneous set that often underperforms due to the lacking nature of cultural interoperation and collaboration. The authors see the collaboration process as a necessary means of sharing decision-making as well as data and resources to “pass the right information, in the right amount, at the right time, from the right place to the right person,” (Sagun, Bouchlaghem, & Anumba, 2008, p. 216). Local government should act as the critical arbiter of interoperation, and collaboration is integral for any crisis, especially during disaster and risk management scenarios when life and death are at stake.

Collaboration and coordination are terms used within the literature and by supplemental information sources as relatively synonymous. Collaboration typically focuses on organizations in long-term relationships co-creating policy solutions to issues, while coordination is about organizations being mobilized to tackle one specific problem in the short-term. Throughout the report and case studies, the term coordination is typically used in place of collaboration to capture both meanings.

Information Sharing

Information sharing is about communicating vital pieces of information with various stakeholders to gain an understanding of the situation at hand. The literature notes that a lack of shared knowledge can lead to adverse outcomes (Comfort, 2007; Waugh & Streib, 2006). What information is shared can come from many different formal (government channels) and informal (anecdotal stories) sources. Typically the local government conducts risk assessments. Through careful analysis with various stakeholders, the management or higher-level officials define what risks in a community are unacceptable, tolerable, or acceptable. This information should then be relayed to the community so they are aware of what to plan for (Tummala & Schoenherr, 2011, p. 479).

Local communities can also provide critical information. Communities are often the first to feel the negative impacts of a disaster and the first to respond to it. Allowing the community to share this knowledge can improve the planning, design, implementation, monitoring, and evaluation of disaster risk activities, making it more inclusive (Haghebaert, 2007). Sheppard et al. (2011) describe many principles used to build a more connected community that include but are not limited to: having an engaging, accessible process with understandable information; including salient information for local stakeholders and decision-makers; incorporating appropriate affective responses that are personally relevant and motivating; and providing salient information for local public and decision-makers (p. 402).

Communication Structures

Communication structures relay vital information to actors who identify risks and manage recovery, as well as to residents of a community who need to be aware of imminent threats. Studies indicate that the strength of communication structures and how risk communication is disseminated determine how communities are impacted by the disaster (Eisenman et al., 2007). Andreas Meissner et al. (2007) identifies the challenges to integrated disaster management systems and states that one of the “primary challenges” of mitigating disaster is maintaining communication (p. 2).

Emerging research shows how these gaps can be overcome and the community included. The integration of the internet can involve citizens in the process of relaying important information and democratize knowledge sharing in the event of a disaster. A study on the role of web 2.0 technologies in the typhoon Morakot disaster in Taiwan, found that internet social networking and mobile technology helped disseminate real-time information, recruit volunteers, and allocate relief supplies. The study noted that the use of microblogging and social media helped emergency medical system workers find people in need of rescue and allowed for nonprofit organizations, local media, and citizens to fill in the gaps of the necessary information that the government could not fill. The researchers of the study suggest that the integration of internet tools in DRM systems can positively impact the accessibility, accuracy, validity, feasibility, and scalability of communication (Huang et al., 2010).

Institutional Arrangements for Local Government

In reviewing the academic literature, there was little research on how local government should be organized. There were, however, a variety of practical sources that reference frameworks for institutional arrangements for local government to improve a city’s processes and governance outcomes. The 100 Resilient Cities program focused on strengthening cities against the future physical, social, and economic challenges that are becoming more common. The framework for the program had four focus areas - Leadership & Strategy, Health & Wellbeing, Economy & Society, and Infrastructure & Environment. Each area had three “drivers” or actions that can help create change in a society. These areas under Leadership & Strategy are (100 Resilient Cities, 2019):

- Promote Leadership and Effective Management
- Empower a Broad Range of Stakeholders
- Foster Long-Term and Integrated Planning

This framework focuses heavily on collaboration, capacity building, and communication. An alternative framework is found in the C40 Cities. This program focuses on strengthening cities facing climate change by improving the management of finances, economic innovation, and urban planning. It also supports cities’ adoption of technology to help drive change and has a network program similar to that of the 100 Resilient Cities. Its framework is divided into three phases - Commitment & Collaboration, Challenges & Opportunities, and Acceleration & Implementation. Commitment & Collaboration is similar to the 100 Resilient Cities program

Leadership & Strategy focus area. Commitment & Collaboration focuses on cities improving coordination and communication with different stakeholders (C40 Cities, 2019). This framework encourages capacity building, information sharing, and collaboration.

Roles of/Relationships Among Stakeholders

Through its research, the Ruta Cívica Capstone Project identified several key relationships with local government in DRM: *nonprofits organizations*, the *private sector*, and *experts*. The following paragraphs will discuss each of these stakeholders and provide an overview of their roles.

Relationship Between Nonprofits and Local Government

Nonprofits play an essential role to local government as both an intermediary to government policy and community engagement—the scope of nonprofits often garner citizen involvement in local government processes and spreads awareness on issues before tangible legislation can be made. As locally-embedded organizations, community and advocacy-centered nonprofits can be an extension of disaster preparedness by educating communities, raising awareness, and training and recruiting volunteers in disaster recovery (Sledge & Thomas, 2019). The outreach part of nonprofits is a primary benefit to local government as an extra avenue of communication to bolster support and promote a grassroots approach to the legislative process. From a disaster management perspective, this can include lobbying local government officials, collaborating with politicians on substantial policy recommendations to improve disaster planning, and holding local government authorities accountable for their actions when needed. Additionally, nonprofits fill in gaps when local government fails to address present issues (Simo & Bies, 2007, p. 125). While government failure is common, many nonprofits see more significant benefits when there is a strong link between the two actors (Coston, 1998, p. 360).

Relationship Between the Private Sector and Local Government

Similar to nonprofit organizations, the private sector can supplement government action, especially during times of crisis. According to the FEMA National Mitigation Framework, businesses are considered an integral part of the community and that their perspectives are "indispensable in mitigation efforts" (U.S. Department of Homeland Security, 2016, pp. 9-10). Furthermore, businesses are an important partner in mitigation efforts because, when they invest in continuity and vulnerability reduction, it makes it possible to restore normal operations faster. Additionally, by ensuring that needed goods and services are delivered in the wake of a disaster, businesses can play an important role in strengthening community resilience (U.S. Department of Homeland Security, 2016, pp. 9-10). Public-private partnerships are often formed to accomplish these goals. These partnerships can revitalize broken communities, invest in disaster-torn regions, and increase aid to surrounding neighborhoods in need.

Relationship Between Experts and Local Government

Subject matter experts are common additions to local government officials when it comes to data-sharing or providing outside research; they are essential when acquiring information, data, and resources when disasters strike. In terms of risk assessment and planning in mitigation, engineers, scientists, urban planners, health professionals, and others in academia can play an important role in identifying and assessing disaster risks, as well as with the formulation and implementation of strategies to reduce risks before disasters occur (Ahmad, 2007). These experts are critical for disaster planning as their knowledge and experience can drive government policy, decision-making, and strategic thinking to best serve affected communities (Alexander, 2015). With technology improving and science increasing, harnessing connections with professionals to extract real-time data, land surveying methods, and accredited research proves invaluable for government agencies working to build safer and more sustainable communities.

Conclusion

This literature review has highlighted how collaboration, information sharing and communication structure are critical to local governments' successful preparedness, response, recovery, and mitigation of community hazards. This research gave the team a solid overview of the origins of disaster risk management, specifically through phases, each of which contains different actions to meet disaster needs. While the literature does not give clear guidance about how institutions should be arranged, it does provide a deep understanding of critical elements for governance as well as particular challenges regarding stakeholder input. In light of the lessons learned from the team's literature review, the case studies that follow will identify how each city implements institutional arrangements to facilitate collaboration, communication, and information sharing.

3. RESEARCH & METHODOLOGY

The question that guided our research was: What local government arrangements should Mexico City consider to help build its capacity for prevention and mitigation in DRM? To answer it, our research involved studying the governance of DRM in Christchurch, Miami, San Francisco, and Santiago. The four cities conduct DRM in distinct ways and knowledge of their institutions can offer insight for similar practices in Mexico City.

Analytical Framework

An analytical framework was developed to guide the collection and analysis of information from each case study city (see Table 1). The literature review, as well as discussions with Ruta Civica and meetings in Mexico City in January 2020, informed the framework.

A key element of the framework was the focus on information pertaining to mitigation and prevention. The framework breaks the information gathered from each respective city into six components: city context, legal and policy context, organizational structure for DRM, coordination, information, and communication. Each component was further broken down into themes. Sorting the information in this manner provided a structure for each case study, helped visualize the information, and increased the analytical value of the information gathered by showing how components and subcomponents relate and intersect with one another.

Table 1: Analytical Framework for Case Studies

Component	Purpose	Themes
1. City Context <i>Basic statistics for cities</i>	<ul style="list-style-type: none"> Contextualized each city's DRM practices Provided a basis for comparison across cities 	<ul style="list-style-type: none"> Population Geography Income Natural hazards Government structure
2. Legal & Policy Context <i>Laws, policies, and plans regarding DRM</i>	<ul style="list-style-type: none"> Assisted interpretation of other components Point of comparison across cities 	<ul style="list-style-type: none"> Structure of how policy is implemented Building codes Policy content
3. Organizational Structure for DRM <i>Information on roles of stakeholders primarily responsible for DRM</i>	<ul style="list-style-type: none"> Understand roles of government and non-government actors Give attention to organizational structures at relevant local level 	<ul style="list-style-type: none"> Role of national and state government Governmental actors involved in DRM External actors involved in DRM

<p>4. Coordination <i>Network of actors and mechanisms for coordination</i></p>	<ul style="list-style-type: none"> • Understand similarities and differences in how actors coordinate horizontally and vertically 	<ul style="list-style-type: none"> • Vertical coordination between national and local government • Coordination across local government and external stakeholders • Collaborative efforts with external stakeholders
<p>5. Information <i>Use and availability of information on risks</i></p>	<ul style="list-style-type: none"> • Understand who generated the information • Understand who has access to the information 	<ul style="list-style-type: none"> • Risk maps and assessments • Building information • Availability and accessibility of information
<p>6. Communication <i>Types of communication taking place in each city</i></p>	<ul style="list-style-type: none"> • Understand purpose of communication and method used • Understand who are the target audiences and if vulnerable populations were engaged 	<ul style="list-style-type: none"> • Emergency alert systems • Education & capacity building • Information that informs policy • Coordinating information • Risk communication

Ultimately, each component was dependent on the other five to develop a holistic picture of each city's DRM institutions and practices. Taken together, the case studies were analyzed across their respective components and subcomponents to offer additional insights into the DRM taking place in each city. After reviewing the literature, collecting data from each city, and analyzing the data across the aforementioned components, the outcome was the basis for our research: practical knowledge that can inform DRM institutions and practices in Mexico City.

Research Design

This report is a case study research project. The case study design was chosen to focus the research on specific prevention and mitigation efforts taking place in four cities. A common framework across case studies allowed for comparison and identification of patterns and themes across the cases. The case study research filled in the analytical framework. Research included contextual information on Mexico City, an analysis of texts, and information gathered from interviews. Collecting information on context allowed the team to make an assessment of relevance to the Mexico City context. Texts from documents, scholarly research, and plans provided information on each city. Interviews provided more background, supplemented research and corroborated information that was found for each city.

Case study selections were based on their potential relevance to Mexico City. Factors that were given due consideration in the selection were the geographic size of the city, population, and experience dealing with natural hazards (such as seismic events and flooding). Before conducting these case studies, the team went in with the expectation of understanding more about how each city structures its governance and coordinates its actors within the prevention and mitigation phases of the DRM cycle.

Methodology

To answer the research question, we employed a qualitative case study method. A survey of the literature was conducted followed by data collection through texts such as government documents, scholarly research, plans, and various online research. Interviews were conducted with individuals from all four cities.

The interviews were with stakeholders engaged in DRM. The research team identified individuals in local government, the nonprofit sector, and academia to gain insight into the important roles and responsibilities institutional actors hold. The information gathered from interviews corroborated and refined the information gathered from our previous research.

A total of 13 individuals agreed to be interviewed after we contacted them via email. Participants include local government officials, technical experts, nonprofit representatives, professional academics, and a private sector executive. Interviews ranged from 30 minutes to an hour in length and consisted of mostly open-ended questions pertaining to prevention and mitigation in the respective cities. Questions were derived from a team-aggregated framework.

Each case study facilitated an analysis of all the information that had been gathered up to that point. Furthermore, the completed analytical framework allowed the research team to identify patterns and make generalizations about the relevance of each case study to Mexico City.

Limitations

A number of limitations were identified over the course of the research. The relevance to Mexico City may have been affected by limiting the number of case studies to four. Additionally, the myriad of ways each city's population, cultural norms and practices, and governance structures differ from that of Mexico City may also limit the relevance of the study. Furthermore, the study relied heavily on self-reported data, which may have reduced the objectivity of the data analyzed. Due to these limitations, we do not attempt to generalize or argue causality with this study. Rather, we identify a range of approaches to institutional arrangements for DRM that may be of relevance to Mexico City.

Limitations on the researchers were identified as well. The study depended on having access to information and people. In some cases, information pertaining to DRM was available solely through password-protected online portals or repositories available for residents of the respective city. To mitigate this, the team collected the information on each city that was available and supplemented the research with self-reported data collected from interviews. The number of people interviewed was limited due to the availability of prospective interviewees and their interest in participating in an interview. Additionally, inherent with self-reported data is the potential for bias from interviewees. Given that our interviews were used primarily to verify some of our findings and fill gaps in our research, this limitation did not significantly impact our results. The impact of these limitations did not prevent the team from being able to find a sufficient amount of information necessary to build the case studies and conduct an analysis.

4. CASE STUDY SUMMARIES

Introduction

The following are summaries of the case studies that present a condensed version of the capstone team's research of institutional arrangements for DRM for Christchurch, Miami, San Francisco, and Santiago. Full versions of the case studies accompany this report, under separate cover.

Christchurch, New Zealand

New Zealand is a parliamentary democracy and a unitary state facing a variety of natural hazards, such as earthquakes, volcanoes, and tsunamis (Ministry of Culture and Heritage, n.d.a)¹. In 2010 and 2011, the country faced two major earthquakes near Christchurch. The unitary system means that the Central government has an increased presence in local affairs. Additionally, there are two local levels of government. The first level are regional councils, which focuses on regional issues such as transportation and resource management (Resource Management Act, 1991). The second tier of local government are the 67 territorial (municipal) authorities, which focus on urban development (Department of Internal Affairs, 2011).

Located in the Canterbury Region, Christchurch is its largest city with a population of almost 400,000, housing half of the population in Canterbury (Christchurch City Council, 2020). The Canterbury Region is currently experiencing an economic and social boom (Christchurch NZ, 2020). Economically, the region produces eight percent of the country's GDP and is focused on internet technology. In fact, 93% of New Zealanders have access to the internet (InternetNZ, 2017). Nevertheless, Christchurch still faces high social vulnerabilities, such as an affordable housing crisis and a high homeless population, predominantly Maori (ENZ Market, 2020; Greater Christchurch Partnership, 2020; Rutherford, B, 2017). Immigrants in the country are highly skilled and are not marginalized as in many cities; even with a growing immigrant population the English literacy rate is at 99% (Knoema, n.d.).

Legal & Policy Context

Christchurch and New Zealand are known for their robust policies, laws, and actions aimed at mitigating disasters. Many of these legislative documents and legal acts speak directly to addressing DRM and improving building standards. Key components of the framework are the emergency management plans, building codes, and land-use plans.

The Civil Defence and Emergency Management Plans are the guiding documents on how DRM is implemented. At the national level, the Central Government publishes the National Civil Defence and Emergency Management Plan. At the regional level, the Civil Defence and Emergency Management plans provide strategic and operational guidance (Canterbury Civil

¹ References from the case study summaries can be found under Case Study References in the References section of the report.

Defence Emergency Management Group, 2018). There are no plans at the territorial (municipal) level.

Building codes are stringent in New Zealand and have a long history of use. In 2004 the Central Government passed the Building Act that consolidated and strengthened the building code by outlining the construction process and building standards. Some organizations feel that the act led to slower consulting and reconstruction times. Others feel it is better to control the built environment than to allow deregulation (Rotimi et al, n.d.). In 2017, an amendment to the Building Act created the Register of Earthquake-prone Buildings, which addressed different standards in the code and required a register so citizens could assess the safety of the building (Ministry of Business, Innovation, and Employment, 2018). There is concern that building owners and smaller or more rural territorial authorities will struggle financially with the required updates and this may trigger a “flight of capital” from the local community as closing properties than expensive updates is a more feasible option (Property Council New Zealand, 2014).

Local level control over community development is exerted through land-use plans. At the regional level, there are the spatial plans discussing goals and regional plans assigning responsibility for implementing the spatial plans. At the territorial (municipal) level, there are district plans, which deal with zoning and urban/rural land regulation. Overall, the goals and plans align well with each other and have led to positive growth (Organization for Economic Co-operation and Development, 2017).

Governance

Disaster Risk Management

In theory, DRM in New Zealand has the Central government provide goals and guidance that the regional councils implement. The Ministry of Civil Defence and Emergency Management creates policy and the Canterbury Regional Civil Defence and Emergency Management Group implements and operationalizes that policy. In practice, the Central government has consolidated power away from the local level. This consolidation led to an increase in coordination among national government agencies and streamlined policy and decision making; however, that has disempowered local government in the decision-making process and limited private and civil society participation (Johnson, L. & Olshansky, R., 2016, p. 26).

Coordination

Within the Canterbury region, coordination takes place primarily through formal bodies that coordinate government leaders for decision making, include the participation of other stakeholders, especially the private sector, in implementation, and bring in technical and academic expertise. There is some space for public participation.

Coordination across the territorial governments occurs at the regional level in the Group Joint Committee, which brings together the territorial mayors from within the Canterbury region to make binding decisions on DRM for the region. It also provides regular meetings for Mayors to

discuss how decisions in their territories impact other territorial authorities. Meeting notes are available online to those unable to attend, but it is unclear how quickly the notes are posted online (Canterbury Civil Defence Emergency Management Group, 2018, p. 16). A potential strength of this meeting format is that meetings are open to the public, allowing any individual to voice concerns or thoughts directly to elected representatives.

The nonprofit and private sectors are included in the DRM process when discussing implementation. Nonprofits and private sectors leaders, along with chief executive officers from the territorial authorities and various local government agencies' representatives from the Coordinating Executive Group (CEG). Its aim is to figure out how to implement the decisions made by the Group Joint Committee. Interestingly, while the government has created this space to include nonprofits, academic studies and our interviews noted a lack of participation of the nonprofit sector in these meetings (International Federation of Red Cross and Red Crescent Societies, 2014). Instead, nonprofits prefer to support each other in their own quarterly meetings.

Technical expertise is provided by the Canterbury Group Emergency Management Office (EMO). The EMO is composed of emergency management professionals and is responsible for providing technical support to the Joint Committee and CEG (Canterbury Civil Defence Emergency Management Group, 2018, 18).

Academic knowledge is provided by the Central Government's Institute of Geological and Nuclear Science (GNS Science). GNS Science focuses explicitly on improving New Zealand's understanding of and resilience to natural hazards (Ministry of Business, Innovation, and Employment, 2020).

Information

In the Canterbury region, strategic and operation information, risk information, and the Register of Earthquake-prone Buildings are available for decision making and to help prepare the community.

The strategic goals and operational plan for the Canterbury region are located in the Canterbury Civil Defence and Emergency Management Plan (Canterbury CDEM Plan). The plan is a single document that contains the information for how the region will prepare for, respond to, recover from, and mitigate future hazards. While this plan is publicly available online, there is no information on how it is shared with those lacking access to the internet or the ability to read in English, a problem multiple interviewees noted.

Information on risk in the community is also located in the Canterbury CDEM Plan (Canterbury Civil Defence Emergency Management Group, 2018, 25-33). Risk Information is shared through the Risk Matrix and Hazard Priority Table. The Risk Matrix shows the likelihood and consequences of different hazards. The Hazard Priority Table indicates which hazard needs the most attention. Risk information is developed in collaboration with GNS Science, using multiple sources of data such as geological and social vulnerability assessments. There are concerns of the financial feasibility of smaller or more rural regional councils' ability to hire the GNS Science

and ability to translate the risk information into practical policy (International Federation of Red Cross and Red Crescent Societies, 2014).

The Register of Earthquake-prone Buildings provides information to the public on what structures are high risk during an earthquake. Territorial authorities identify the buildings via an extensive process that includes community and expert input. The register is available publicly online and information is also displayed on the building. (Ministry of Business, Innovation, and Employment, 2018). This system is still in the early phases and limited academic research was found on the success of this program.

Communication

Communication is a top priority in Christchurch and across New Zealand. The strategies and methods listed below enable the public to stay engaged and informed across all demographics

A major communication tool is the internet. 93 percent of New Zealanders have access to the internet (InternetNZ, 2017). As the interviewees noted, most information can be found online. Additionally, some information is published in the newspaper, although no comprehensive list of what topics are published was found (International Federation of Red Cross and Red Crescent Societies, 2014).

The early-warning system is widely used throughout Christchurch and has two levels. The first system is managed at the territorial authority. The second system is managed by the Central government and regional council for large-scale events (Canterbury Civil Defence Emergency Management Group, 2018). This second system has high levels of public trust due to the high degree of cooperation between the two levels of government; however, reaching individuals who are “disconnected or disable” is still a problem (International Federation of Red Cross and Red Crescent Societies, 2014).

Education and outreach are part of Canterbury EMO attempts to prepare the community. EMO has a wide array of literature and resources to help the community prepare online (Canterbury Civil Defence Emergency Management Group, 2020, *Be Prepared*). Research also indicates that while the education programs that have been developed by EMOs have a positive impact, there is no incentive to incorporate these activities and therefore has led to low participation in them (International Federation of Red Cross and Red Crescent Societies, 2014).

Forums and meetings seem to be a critical feature of New Zealand society. The Canterbury Regional government routinely uses public forums and meetings. A 2009 study notes that civil participation in New Zealand is incredibly high and public forums are well attended, except by the Māori, a marginalized group (Goldfinch, Gauld, & Herbison, 2009; Reid, Cormack, Paine, 2019). Two interviewees emphasized how the Māori have a special arrangement to communicate needs with the Central Government. Taken together, this information highlights a society that is willing to participate in DRM, although the Māori may face some exclusion in participation.

Communication is key. If agencies, stakeholders, and community members fail to communicate accordingly, this can lead to misinformation, strategic differences, and disorganization among groups. It is imperative then that inclusive measures are put into action to make sure everyone, from all backgrounds and circumstances, receive accurate information through a variety of communication tools.

Conclusion

What makes Christchurch—and New Zealand—an intriguing case study for disaster risk management is its unique demographic orientation, social structure, and parliamentary government system. The government provides consistent access for participation; whether stakeholders wish to use these channels is a different story. Additionally, information and communication are presented through a robust online system that many individuals have access to. It would be remiss not to acknowledge the small and rather homogenous population increasing the effectiveness of DRM. Nevertheless, New Zealand does a good job at coordination, information sharing, and communication to the benefit of their society.

Miami, USA

The greater Miami metropolitan area, with a population of nearly 6 million, is one of the largest in the United States. The City of Miami itself, the largest city in the area, is home to just shy of half a million. Representing a global hub for finance, trade, media, and immigration in the U.S., Miami's cultural and economic influence on the world is without question. However, as it is situated along the South Florida coast, the City of Miami and other nearby communities within the region are susceptible to hurricanes, which are the most common natural hazards Miami faces. Hurricane Andrew in 1992 and Hurricane Irma in 2017 were two of the most recent, devastating disasters to hit the area. Both resulted in numerous fatalities, over \$25 billion in damages (Cangialosi, Latto & Berg, 2018). Aside from hurricanes, accelerated sea-level rise is one of the most pressing issues Miami faces. Constant rises in sea level triggered by climate change have caused numerous floods in the area. According to recent estimates, a substantial portion of land within the city will be perpetually flooded in the decades to come (Garcia, 2016)². These natural hazards exacerbate vulnerabilities for many of Miami's residents, namely the 25.8% living below the poverty line and large parts of the immigrant communities.

The City of Miami has several similarities to Mexico City, including its dense population, rapid urbanization and development, and variety of natural disasters. This case study will provide context on the City of Miami, as well as the greater metropolitan area, and will explore how relevant government and other actors carry out the governance of DRM efforts in three areas: coordination, information, and communication.

² References from the case study summaries can be found under Case Study References in the References section of the report.

Legal and Policy Context

The U.S. is a federal republic where the federal government shares its powers with the states. Policies related to mitigation in Miami can come from the federal or state government, or from local governments themselves. In Florida, both cities and counties are local levels of government and central stakeholders in mitigation efforts. Counties encompass cities, the City of Miami, along with 33 other cities, is within Miami-Dade County.

A handful of important plans dictate mitigation efforts within and around the City of Miami. From the top down, these important mitigation plans include the Regional Climate Action Plan, a four-county compact detailing regional efforts; the Local Mitigation Strategy, the mitigation plan created at the county level that includes all 34 cities in the county; and the Resilient 305 Strategy, a partnership between the county and two cities within it that was created through the 100 Resilient Cities program. The Miami Forever Climate Ready Strategy is the City of Miami's city-wide mitigation plan, and smaller adaptation action area plans are plans created at the county-level for mitigation efforts in densely populated, unincorporated areas.

Some of the most important mitigation policies governing the area have been the building codes created both by Miami-Dade and the City of Miami. These were considered strong when they were updated after Hurricane Andrew in 1992, but now have acknowledged limitations. However, as Miami's priorities have shifted from hurricanes to policies addressing sea-level rise, the emphasis on updated building codes is becoming more prominent.

The efforts to address sea-level rise are often referred to as "adaptive" versus "mitigative". The distinction between adaptation versus mitigation appears to be in the longevity of the solution. For instance one strategy of adaptability is raising the level of roads, which may be a short term solution to a long term problem. Interviewees from both The Miami Foundation and the CLEO Institute felt "adaptability" is a step in the right direction toward mitigation, but did not quite feel that the city has enough incentive or resources to fully commit to mitigation.

Organizational Structure for Disaster Risk Management

The two key government actors in mitigation are the City of Miami and Miami-Dade County, which often work as equal partners. The county, however, leads more mitigation initiatives in the area than the City and has a stronger relationship with many of the nonprofits involved. The office within Miami-Dade that is primarily responsible for mitigation efforts is the Office of Resilience, located within the Regulatory and Economic Resources Department. The parallel City office is the Office of Resilience & Sustainability.

There are many other relevant government actors within area-wide mitigation efforts. In short, these include:

- Elected officials in both the city and county who guide policy change;
- Other counties and cities within the area and their subunits who participate in regional mitigation efforts; and

- Other departments and offices within Miami-Dade and the City of Miami that participate in and are affected by mitigation efforts, such as the Public Works Department, Planning and Development Department, Police and Fire Rescue Departments, and the Management and Budget Department.

Nonprofits within the area have a large role in mitigation efforts as well. The prominent organizations involved include: CLEO Institute, Miami Foundation, and the Florida Regional Interfaith InterAgency Emergency Network for Disasters (F.R.I.E.N.D). Nonprofits typically serve one of two functions towards mitigation efforts:

- As a facilitator of a network of other nonprofits, academics and other experts, government professionals, communities, businesses, and more which organize towards specific mitigation efforts; or
- As a service or resource provider for mitigation efforts through these networks.

Real estate developers, although not as explicitly included in many mitigation plans and efforts, often participate in government and nonprofit boards and typically have a heavy hand in mitigation policy.

Governance

Coordination

Coordination in Miami happens in a variety of ways and is both intergovernmental and cross-sectoral. Among government stakeholders, formal coordination documents and processes outlined in relevant plans support mitigation efforts. Many intergovernmental mitigation efforts within the area can be described as regionalism. Regionalism offers a powerful tool for encouraging intergovernmental cooperation among cities and counties, as well as for managing the costs associated with DRM (Caruso & MacManus, 2008, p. 292). Regionalism in Southeast Florida can be witnessed in what is referred to as the four-county compact, comprising Broward, Miami-Dade, Monroe, and Palm Beach Counties.

In addition, the Southeast Florida Regional Climate Change Compact was executed in 2010 to coordinate climate mitigation and adaptation activities across county lines (Southeast Florida Regional Climate Compact, 2020). This coordination led to communication and knowledge sharing among over 100 municipalities. The collaborative efforts led to a Climate Action Plan published in 2012 that led to increased consistency in mitigation efforts of the Office of Emergency Management across counties.

Cross-sector coordination with a multitude of stakeholders supporting mitigation efforts looks different. It includes formal mechanisms like conferences, workshops, trainings, symposiums, and informal mechanisms like group chats. One example of cross-sector collaboration can be seen between the CLEO Institute, the city Office of Resilience, and the local universities. Different local municipality and county agencies contract the CLEO Institute to conduct the

training with their department employees. The information is shared formally across multiple sectors to promote mitigation.

Overall, intergovernmental and cross-sector coordination is occurring consistently in the context of mitigation efforts. The organizations or departments in charge of coordinating stakeholders varies depending on the initiative or program. While the Offices of Resilience seem to be consistently involved, they do not always spearhead the initiative or facilitate coordination. The main nonprofits mentioned above often take the lead in facilitating coordination and acting as a liaison between stakeholders.

Information

The Sea Level Rise Maps, Coastal Flood Risk Maps, and the 311 Contact Center are the major platforms for information collection and dissemination. All platforms are housed on the Miami-Dade County website.

On the sea level rise mapping tool individuals can view building impacts as well as search their address and access their vulnerabilities. Additionally, the mapping tool has allowed community members to view the progress of all the counties' Local Mitigation Strategy (LMS) plans in the area. It is unclear whether this information is available to only individuals who have access to computers/smartphones and the internet, or if there are additional ways to access this information.

The Flood Zone Maps, also referred to as the Flood Insurance Rate Maps (FIRMs), reflect current flood risks for Miami-Dade County and are used when determining flood insurance policy rates (Regulatory & Economic Resources Miami-Dade County, 2019). Residents and businesses can view the maps to better understand their potential flood risk and help protect themselves against property damage and loss. Aside from the online interactive web tool, individuals can obtain PDF versions of the maps by contacting the Environmental Resource Management Department. Physical copies of the FIRMs maps can also be viewed in the same department. The website did state, though, that to keep a copy of a map required purchasing it from FEMA by calling the Map Service Center.

The primary purpose of the 311 Contact Center is information dissemination, communication and transaction services. Additionally, it creates a multi-channel environment in that it acts as a secondary knowledge base for local government (Schellong & Langenberg, 2007). The information is crowdsourced and used for two distinct actions: 1) to improve modeling of associated hurricane hazards such as coastal erosion, and 2) to provide an educational tool for contributors to learn about coastal hazards associated with hurricanes (Harrison & Johnson, 2016, p. 32).

In an effort to increase transparency, Miami has also made the 311 system data sets available to the public. Community members with access to technology and the internet are able to see every complaint and request for service made to 311. To complement the data sets there are maps that

show neighborhood code violations. There are complaints of limited useability, however, due to the complex nature of the webpages and data sets.

In its entirety, Miami has a robust amount of information available to help residents protect themselves and reduce vulnerabilities. The interactive maps allow people to tailor their experience and search for specific addresses or locations of interest. A major limitation of Miami's information management strategy is that a majority of the information available is online, which can increase the possibility of excluding access for people without the necessary technology.

Communication

Florida, in particular the southeastern area including Miami, is recognized for its strengths in communication during emergencies. Miami's communication efforts in mitigation and prevention are improving as the City tries creative new methods to communicate with all residents.

The 311 Contact Center is the main platform used to enable direct interaction between residents and governments concerning non-emergency information (Hagen, Yi, Keller, Pietri, 2019, p. 1). The call center line offers services in English, Spanish, or Creole to accommodate the large immigrant populations in Miami. Residents can access information, report problems, and complete service requests in a variety of ways including calling, emailing, tweeting, downloading a mobile app, reporting online, and in-person and 311 service centers.

The government has made efforts to create communication channels outside of the internet, social media and phone access. From a state level, they are utilizing TV advertisements, infomercials, and radio stations. Miami-Dade County also began communicating to residents via regular paper mail. They were trying to target households that do not have access to the internet or technology. The limitation to this is that the guides and information are mailed only in English and thus useless for families who do not speak English. The county also targeted marginalized communities through the children in the community. The schools would hand out pamphlets and various informative documents to the students to take home to their parents. While these efforts are closing the information accessibility gap, there is still greater initiative needed from the government to truly provide these communities with the information needed to be resilient and be a part of mitigation efforts.

Marginalized Communities

As a whole, Miami-Dade County still heavily relies on the internet or their partner nonprofits to communicate with marginalized communities. The nonprofit representatives that are a part of F.R.I.E.N.D. often act as a liaison between the marginalized communities they serve and government agencies. The lack of direct interaction between the government and marginalized communities as well as the inaccessibility of available information leads to a further disconnected and untrusting relationship. However, alternative strategies such as sending paper

mail and communicating via the radio highlight the improvements and progress of government efforts.

Conclusion

The City of Miami proved to be a compelling case study due to the severity of the risks they face. The projected level of sea-level rise predicts parts of the city may be underwater within the next decade. Coupled with sea-level rise the city also faces extreme risks due to the prevalence of hurricanes that hit the area.

One trend recognized in the decentralization of DRM strategies. The decentralized structure promotes involvement from various departments and organizations from different sectors. This leads to increased cross-sector collaboration and the production of several plans, programs, and tools. Though, the saturation of plans and initiatives across the city made it hard to find any formal mechanisms for oversight and evaluation of efforts.

Another interesting trend recognized in Miami is the use of the term “adaptability”. This term is widely adapted across departments and can influence the way the city addresses risks. The lack of incentive to fully commit to mitigation can be attributed to the development priorities of the city. Much like Mexico City, developers play an important role in this as economic development is a main priority of the city and at times takes precedence over DRM efforts.

Despite potential shortcomings or challenges Miami faces to effectively carry out DRM, the city has strengths in the areas of coordination, information management, and communication. There is substantial evidence of strong intergovernmental and cross-sector relationships as well as multiple mechanisms for information dissemination and multi-lateral communication channels.

San Francisco, USA

City Context

Although spatially small, San Francisco is home to nearly 900,000 people. To govern its residents, San Francisco has a consolidated city and county local government, which means there is one mayor and one city council that exercise authority within both city and county boundaries. It also employs a city administrator to assist the mayor. The city is fairly wealthy with an average income over \$100,000 and a median property value of \$1.2 million. However, even with its wealth, the city faces a variety of natural hazards and social vulnerabilities. Its main natural hazards include earthquakes, fires, and extreme weather. Its social vulnerability is exacerbated in several aspects such as its high immigrant and homeless populations, low rates of property ownership, and racial/ethnic disparities (San Francisco, n.d.)³. All of these factors, in addition to past disaster experiences, impact the city’s key priorities and actions.

³ References from the case study summaries can be found under Case Study References in the References section of the report.

San Francisco's most memorable natural hazard occurrences are The Great Earthquake of 1906 and The Loma Prieta Earthquake of 1989 (Tanaka, 2005). The 1906 earthquake caused approximately 3,000 deaths and rendered almost half of the city's population homeless. The Loma Prieta Earthquake killed over 60 individuals, injured a few thousands, and caused billions of dollars in damage. At this point, the city is well aware of the possibility of another deadly earthquake, as well as climate change effects. Due to their awareness, the city is constantly thinking of ways to adapt.

Legal and Policy Context

Although San Francisco's DRM practices and procedures derive from federal, state, and regional frameworks, local governments in the US have autonomy over what mandates and programs they enforce. These frameworks are general; however, the federal and state governments typically offer some type of financial incentive for local government compliance. Although the city faces a number of hazards, the majority of their plans and efforts are centered on earthquake mitigation. Therefore, the following paragraphs in this section will focus on earthquake mitigation policies and plans at various levels of government.

As in other US cities, programs, mandates and funds for DRM start at the federal level through FEMA. One major program aiding earthquake mitigation is the National Earthquake Reduction Hazards Program (NEHRP), whose main purpose is to reduce deaths and property damage as a result of an earthquake (NEHRP, n.d.). A significant mandate that promotes earthquake mitigation is the Earthquake Hazards Reduction Act of 1977. It assigns four key government entities to monitor seismic safety: FEMA, the National Institute of Standards and Technology (NIST), the National Science Foundation (NSF) and the United States Geological Survey (USGS). A federal funding source for earthquake mitigation is disaster relief funding provided through the Stafford Act of 1988. This support from the federal government enables San Francisco to properly plan and implement programs.

California's state laws, including the California Earthquake Reduction Act and state building codes, have guided retrofit processes in San Francisco. With these state standards, San Francisco was able to create its local earthquake mitigation rules and programs (The State of California, 2004).

San Francisco belongs to the Association of Bay Area Governments, which is guided by California Senate Bill 375. This Bill mandates the collaboration of cities within the Bay Area region to coordinate regional housing, land-use, and transportation planning, and requires regions to adopt Sustainable Communities Strategies (Rodriguez, 2019). As of the fall of 2019, the regional government had adopted and implemented at least two of these strategies, identifying Priority Development Areas and adopting *Plan Bay Area 2040*, which focuses on growth and transportation expenditures (Rodriguez, 2019)

At the local level, San Francisco has adopted various earthquake mitigation efforts. The 2014 Hazard Mitigation Plan compiles all of the program, ordinances, and building codes that have been adopted in respect to natural hazard mitigation.

Organization Structure for DRM

There are a variety of key organizations involved in San Francisco's DRM at varying capacities. Although the most relevant actors are at the city's local level, its DRM hierarchy begins with the U.S. federal government. At this level, FEMA is a key organization and provides necessary policy guidelines and funding. Similar support is given from California's state government through the Governor's Office of Emergency Services (CAL OES). Less of a governing authority and more of a collaborative body is the Association of Bay Area Governments at the regional level. This body serves as a means to coordinate with surrounding cities to address current and future infrastructure needs.

At the local level, there are various offices and departments that spearhead DRM efforts:

- The Office of Resilience and Capital Planning, in Office of the City Administrator, implements the Resilient San Francisco plan, oversees implementation of the city's Earthquake Safety Implementation Program, and serves as the managing body of the City's Lifeline Council.
- The Department of Emergency Management oversees the Hazard Mitigation Plan for which the city receives funding through the 1988 Stafford Act to maintain an updated version.
- The San Francisco Department of Public Health focuses on developing social maps and working to inform residents about the environmental health of the city.
- The Department of Building Inspection (DBI) has a multifaceted role in the DRM processes and procedures as it not only enforces local laws, specifically building codes, but it also establishes various programs and disseminates vital information to residents.

Governance

San Francisco collaborates with multiple sectors to formulate their plans, mandates, and programs. This collaboration is often in the form of funding, inclusion in decision-making, or utilizing information and tools derived from scientific studies. The extent and importance of collaboration can be seen in all three dimensions of governance: coordination, information, and communication.

Coordination

San Francisco coordinates with various levels of government, including federal, state, and regional. Its coordination with the federal government is primarily conducted through the Department of Emergency Management to FEMA. San Francisco coordinates with the state government more extensively in the phases of emergency response and recovery. Coordination within the Bay Area takes place between the Office of Capital Planning and Resiliency and the Association of Bay Area Governments, to implement Sustainable Community Strategies.

A major mechanism for coordination with the private sector is the Lifeline Council. The Lifeline Council examines the extent to which vital resources, such as water and electricity, will be

unavailable during an emergency situation. In 2014, The Lifeline Council released an Interdependency Study based on data from the 1989 Loma Prieta earthquake to determine how interrelated the utility services are (Office of Resilience and Recovery, n.d.). There are a variety of stakeholders included in this on the council: private utility companies, engineering companies, public service entities, telecommunication companies, academic and community partners.

There is not much evidence of how the government coordinates with nonprofits beyond the response and recovery phases. Nevertheless, San Francisco, specifically the Department of Building Inspection, collaborated with the Applied Technology Council (ATC), a nonprofit organization that strives to create hazard-resistant structures, to predict the future effect of seismic activity on vulnerable building structures and provide recommendations for how San Francisco should carry out its retrofit process. This relationship laid the foundation for various seismic safety plans and programs.

The San Francisco City government relies heavily on the Berkeley Seismology Lab to perform vital research on earthquakes to estimate the effects of future seismic events. Furthermore, the Berkeley Seismology Lab issues “real-time earthquake maps” and an early warning system (UC Berkeley, n.d.). These tools were recently implemented in the fall of 2019.

Information

San Francisco’s network of information for risk management utilizes a myriad of stakeholders--such as private sector companies, academic institutions, city departments, and the contributions of everyday citizens-- to enable a robust, comprehensive network that monitors and mitigates risks. The primary forms of risk-related information includes resilience/vulnerability assessments, disaster preparedness guides and training, climate projections, and identification of region-specific hazards. Much of this information is obtained through either scientifically-gathered data or lessons learned from previous disasters, particularly the 1906 and 1989 earthquakes.

Some of the most vital information which serves San Francisco mitigation strategy is seismic monitoring, as this allows stakeholders to anticipate when, and how severely, the city will be affected by the next earthquake. The Berkeley Digital Seismic Network (BDSN) spearheads the regional monitoring and aggregation of seismic data in Northern California by providing “high quality data” to be contributed to a global broadband seismology system (“Overview”, n.d.). BDSN coordinates its findings with other seismic monitoring institutions such as the United States Seismic Monitoring Network for scientific consensus.

Other forms of information, such as those related to urban planning and social vulnerability, rely on web-based technology to make information accessible and usable. One significant innovation is Building Eye, an online database launched by a tech startup which gives users access to building permits and enforcement code information. Making such information public allows for transparency between local government and citizens on city planning, an area which is traditionally obscured from the public eye (Sheuh, 2016).

The Community Indicator Resiliency Maps, developed by the San Francisco Climate and Health Program, are another important tool that provides a social, environmental, and infrastructural overview of the city. The maps are publicly accessible via the Department of Public Health's website. The tool uses neighborhood-level resilience data to visually map out "quantitative measurements of resiliency and vulnerability" ("Community Resiliency Indicator Maps," 2020). The maps cover data related to community, demographic, economy, environmental, hazard risk, health, housing, public realm, and transportation. By streamlining the access of such information, the Community Indicator Resiliency Maps allow decision-makers to utilize these assessments and inform their disaster preparedness strategies.

San Francisco's mechanisms for the collection and dissemination of information are essential for effective DRM. This information aids how the city communicates with its constituents.

Communication

Keeping with the trends of the digital era, San Francisco's risk communication emphasizes accessibility, participatory methods of data collection, and capacity building for vulnerable communities. Integrating mobile technology into the city's communication strategy has become especially important for increasing preparedness and mitigation. Citizen science projects such as the MyShake App enable citizens to crowdsource seismic data, while text-based notification systems such as ALERTSF make it easier for all residents to be instantly aware of natural disasters and other emergencies.

Considering the needs of vulnerable communities has also been emphasized for San Francisco's communication strategy. The city's Department of Emergency Management has made efforts to build capacity for all neighborhoods with the development of SF72, a "community-building platform" that builds on other communication services DEM offers and connects users to preparedness and post-disaster information on social media apps such as Twitter and Facebook ("Resilient San Francisco," n.d., p.31). The website is also powered by google translate, allowing non-English users to stay connected and informed. The Mayor's Office of Disability has also partnered with nonprofits to create Vulnerable Population Working Groups intended to inform and connect with vulnerable groups on preparedness.

San Francisco's mechanisms for communicating with its constituents through its cross-sectoral collaboration enables the city to effectively mitigate the risks of natural hazards.

Conclusion

San Francisco possesses three main strengths: the quantity and quality of risk-related information, the degree of collaboration with and willingness to engage with a variety of stakeholders across sectors, and the use of technology for communication and information gathering. These strengths are apparent through the development of websites (Building Eye, Department of Public Health, San Francisco. gov) and mobile tools (My Shake App and Alert SF). While these resources may not reach all communities due to various social vulnerabilities,

the city's transparency of its coordination, information, and communication efforts is a characteristic that could be implemented in Mexico City.

Santiago de Chile

Chile is considered one of the most earthquake-prone countries in the world. Situated along an area of intense volcanic activity and earthquakes known as the Pacific Ring of Fire, Chile has been subjected to some of the most severe seismic events in history. For example, Chile's second-strongest ranking earthquake was considered to be the sixth strongest earthquake in the world. The 8.8 in magnitude earthquake in 2010 prompted the country to learn how to prevent, mitigate, prepare, respond, and recover from disasters. Similar to Mexico City, Santiago de Chile not only faces the threat of earthquakes, but also tsunamis, floods, landslides, drought, and wildfires. Research has shown that extreme weather events in Santiago will increase in frequency and intensity due to its geographical and natural characteristics (CONAMA, 2009)⁴.

Chile is a centralized unitary state with two tiers of government at the subnational level, regions, and municipalities. The Chilean governmental structure includes regional governments that are headed by Regional Intendants, a representative of the President, and municipal governments that are formed by a municipal council and a mayor, who serve four-year terms and are elected through a proportional representation system (Hudson, 2009). The Regional Intendancy of the Santiago Metropolitan Region is the administrative level within Chile's governmental system that has oversight over the municipality of Santiago. This level of government is the one within the Chilean system that most corresponds to that of Mexico City. Administratively speaking, Santiago Metropolitan Region extends throughout 37 municipalities, covering an area of 641.4 km² in 2002. ("Santiago, Chile", n.d.) A distinctive characteristic is the massive socioeconomic differences that exist between the municipalities because there is no government authority that is responsible for the Santiago Metropolitan Region in total. (Dockendorff, Rodríguez & Winchester, 2000, p. 172)

Santiago, the capital of Chile, is located in the Santiago Metropolitan Region, the smallest region of the country, whose total population is 7 million ("Santiago, Chile Population", n.d.). Economically, the region can be described as one of Latin America's most economically advantaged regions, generating 45% of the country's GDP. While at the same time showing immense social inequalities such as greater economic growth benefits and greater segregation of wealthy groups ("100 Resilient Cities", 2017). Additionally, Santiago sees its population gradually aging, and migratory processes from several Latin American countries have grown steadily. (ENT, 2016) Although Chile has developed several policies, programs, and structural reforms to reverse these problems, their territorial implementation remains uncertain (ENT, 2016).

⁴ References from the case study summaries can be found under Case Study References in the References section of the report.

Legal and Policy Context

Chile's DRM practices generally have preserved traditional approaches to DRM focusing primarily on emergency management. More recent events have led Chile and Santiago to shift the focus towards risk reduction. The disastrous earthquake in 2010 ultimately led Chile to revisit the National Civil Protection and Emergencies System; it spurred many of the initiatives related to DRM, including prevention and mitigation, that are part of the current legal framework.

The framework for DRM stems mainly from national level plans including the National Civil Protection Plan (NCP) (2002,) National Policy for DRM (2014), and the Strategic Plan from the National Emergency Office (2019). These plans generally define the strategic objectives, individuals, programs, actions which have been influenced in part by the guidance published by the United Nations' Sendai Framework. The Sendai Framework, for example, suggests communities affected by disaster be subsidized to provide emergency housing and promote sustainable construction. This provision is included within the Ministry of Housing and Urban Development's Reconstruction Program (Fernandez, 2017).

The disaster risk reduction (DRR) plan at the regional level was created to structure the prevention and mitigation efforts in the Santiago metropolitan area. The plan is meant to identify the roles of various "relevant" actors in the public, private, and nonprofit sector before and after a disaster (Dirección Regional de ONEMI, Región Metropolitana, 2018, p. 68). This plan is essentially a guideline for developing intersectoral work to prevent and mitigate risk in the region.

Each of Greater Santiago's municipalities have the power to develop their own respective DRM plans and dedicate funds towards prevention and mitigation activities, however, the degree to which they do so varies. Additionally, the content of such plans varies as well. Some municipalities have longer and more detailed plans, but generally the plans contain information pertaining to responsibilities of specialized personnel, alarm and communication systems, and how coordination of educational activities and drills should take place (Subdirección de Emergencia y Protección Civil, 2017; Fernandez, 2017)

Organizational Structure for DRM

The administrative structure through which Chile's DRM and DRR efforts are planned and implemented is Chile's national Civil Protection System. This system is highly centralized yet operates in a way that permits broad authority at the local level. This provides both local-level discretion and a structure that can facilitate collaboration across administrative levels. The national Civil Protection System includes the National Emergency Office of the Ministry of the Interior and Public Security (ONEMI) at the national level and Civil Protection Offices at the regional, provincial, and municipal levels. These Offices have authority over DRM and DRR efforts, including Civil Protection Committees.

Civil Protection Committees at the national, regional, provincial, and municipal levels serve as the mechanism by which ONEMI and the Civil Protection Offices coordinate with other governmental agencies, private businesses, and nonprofit organizations at their respective administrative levels. Civil Protection Committees are the principal agents involved in the planning and implementation of all aspects of DRM, including prevention, mitigation, preparation, and the completion of plans and programs.

Oversight of the System at each administrative level is provided by the Ministry of the Interior and Public Security, regional intendants, provincial governors, and municipal mayors, respectively (Ministerio del Interior y Seguridad Pública, 2002, p. 11).

The current policies and plans that guide the Civil Protection System and Civil Protection Committees emphasize the involvement of actors from across the public, private, and voluntary sectors. Private-sector involvement includes key businesses that provide essential goods and services such as water services, energy, and security. Nonprofit-sector involvement consists of organizations such as the Chilean Red Cross and Caritas Chile that are primarily involved in disaster response and recovery as well as preparation efforts. In spite of these attempts to develop multi-pronged, multi-sector approaches to DRM and DRR, Chile's plans have not significantly incorporated urban planning functions or citizen engagement (Hölzl & Nuissl, 2014, pp. 27–32).

Governance

Coordination

Coordination between different levels of government for prevention and mitigation of disasters in Chile is established through the vertical-alignment of the various policies and plans for DRM and DRR. These policies and plans are elaborated and implemented by ONEMI, the Civil Protection Offices, and the Civil Protection Committees that make up the Civil Protection System at the national, regional, and municipal levels. Coordination between Civil Protection Committees of different levels (from local to national) can be carried out through communication between the Director(s) of Civil Protection and Emergencies at each respective administrative level or between the corresponding agencies and organizations of other levels of governmental administration (Subdirección de Emergencia y Protección Civil, 2017, p. 79).

At the regional level, the ONEMI Regional Directorate and the Regional Civil Protection Committee of the Metropolitan Region are responsible for coordinating DRM efforts.

The main mechanisms for participation by stakeholders outside government are the Civil Protection Committees. The most important one, the Regional Civil Protection Committee, consists of a wide variety of public agencies, private businesses, and nonprofit organizations. Coordination on DRM and DRR efforts occurs through collaboration of the agencies and organizations that participate in the Civil Protection Committee. Businesses and voluntary/nonprofit organizations are primarily engaged in activities related to preparation for or response to disasters, rather than disaster prevention and mitigation. The businesses involved in DRM through the Regional Civil Protection Committee include Aguas Andinas (water services

company), Enel Chile (energy company), and Metrogas (gas company). Some of the nonprofits involved in DRM include the Chilean Red Cross and Socorro Andino (Andean Aid).

Additionally, nonprofits have representation on Civil Society Councils (Consejos de la Sociedad Civil (COSOC)) (Oficina Nacional de Emergencia del Ministerio del Interior, 2016, p. 78). Civil Society Councils are a way through which the Chilean government seeks to encourage citizen participation in public policy execution and evaluation. Governmental agencies are required by law to establish Civil Society Councils that consist of representatives of nonprofit organizations whose purposes are related to the work of the agency.

Neighborhood Councils (Juntas de Vecinos) are a primary mechanism for local residents to represent their respective interests. These Councils are included in Municipal Civil Protection Committees and have the authority to represent local interests (Subdirección de Emergencia y Protección Civil, 2017; Ministerio del Interior; Subsecretaría de Desarrollo Regional y Administrativo, 1997, p. 1).

Chile's top-down, orderly structure of the Civil Protection System and Civil Protection Committees is a reflection of Chile's unitary, rather than federal, governmental system. While the System provides an integrated framework through which public, private, and nonprofit actors can collaborate on disaster prevention and mitigation efforts, it has suffered from a lack of enforcement mechanisms and difficulty with collaboration with other agencies and the private and nonprofit sectors (Sandoval & Voss, 2016, p. 109; Sánchez, 2010, pp. 11–12).

Information

The type of information Santiago shares and distributes to the public, government decision-makers, and stakeholders is an essential area of focus that is crucial for the country's collaborative development between public-private partnerships and strategic initiatives for preventing and mitigating natural disaster efforts. Santiago's information is created in collaboration with various levels and departments of government, universities, and nonprofits.

Three web-based tools and one national law were identified as sources of information open to the public. First, the KimGenLab: Virtual Laboratory of Natural Risks in Chile project is an applied research initiative developed by the Territorial Planning Laboratory of the Catholic University of Temuco, funded by the Scientific and Technological Development Support Fund (FONDEF) of the National Commission for Scientific and Technological Research (CONICYT), sponsored by ONEMI Chile, and supported by the Fundación Instituto Indígena and the Fundación del Magisterio de La Araucanía. The project seeks to strengthen the learning of Geography and Natural Risks, through a national educational, technological platform, to improve the response capacity and decision-making of people in the face of the occurrence of catastrophic natural events.

Second, the Sistema Nacional de Información Municipal (SINIM) is an information system of the Ministry of the Interior with nationwide coverage that makes a set of variables and indicators available to the public. Currently, information is available from 2001 to 2009 in the areas of

Administration and Finance, Health, Development, and Territorial Management, Social Aspects and Community, as well as Gender and municipal Characterization (“Sinim,” n.d.). The information gathered from this database is important for understanding vulnerability to risk at the municipal level. For example, academia has used this database to create a Flood Adaptive Capacity Index Municipal Spending, which was calculated out of SINIM’s 2008 data on: total municipal spending in the financial year in Chilean pesos and population per municipality. Recognizing how vulnerability is distributed among municipalities is necessary for setting priorities in policy formulation. (Richter, 2010)

Third, the Observatorio Urbano del Ministerio de Vivienda y Urbanismo (OU MINVU) generates knowledge, through the development of studies, surveys, and publications of interest, for decision-making by the authority in the residential and urban sphere. The OU MINVU is a website that provides citizens with information on indicators, statistics, studies, and self-prepared surveys. It is made up of a multidisciplinary team made up of professionals from the social and economic sciences, as well as from geography, architecture, and statistics. (“Observatorio Urbano”, n.d.). Although this database is not directly about DRM or risk reduction the interactive maps, publications and the Geoportal are used to understand vulnerability. For example, the Geoportal makes information about investments and ministerial projects with geospatial components available to citizens. One segment of the portal is the disaster risk management section, which has a map that identifies houses affected and damaged by the 2015 Coquimbo Earthquake.

Finally, Chile introduced a major piece of legislation entitled ‘Ley de Transparencia de la Función Pública y Acceso a la Información del Estado’ (Law for the Transparency of Public Administration and Access to State Information). An autonomous four-person Transparency Council has been established to oversee implementation of the new transparency laws. The law provides for free access by the citizenry to government documents, public budgets and records of expenses, and any other document produced using public funds. It is a “document law” because it gives citizens the right to obtain documents held by public officials. An organization, in theory, has 20 days, to provide the information requested and it can either be mailed or emailed. The law states that everybody has the right to ask for public information. If they do not get an answer within 20 business days or if the answer is not satisfactory, they have the right to file a complaint with the Transparency Council. In order to enforce these rules, the Transparency Council has powers to enact regulations, require applicable public bodies to adjust their procedures in order to abide by the law, and sanction the heads of public bodies found in violation of the law by handing down suspensions, fines of 20-50% of their salaries, or both.

As a whole, Santiago has a myriad of information available to the general population in order to improve decision-making through education. However, there seems to be limited useability due to the complex nature of the webpages and data sets. It is also unclear whether this information is available to only individuals who have access to computers/smartphones and the internet or if there are additional ways to access this information.

Communication

The centralized nature of Chile characterizes much of its communication. The majority of Chile's DRM communication is from the national government, expert-led, and unidirectional. Outside of national government communications, prevention- and mitigation-related communications also come out of the municipal government, the majority of which are online. In-person communication is also prevalent in many municipalities in Santiago as well. Training and education for residents on DRM subjects is carried out in municipalities and is an important mechanism for getting residents to understand risk.

Public meetings held in each municipality are open to the public, however, as with any participatory method, participation varies across municipalities. Some offices housed in municipal government even have officials perform in-house visits to discuss risk and create personalized prevention plans.

Academic institutions and nongovernmental organizations in Chile take part in communications about prevention and mitigation. Many of the education and outreach programs at the local level are done in some partnership with an academic or nonprofit organization. Multiple channels of communication are available to entities in Santiago as well including conventional methods such as print and broadcast media, and online communications such as through social media platforms and official websites. National plans state that "inclusive participation that is non-discriminatory and accessible" is a guiding principle, but the degree to which communications routinely reach marginalized communities has not yet been verified.

Conclusion

Santiago de Chile provides an interesting case study for Mexico City for a variety of reasons. For one, the hazards it faces are very similar to those of Mexico City, and Chile has developed a well-established system to withstand those hazards. Interestingly, Chile's national Civil Protection System remains highly centralized, yet operates in a way that permits broad authority at the local level. In this way, Santiago has a decentralized, yet controlled system for handling disaster risks. While the system's focus in the past has largely been on disaster response and recovery, since the major earthquake in 2010, Chile has taken steps to incorporate more prevention and mitigation efforts through its international engagements and its 2018 Regional Disaster Risk Reduction Plan. In terms of information, the KimGenLab: Virtual Laboratory of Natural Risks in Chile project is notable as an example of map-based risk atlas that is aimed at education of common citizens. While Mexico City's Risk Atlas provides detailed technical information regarding natural hazard risk that is useful for decision-makers, Chile's Virtual Laboratory provides similar information in an interactive way that is more geared for the education of average citizens.

5. ANALYSES & FINDINGS OF CASE STUDIES

In addition to studying each city individually, the team looked across the cities, utilizing an individualized matrix for each variable to enable us to systematically view the range of approaches and patterns that stood out. Taking into account the challenges identified in Mexico City, this section analyzes the main aspects of disaster risk management governance: coordination, information, and communication while also including city context, policy and legal, and organizational structures. The purpose is to identify the range of approaches utilized in these cities and identify approaches and innovations that may provide insights relevant for Mexico City.

City Context

Understanding the context of the different cities is important because how cities address disaster resilience is affected by the context within which they operate. It is also essential to identify similarities and differences between the case study cities and Mexico City in order to assess the relevance of their experiences. We looked specifically at population size, income level, social vulnerabilities, natural risks, and government structure of the case study cities. See Appendix 1 for a detailed matrix of comparative city contextual factors.

All of the case study cities, except for Christchurch, are parts of large metropolitan areas, although the size of their city proper are considerably smaller (all under 1 million). In terms of metropolitan population, Miami and Santiago are the closest to Mexico City with populations of over 5 million. Christchurch's metropolitan area is only slightly larger than its city proper population and stands out for having a much smaller city and metropolitan area population than the other case study cities and Mexico City.

The United States and New Zealand are wealthy countries, and among the Latin American countries, Chile is an upper middle-income country like Mexico. This affects resources available to governments and to citizens. Miami and San Francisco have higher country per capita income rates than Christchurch and Santiago, with the United State's per capita income rate being over twice that of New Zealand's. Nonetheless, San Francisco's city proper median income rate is almost three times Miami's, with Miami's being close to the country per capita income rates of Chile's and New Zealand's. City median income rates were not available for Santiago and Christchurch specifically. Notably, the country inequality rates were the highest in Chile and the lowest in New Zealand. These factors paint the picture that each case study city has strengths and weaknesses related to its available resources, both locally and nationally.

The case study cities vary widely in the challenges they face in regards to social vulnerability. Populations with low incomes or living below the poverty line were a concern for most case study cities, with significant poor communities in both Santiago and Miami. In Miami, poverty is also associated with communities of color and some immigrant groups. Miami and San Francisco have large homeless populations, with San Francisco's being one of the largest in the United States, while Christchurch's homeless population is smaller. In all the cities, there are vulnerable

communities that are an important consideration with regard to preventing and mitigating disasters, but Miami and Santiago are the most similar to Mexico City in the size and marginalization of poor communities.

All the cities face significant natural hazards. There are some consistencies in natural risks among the case study cities. Christchurch, San Francisco, and Santiago are highly earthquake-prone cities. Miami's primary sudden-disaster risk is hurricanes, but it is also facing constant sea level rises which has exacerbated the issue of flooding. Disaster risk management in the earthquake-prone cities is especially relevant for Mexico City, given its seismic risk, but its problems of drought and flooding, and the longer term climate change risks, are shared with other cities too.

In terms of government structure, New Zealand and Chile are both unitary systems, while the United States, like Mexico, is a federal system. Even in the unitary systems, however, there are multiple layers at the local level. Each city proper has its own government with an elected mayor. Regional administrations in Chile and New Zealand take on particular importance. In Miami, Miami-Dade County is just as important as the city of Miami, whereas in San Francisco, the city and county are consolidated. In both Miami and San Francisco, the counties do not encompass the entire metropolitan area and there is no singular governing body that does. The parallels are not exact with Mexico City, with its consolidated city/state government and also a lower level of elected municipal governments, but it is somewhat similar to the county-level government in the US cases or the regional levels made up of several municipalities.

Policy and Legal Context

In addition to looking at the broader context for each city, we also looked at the legal and policy framework for risk management as an important part of the context for understanding DRM governance. We found similarities and differences across the cities in the presence and strength of the framework, the primary focus, the sources and approaches to policy making, and the unified or diversified nature of the policy framework. A matrix that outlines some of the components of the policy frameworks across the cities is located in Appendix 2.

Unified or Diversified Nature of the Policy Framework

Christchurch and Santiago have a unitary government in which national, regional, and local level government craft, promote, and implement policies that build on each other. The unitary system helps create cohesive and uniform policies consistent with each governing layer. For example, the Central government in New Zealand has the National Civil Defence and Emergency Plan that established DRM goals and policies for the nation. The Regional Authorities have the responsibility to develop strategies, tools, and procedures at the local level that support the national goals. Meanwhile, Miami and San Francisco are part of a federalist system, which means policy, planning and implementation is typically done at the local level. For example, in the 1970s the federal government was seeking to reduce the impacts of earthquakes throughout the United States. The federal government mandated that areas that were at-risk develop policies

and procedures to mitigate earthquakes. San Francisco developed a local advisory committee that researches and implements DRM mitigation tools to reduce impacts of earthquakes.

Primary Focus of Policy

Each city has a different way that they addressed DRM regardless of government system and touches on preparedness, mitigation, and resiliency in different ways. San Francisco has clear and direct plans and policies that deal with preparedness and mitigation. The city has the Earthquake Safety Implementation Program, participated in the Earthquake Reduction Act to strengthen buildings against earthquakes, and has an Office of Resiliency. Santiago's plans and policies are similarly focused on prevention, mitigation, and resilience efforts. Meanwhile, Christchurch and Miami take different approaches to dealing with preparedness and mitigation. Miami frames their conversation of preparedness and mitigation through the lens of climate change. Their plans include examples such as Regional Climate Action Plan, Miami Forever Climate Ready Strategy, and smaller adaptation action area plans. Christchurch specifically focuses on emergency management. The city does not have independent plans that focus on preparedness or mitigation, but rather one consolidated plan to address these issues through the lens of emergency management.

Presence and Strength of the Framework

Christchurch and Santiago at the local level have more consolidated plans and policies compared to Miami and San Francisco that have policies and plans for all topics. The content differs from city to city, but overall they include elements such as addressing natural disasters, infrastructure, and land-use planning. For Christchurch, these overarching policies can be seen in its Canterbury Defence and Emergency Management Plan. This plan lays out clear procedures and policy tools like considering welfare plans for DRM and allocating funding resources for risk management. For Santiago, these elements can be found in its 2017 Civil Protection Plan, which escalates budgetary provisions and strengthens regulations for mitigation efforts across the region, as well as combines DRM strategies in the same document.

Miami and San Francisco have a wide variety of plans based on specific topics related to disaster management and mitigation. Unfortunately, unlike Christchurch and Santiago, these plans are not as consistent and inclusive within one broad policy report. For example, Miami has its Regional Climate Action Plan, a Resilience Plan, and a Resilient 305 Strategy Plan that all encompass the overall scope of municipal disaster management but through different premises. Each of these policies focus heavily on different topics from advancing climate change efforts and improving social inequities, to addressing infrastructure failures. Similarly, San Francisco has its Community Action Plan for Seismic Safety Plan, 2014 Hazard Mitigation Plan, Applied Technology Council (ATC), California Senate Bill 375, and Plan Bay Area 2040. All of these planning programs initiate policies through various lenses, surrounding areas concerning seismic hazards, establishing performance evaluations, incorporating the need for better transportation planning, addressing urban growth, and emphasizing sustainable communities.

The Sources and Approaches to Policy Making

These different approaches to policy content reveal how U.S. cities in general use more incremental methods when it comes to policy, planning, and legislation compared to Christchurch and Santiago. Additionally, demographics and social structure, geography also plays a key role in affecting policy and legislative procedures. For example, New Zealand's relatively small population enables the country to have less ground to cover for disaster management and can lead to quicker results in the process. This dynamic is not true for the U.S. or Chile, with both Santiago and Miami's metropolitan area population surpassing the entire country of New Zealand alone—each by over 2 million inhabitants. Factors like these can significantly hasten or stall the policy-making process in times of crisis—all of which can influence the area of damage done, the amount of money used, and the number of people saved.

Conclusion

There are many factors that come into play when characterizing the nature of the policy process. Policy and laws are framed through a variety of lenses that prove integral to how DRM is shaped, managed, and implemented. Here, we see that Christchurch and Santiago work under a unitary policy process, with Christchurch being active in the field of emergency management and cumulative government intervention. Santiago, like Christchurch, works under a more consolidated planning and policy context, with plans and policies tailored more to prevention, mitigation, and resilience. San Francisco works under a consolidated government and policy structure with clearly defined policies dedicated towards preparedness and mitigation mostly for earthquake prevention. Lastly, Miami, like San Francisco, frames policy through a federalist system and steers its DRM process more towards climate change response than its counterparts. Knowing these vital concepts to formulate policy will help measure and dictate the viability of DRM moving forward.

Coordination for DRM

Disaster risk management needs to involve a variety of different players. Governance arrangements, therefore, need to ensure coordination across these different players, including across different government levels and entities, as well as between government and external stakeholders. How did we see this being done in our case studies?

In several cases, the cities were made up of multiple municipalities. Where all the municipalities were under the same regional government or administration, coordination was done through formal bodies that included all the municipalities. This was the case with Christchurch and Santiago. In Miami, by contrast, county and city authorities worked both together and separately, but without a formal coordinating body. In San Francisco, the county and city were consolidated, so coordination was less of an issue.

The metropolitan areas of Miami and San Francisco both extended beyond a single city or county jurisdiction. Coordination with other neighboring counties was done in San Francisco

through the Association of Bay Area Governments. In Miami, some planning processes were conducted among several adjoining counties.

Several of the cities (Miami and San Francisco) have Resilience Offices and a Resilience Officer who takes the lead in coordinating planning for resilience. That arrangement was created out of the 100 Resilient Cities Program, which has ended, but the cities have maintained the office. We have limited evidence about their importance, but our studies suggest that these offices do play a coordinating role in both San Francisco (including for risk assessment) and Miami. Located outside the regular emergency management departments of city administration, they are able to work more easily with a variety of government agencies and beyond the narrow context of emergency response.

In terms of engaging with a wider range of stakeholders, several cities have formal commissions or councils with membership from a range of government agencies, private sector, and sometimes nonprofit organizations. Both Christchurch and Santiago have such bodies: Christchurch at the regional level and Santiago at both the regional and municipal levels. Private sector membership tends to be utility and infrastructure companies, and the most typical nonprofits included were the Red Cross and other similar organizations. Preparing for implementation of response to disaster is a major role for these commissions. San Francisco's Lifeline Council also includes private companies, not just in an implementation role but also in assessing risk. See Appendix 3 for a detailed matrix of comparative city organizational structures.

Across the cities, the role of nonprofit organizations was less than we expected. In most cities, there was formal provision for participation on a commission or council but less evidence of actual participation in practice. Miami was the exception. There, a few strong nonprofits play an important role, but it was less formalized in terms of official links with government bodies.

Some of the most interesting and innovative examples of coordination were more informal arrangements. Among the examples of coordination that relates to prevention and mitigation with either the private sector or nonprofits are the following:

- Using a WhatsApp group to promote collaboration between experts from local government, nonprofits, and academia (Miami).
- Bringing together private utility companies, engineering companies, public service entities, telecommunication companies, academic and community partners to review the extent to which vital resources, such as water and electricity, will be unavailable during an emergency situation through the Lifeline Council (San Francisco).

In conclusion, coordination across government levels and entities is less of an issue in the unitary systems, but a critical challenge in federal systems, with Miami being the example of a city facing enormous coordination challenges because of the complexity of its governing arrangements. On the other hand, while Christchurch and Santiago formalize engagement with stakeholders outside government, there seem to be less opportunity in those unitary systems for

those stakeholders' participation beyond formal membership in the commissions. The context of Mexico City, which functions within a federal system and with a fairly complex set of government structures, is more similar to the Miami and San Francisco contexts; their experiences and approaches are likely, overall, to be more relevant for Mexico city than those of Christchurch and Santiago. Appendix 4 includes a detailed matrix of coordination arrangements across the case studies.

Information

The type of information that the cities share and distribute to the public, government decision-makers, and stakeholders is an essential area of focus that is crucial for planning and policy making, developing public-private collaborations and strategic initiatives, and empowering individuals and communities for preventing and mitigating natural disasters. The following analysis will compare the information strategies in the four case study cities, looking at types of information available, information management, information accessibility, and the limitations or shortcomings of efforts. The analysis showed that both Miami and San Francisco have the most robust information strategies of the four cities. Appendix 5 includes a detailed matrix of comparative information tools.

Our analysis is somewhat tentative, given research limitations. While we tried to get as complete a picture as possible, we were unable in some cases, especially in Christchurch and Santiago, to gain access to government data portals or other information tools.

Information Tools

All four cities make available a variety of types of risk-related information for the public. These include comprehensive plans for response, recovery, prevention, and mitigation; risk and vulnerability maps, building codes and building information, and progress on mitigation projects.

One recurring theme is the creation of an online, interactive atlas or map (or matrix, for Christchurch) that identifies the city's risks associated with disasters and natural hazards. While the tools provide information on disaster risks, how the information is conveyed and what is included vary. For instance, Miami created Flood Risk Maps and Sea Level Rise Maps that allows the public to get information on the risks and vulnerabilities of specific addresses. In contrast, both San Francisco and Christchurch created risk atlases with more of a focus on people: the maps display information such as communities at most risk of becoming isolated during an event, health impacts of climate change, and social vulnerabilities at a neighborhood level. For Santiago, the information is presented as a multiplatform educational tool. The purpose of the Virtual Laboratory of Natural Risks is to teach about geography and different types of natural risks in an attempt to increase community resiliency and equip people to be better prepared for an emergency.

Another consistency across cities is the creation of the interactive web tool intended to provide information to the public on buildings. All cities utilize such a tool to provide the public with information, including building permits, enforcement codes, building code violations, and

assessment ratings for buildings in hazard-prone areas. The intent of these tools appears to be to increase transparency and government accountability regarding sustainable development and building/updating buildings to be safer. However, San Francisco stands out in having more tools than any other city.

While all of the cities had similarities in types of information provided, there were a few instances where the cities are innovative and unique from the others. San Francisco particularly had more innovative tools than the rest. Examples of some of the innovative tools include:

- San Francisco's community-level asset mapping tool, which highlights the strengths and resources of 29 neighborhoods. This tool is different from the information available in the three other cities which mainly focus on the weaknesses and vulnerabilities of neighborhoods.
- San Francisco's Community Resilience Maps provides information unique from the other cities in that it displays quantitative measurements of resiliency and vulnerability to climate change stressors of numerous San Francisco neighborhoods. Included is data about a neighborhood's demographics, economy, environmental, hazard risk, health, housing, public realm, and transportation.
- Santiago's Virtual Laboratory of Natural Risks. Santiago has planned to update the tool to include a special section for teachers, which will include games and trivia for their students. This strategy of disseminating information through an educational platform is distinct from the other cities.
- Miami's 311 Contact Center acts as a secondary knowledge base for local government. The government crowdsources information gathered from residents' service requests and complaints and uses it to improve mitigation planning and procedures.

Information Management

Information management in disasters is constructive in guiding plans, projects, and laws that mitigate and prepare for risks. Various sectors create and manage the information tools mentioned above, including universities, businesses, public entities, and national and local departments. Each city shows that they have a distinct way in which information is generated.

For the most part, almost all the tools are published and available on a government website. Distinctly from other cities, two of the San Francisco tools, the Building Eye and Fire Department Inspection Map, were both created by businesses. In contrast, the building information tools in the other case study cities were all created by the government. Government information management is predominantly seen in the city of Miami, which produces most of its information in collaboration with local, regional, and national departments. Finally, cross-sector coordination with universities/academics play an essential role in generating information tools. This is largely seen in the tools created in San Francisco and Santiago. University departments play two roles in San Francisco, they either spearhead the tool, or they offer scientific data and empirical evidence that helps create the tool. However, in Santiago, the KimGenLab was developed by a university department, was funded by government funds, and is supported by

nonprofit organizations. Having multiple sectors producing maps could increase transparency and as well as increase the amount of information available to the public.

Information Accessibility

Accessibility of information is based upon whom the information is made available to, where it is located, and its usability. As mentioned above, most of this information is shared by the respective governments to be more transparent with the general public. However, “open to the public” does not guarantee all people have access to the information.

For all of the case study cities, the central platform to share and disseminate information is online. A consistency observed in each of the four cities is that the primary audience is technical experts. All of these web tools are open to the public, except for San Francisco’s Building Occupancy Resumption Program that uses an online tool to streamline the building inspection process and is only available for business owners. While information is available to the public, it is tailored for the target audience and may not be intended for public use. One example is Miami’s flood risk maps. They are available to the public but primarily created for banks and insurance companies, thus making them highly technical and hard for residents to navigate.

A consistent theme across each case study is the lack of accessible information to marginalized communities. As mentioned, most of the information is available in an online platform with no alternative options to access the content. For a person without access to a smartphone or computer, this information may not be accessible. For example, low-income communities may not be able to afford the technology and the elderly community may not be tech-savvy enough to navigate an interactive, multi-layered Flood Risk Map. Inaccessibility to information can further exacerbate the exclusion and vulnerabilities of marginalized communities. Miami was the only city to offer an alternative for the public to access information. Individuals have the option to obtain PDF versions of the Flood Risk Maps (FIRM) by contacting the county’s Environmental Resource Management Department. Physical copies of the FIRM maps can also be viewed in the same department. Though, the Miami-Dade County website did clarify if one wanted to keep a copy of the map, they had to be purchased from FEMA by calling the Map Service Center. While offering print versions can make information accessible, Miami’s strategy seems time-consuming and more costly to individuals.

Aside from offering multiple ways to access information, it is essential to have content available in multiple languages in order to help ensure usability. All of the cities offer information resources in multiple languages, except Christchurch, where most of their information is only available in English given most residents speak English. As a whole, all four cities appear to currently be mostly one-dimensional in how they disseminate risk-related information (via online), meaning that it may be inaccessible to marginalized communities.

Conclusion

In conclusion, having a robust information platform is critical to mitigate and prevent a disaster. Across the four cities: the type of information, tools created, who created the tool, and who can

access the information, varied in many regards. The few consistent themes seen in all case studies included: government's involvement in information management, the use of maps/matrices, and the publishing of tools in an online platform. Additionally, in all cities there seems to be limited usability due to the complex nature of the webpages and data sets. The data does provide key insights on information that is relevant to Mexico City.

While Mexico City's Risk Atlas provides detailed technical information regarding natural hazard risk that is useful for decision-makers, Mexico City can consider the creation of interactive tools to educate the community or provide an information platform for the community to access. Such as creating tools that provide information to the public on buildings. Finally, the data pointed to both of the U.S. cities: Miami and San Francisco, as the cities with the most comprehensive and unique information management and dissemination tools.

Communication

Ensuring effective communication is an essential dimension of governance for risk management. Our four cities share many similarities in communication strategies. We looked across the cities at their communication between government and other stakeholders, as well as communication with citizens and communities, including issues of reaching vulnerable communities. The analysis below highlights how cities try to communicate with the public and other stakeholders through early warning systems, public communication, cross-sector communication, and multi-directional communication. Appendix 6 includes a detailed matrix comparing avenues of communication.

Early Warning Systems

Communications aimed at reducing the impact of an impending hazard were fairly uniform across our case study cities. All cities had early warning systems dedicated to reaching the public at large. Each city utilized conventional methods of communication for their early warning systems such as alarms and broadcast media. Notably, San Francisco's text-based notification system allowed residents to receive alerts on up-to-date information on current emergencies, including specific action the public should take (i.e. boil water, shelter-in-place, avoid specific areas). This sort of information delivered quickly sets the stage to prepare coordination efforts post-disaster and could be an effective mitigation tool so long as people register to receive alerts.

Noteworthy capacity building communication has improved the mitigation efforts of San Francisco. The Building Occupancy Resumption Program is an innovative program designed to reduce delays of post-disaster building inspections by deputizing inspectors to conduct emergency inspections. Programs like this in Mexico City that could target structures where socially marginalized populations live could significantly reduce the impact of disasters on them in the future.

Communicating with the public and neighborhoods

In all the cities, the majority of risk communication from government to the public was online. Each city posted information online through websites and social media. San Francisco went to the greatest length at streamlining risk communication online by making every tool for receiving risk communication available on the same web page.

Because much of the information about risk is designed for technical experts and decision makers, its technical nature presents a barrier to the general public. Therefore, one key component of a communication strategy is finding ways to make the information understandable for more general users. All of our case study cities had maps depicting risks at various levels; however, San Francisco's Community Resiliency Indicator Maps deserved some added attention. Rather than being cluttered with layers and complex menus like other cities' maps, these maps were specifically designed to be used by neighborhood organizations, private partners, and other government departments. The maps were categorized plainly across a wide range of neighborhood-level risks and the raw data is available for public consumption. This approach showed considerable attention to communicating with neighborhoods and the public in general.

There were various approaches to communicating with low-income neighborhoods. The municipal government in Santiago placed a greater emphasis on meeting people personally in low-income neighborhoods. These meetings produced Personal Disaster Contingency Plans tailored for individual households. Engaging with the public on a personal level presumably can be effective but inevitably takes a lot of time, resources, and workforce to accomplish.

We saw several efforts to communicate with other types of vulnerable groups, including having risk information produced in multiple languages and using not only online but also print media, radio, and television. San Francisco accomplished this through a partnership between the mayor's office and nonprofits - the Vulnerable Population Working Group is dedicated to informing and connecting with identified vulnerable populations, such as disabled people.

Education and Capacity Building

A few of our case study cities had invested in education and capacity building efforts to bolster their prevention and mitigation efforts. Christchurch's emergency management department in particular went to greater lengths to incorporate education on risks and disasters to the public. Examples of this included their "Be Prepared" resources for families, children, businesses, and communities. These resources contained information on what everyone can do to mitigate the effects of disasters. Additionally, Christchurch was the only case study city that formally incorporated disaster and risk education into school curriculums.

Workshops and other educational programs to help build individual and community capacities were one of the communication strategies utilized to reach low-income communities. Notably, these were most often carried out by nonprofit organizations, either on their own or in collaboration with the local government. Santiago and Miami both had examples of this kind of strategy, and nonprofits played a key role in both cities.

Cross-sector Communication

Communications that assist in coordinating efforts across sectors varied widely among the case study cities. Public forums were a common theme among case study cities. Santiago and Christchurch in particular placed an emphasis on nonprofit participation in these forums. Cities also used technology to coordinate and communicate with the public. Miami's coordination communication involved a network of experts, government officials, academics, and nonprofits communicating informally through WhatsApp. San Francisco's MyShake mobile application connected citizens with the U.S. Geological Survey and other global earthquake authorities to understand impacts of seismic events. All of these seemed like effective practices for promoting coordination geared towards prevention and mitigation.

Multi-directional communication

Multi-directional communication is a tool that has avenues that allow information to flow between multiple communication channels. Both Christchurch and Miami had examples of this form of communication. Miami has the 311 call center that allowed citizens to report issues, as well as, allow local government to address concerns that a caller may have. In Christchurch, multi-directional communication occurred through in-person forums or meetings. Both practices are seen as positive tools.

Conclusion

Looking at communication strategies and practices in each of the four cities provided an overview of what they were doing and how communication was done. As the analysis indicates there are a variety of different communication structures that could be implemented to ease in the flow of communication. Tools such as forums or 311 call centers can aid in the flow of information between both local government and its citizens. Meanwhile, different top-down or bottom-up techniques, such as citizen education or multiple languages used for information sharing, are implemented. Despite different different contexts, each city can benefit Mexico City from their lessons.

6. LESSONS LEARNED & CONCLUSIONS

Our analysis of the experiences with disaster risk governance in Christchurch, Miami, San Francisco and Santiago has provided insights into the central dimensions of governance that we have studied: coordination, information, and communication. In this concluding section of the report, we seek to draw out key learning from the study. We address first considerations that affect the shape of DRM governance across the cities and also the relevance of potential lessons for Mexico City. Then we outline lessons learned for each of the dimensions of governance.

Considerations

It is important to note that each case study comes with its own context; no two cities are alike. We found three sets of factors that were important in shaping DRM and its governance.

- **Economy and inequality.** DRM is expensive to implement for governments, and income level also affects households' ability to prepare for and withstand emergencies. The United States and New Zealand are wealthy countries. Chile's per capita income is lower than the other countries, but still somewhat higher than Mexico. This means the four cities in our study may have more money to place towards DRM.

The level of inequality is a measure of the degree of social vulnerability. Inequality is fairly high in the United States, as it is in Mexico, whereas New Zealand has a lower level of inequality than the other countries, suggesting a relatively low social vulnerability. Christchurch thus has less of a challenge of reaching vulnerable communities than the other cities, including Mexico City. In terms of income and inequality within the cities themselves, Miami and Santiago stand out for having great disparities in income and large poor populations.

- **Size and heterogeneity of population.** These factors affect the magnitude and complexity of the challenges faced in DRM. Like Mexico City, Santiago, San Francisco, and Miami have large and diverse populations. Meanwhile, Christchurch is smaller and more homogeneous than the other cities.
- **Government structure.** Santiago and Christchurch are part of unitary systems, while Miami and San Francisco, like Mexico City, function within a federal system. These differences are important in understanding where policy originates and how it is implemented. Santiago and Christchurch may naturally have a more cohesive policy, given the governmental structure.

These factors need to be taken into account in considering the relevance of DRM arrangements in the four cities to Mexico City. Miami and Santiago are the closest to Mexico City in size, Santiago is more a peer on income level. All the cities except Christchurch face similar challenges of vulnerable populations due to low-income and socio-economic vulnerability. The U.S. cities have the same overarching government structure of federalism, which we found to be

a major influence on DRM governance, suggesting that the approaches adopted by Miami and San Francisco may be of particular relevance to Mexico City.

Lessons Learned

Below are our reflections on the key insights from the study of the four cities. For each of the areas of governance—coordination, information sharing, and communication—we considered what the case studies had shown to be the major challenges in the area, with particular reference to prevention and mitigation of disaster. We then identified what came out of the experiences as good practices that helped address the challenges.

Coordination

Institutional arrangements for disaster risk management need to ensure effective coordination vertically--between different levels of government--and horizontally--across different units of government at the local level and beyond, to include a variety of stakeholders. In our case studies, we found that vertical coordination was generally addressed fairly comprehensively in the unitary systems, while national-local coordination in the U.S. cities was often a matter of a mix of funding as incentives for policy change at the local level. Coordination across the local level was also more planned and controlled in the unitary systems. It was more complex and messy in the federal systems, especially in Miami, but essentially functional. We found, though, that the issue of engaging with key stakeholders was both important and one of the most difficult aspects of coordination.

Challenges

- **Bringing a variety of stakeholders to the table.** Disaster risk management is complex and must bring a variety of stakeholders together to address mitigation and prevention. Therefore, a variety of actors, including nonprofits, experts, and community members must be formally engaged to carry out DRM.
- **Making stakeholder engagement real and meaningful.** Formal coordination needs to be coupled with a willingness on the part of all stakeholders involved to utilize formal structures for them to be successful. This willingness is manifested in the form of informal mechanisms for coordination. Informal mechanisms for coordination can be understood as functional working relationships.
- **Ensuring that policy, plans, and practice are informed by expert voices.** Analysis and assessment are involved in identifying geophysical or natural risks, social and economic vulnerabilities, and weaknesses of the built environment. This leads to a need for a variety of expert voices to ensure a wide range of perspectives.

Good Practices

- **Establishing inclusive decision-making bodies that foster coordination.** Formal committees or commissions that bring multiple actors together and establish actor roles, responsibilities, and relationships are valuable for coordination. Each of the case study cities included a formal process to receive feedback on policy or implementation from nonprofits and businesses through a committee, council, or group. These entities meet regularly and provide a space for the nonprofits and private sectors to voice their concerns. Christchurch's model was specifically impactful since the CEG provided the space for all stakeholders to come together and work on how policies would be implemented. This model allowed for nonprofits and businesses to jointly collaborate on recommendations rather than through more closed-door meetings.
- **Building social capital and mutual buy-in.** Formal mechanisms do not replace informal information/relationship networks. Informal mechanisms for coordination (functional working relationships) can be promoted through social capital and increased buy-in (prioritization of coordination) by all the actors involved. For example, in Miami a strong working relationship was formed between certain nonprofits and government agencies in part due to people's moving between jobs in government and nonprofit organizations. Another example of informal information networks are the nonprofits in Christchurch. The nonprofits meet quarterly outside of the government meetings to address the needs of their clients, network with each other, and see what resources are available or soon to be cut off.
- **Developing meaningful relationships with experts.** Three of the cities have consulting relationships between their local governments and academia. Both Christchurch and San Francisco have ongoing, formal consulting relationships with an academic institution. These consulting relationships offer scientific data and empirical evidence that helps inform policy implementation and assess risk. When tied to a specific academic institution, this approach may lack the needed range of perspectives, such as including social scientists. Another style of relationship with experts is found in Miami. In Miami, the local government partners with a local nonprofit that advocates for the academic and scientific community within the city. This relationship is broader and pulls from a variety of experts on many different topics.

Information Sharing

Information is critical for disaster prevention and risk mitigation. Those phases require assessment and analysis of risk, which are information-intensive activities. But they equally require citizens' and communities' taking actions that reduce risks, and that requires information relevant at that level. Our studies showed that every city had risk-related information available for decision makers. The main challenges were not there, but were with regard to the availability of needed information for citizens and communities.

Challenges

- **Making risk-related information available, accessible, and usable for communities.** Residents need to understand the risks and vulnerabilities they face to prepare and mitigate effectively. They have varying degrees of background knowledge, technical expertise, and information accessibility, and they face different situations. Therefore, a variety of types of information should be available so that the information is both widely usable and accessible by the public. It needs to be relevant and practical for their needs.

Good Practices

- **Intentionally designing information tools with citizens and community members as targeted users.** In an effort to increase access and usability of information tools, they need to be designed with residents being the target audience. While this level of intentionality was missing from a majority of the case studies, it was found in San Francisco. San Francisco offered easy to use interactive online maps that focused on the city's various risks and hazards. Additionally, Santiago created the KimGenLab tool with the intention of it serving as an online educational tool to teach community members about natural hazards and risks. The KimGenLab has been viewed as a positive educational tool. These tools appear to be created with the target audience being the public. This can be the differentiating factor in how usable information is.
- **Working across sectors when creating informational tools.** A benefit of having a multitude of stakeholders collaborating, sharing information, and creating informational tools is the increased overall amount and types of information available, as well as increased usability, reliability, and relevance of the information. A trend, most recognized in San Francisco, was the involvement from multiple sectors including government, academia, nonprofit, and businesses. Examples of their tools include:
 - ❑ Building Eye- created by a business,
 - ❑ The Berkeley Digital Seismic Network- created collectively by Stanford University and the United States National Seismic Network,
 - ❑ The Community Resiliency Maps- created collectively by government, nonprofits, academic institutions, and community members.

Communication

Communication is closely linked with information, but involves active steps and strategies to make sure that information and messages are conveyed to the people who need to receive them. In prevention and resilience, failures in communication lead to inadequate coordination, as well as to failure to enable individuals and communities to take steps toward reducing their own risk or participating with the city government and nonprofits in increasing resilience.

Challenges

- **Communicating with citizens and community members at large.** Risk-related information needs to be actively communicated to the public in a way that is easily accessible, usable, and reliable. To gain a holistic understanding of a situation, there needs to be a variety of different communication channels. The general public will not benefit from it unless it is purposefully communicated to them through channels they have access to and can understand.
- **Effectively reaching marginalized groups.** Risk-related information needs to be intentionally communicated to different marginalized groups to prepare them for potential risks and mitigate negative outcomes. Marginalized groups often do not have the same resources that the public at-large does, but are often in more vulnerable or risk-prone positions than the public at-large. As they are notably more vulnerable and have less resources, they are in more danger.
- **Facilitating co-learning.** Creating open channels that encourage multi-direction communication is valuable. Top-down channels can provide wide-scale, accurate information, while bottom-up channels can provide community-based knowledge and understanding of people's realities, needs, and priorities. Additionally, creating a co-learning environment where everyone gains greater DRM knowledge can result in greater impact on mitigation and preparation efforts. Co-learning can occur at many levels including: intergovernmental, cross-sector, and with communities. Increasing the knowledge base not only helps to further educate partners and community members, but it can increase capacity to more effectively carry out DRM.

Good Practices

- **Diversifying means of communication.** All case studies have robust online presences, however, to reach additional communities that may lack access to online materials or the ability to read a country's common language alternative methods must be used. Diversifying the means of communication can assist in this process. Additionally, the use of print material in secondary languages found in the community, such as San Francisco and Miami having print material available in Chinese and Spanish respectively, can aid in reaching marginalized communities. Best examples of alternative means of communication include:
 - ❑ Christchurch's use of print material in newspapers
 - ❑ Miami's use of mailed print material, television adverts, radio programing, and the 311 call center
 - ❑ San Francisco's text alert program
- **Carrying out targeted community outreach.** Community outreach was critical to educating the community and receiving feedback from the community; however, targeting specific communities had a more significant impact on communities than

general outreach. Santiago ran a community preparedness program in over 900 locations to target low-income areas that need the greatest assistance in this area. The government officials facilitating the training also use this time to go door-to-door in the communities to further the education efforts. Additionally, Christchurch relies heavily on in-person meetings and forums to gather community feedback, and this system is widely viewed as a success.

- **Partnering with nonprofits.** Nonprofits play a vital role in engaging with communities and helping them understand risks. The pre-established relationships and trust nonprofits have built within a community have proven to be advantageous. Without the nonprofits help, government departments may not have the capacity to carry out direct communication. Utilizing this partnership can be beneficial for all parties involved. Throughout the case studies there were examples of local governments working with nonprofits to better reach communities. Overall, outcomes of such partnerships are successful and governments are able to be responsive, better inform communities of their risks, and provide them access to resources and programs.
- **Learning from local experts to inform DRM.** Utilizing a bottom up approach requires multi-directional communication channels and promotes co-learning. People living within neighborhoods possess knowledge and expertise that can be useful to help inform DRM policy and decision making. Miami is currently deploying a pilot program where the county Office of Resilience is partnering with local communities to better assess risk in their own neighborhoods. They are asking residents to take pictures of any damaged buildings or houses impacted by flooding or hurricanes. These photos can be used to help decision makers truly understand the risks marginalized communities are exposed too. Instead of the government producing maps and telling people where the risks are, they are seeking help from people within the neighborhoods, the ones who know the area best.

This project has highlighted the critical importance of coordination, information sharing, and communication in governance of risk management. The case study research has highlighted the different methods that cities have used to accomplish them. While there were overarching themes and ideas amongst all case studies, differences arose in the details. We found both innovative ideas and practices. Many of the challenges that we saw in the case study cities mirror challenges that Mexico City faces. Our intention in this project has been to provide perspectives on some international experience that can help inform the current efforts to build good governance for risk management in Mexico City.

APPENDICES

Appendix A: City Context Matrix

THEMES	CHRISTCHURCH	MIAMI	SAN FRANCISCO	SANTIAGO
City Proper Population	369,000	470,914	883,305	404,495
City Proper Land Area	546.66 mi ²	55.25 mi ²	46.87 mi ²	8.49 mi ²
Metropolitan Population	599,694	6,200,000	4,730,000	7,112,808
Metropolitan Land Area	17,183.2 mi ²	5,067.5 mi ²	2,470.3 mi ²	5,947.21 mi ²
Immigrant Population	N/A	55.4%	34%	N/A
Homeless Population	200	3,700	8,000	N/A
Socially Vulnerable Groups	Maori, homeless	Recent immigrants, communities of color, homeless, those living below the poverty line	Immigrants, non-English speakers, disabled, homeless, those living below the poverty line	Low-income households and communities, households headed by women
Country Per Capita Income	\$39,000	\$59,800	\$59,800	\$24,600
Country Inequality Rates (GINI Index)	36.2	45.0	45.0	50.5
City Median Household Income	N/A	\$36,638	\$104,552	N/A
Notable Risks	Earthquakes and volcanoes	Hurricanes, sea-level rise, flooding, lightning, tornadoes, and droughts	Earthquakes, fires, and extreme weather	Earthquakes, flooding, droughts, and wildfires
Notable Major Disasters	Earthquakes in September 2010 and December 2011	Hurricane Andrew in 1992	Earthquake Loma Prieta in 1989	Earthquake in 2010
Government Structure	Unitary System	Federal System	Federal System	Unitary System

Relevant Levels of Local Governments	Regional councils relevant	County government relevant to city proper, nearby counties relevant to metropolitan area	Consolidated city and county government relevant	Regional Council relevant
City Proper Chief Executive Officers Elected or Appointed	Territorial mayor: elected	City mayor: elected, City manager: appointed	Mayor: elected, city administrator: appointed by mayor	Mayor: elected
Relevant Levels of Local Government Chief Executive Officers Elected or Appointed	Regional council made up of mayors: elected	County executive: elected	N/A	Regional Intendent: appointed by the President

Sources: Case Studies, New Zealand Census (2018), United States Census Bureau (2019), Chile Census (2017)

Appendix B: Legal & Policy Context Matrix

THEMES	CHRISTCHURCH	MIAMI	SAN FRANCISCO	SANTIAGO
<p>STRUCTURE OF HOW POLICY IS IMPLEMENTED</p> <p>Where does the policy come from?</p> <p>Who implements the policy?</p> <p>Who is impacted by the policy?</p>	<p>→ Policies come from the national/central level.</p> <p>→ Policies are implemented at the regional/territorial and local levels.</p> <p>→ Policies impact regional/territorial and local governments which then impact community stakeholders.</p>	<p>→ Policies come from the county and local levels.</p> <p>→ Policies are implemented at the local level.</p> <p>→ Policies impact local community stakeholders.</p>	<p>→ Policies come from the national, state, and county levels.</p> <p>→ Policies are implemented at the county and local levels.</p> <p>→ Policies impact county and local governments which then impact community stakeholders.</p>	<p>→ Policies come from the national, regional, and local levels.</p> <p>→ Policies are implemented at the regional and local levels.</p> <p>→ Policies impact the metropolitan area and regional and local governments, which then impact community stakeholders.</p>
<p>BUILDING CODES</p> <p>Who initiates the building codes?</p> <p>Who implements the building code?</p> <p>What buildings are targeted by the building code?</p>	<p>→ Building codes initiated at the national level.</p> <p>→ Building codes implemented at the regional/territorial and local levels.</p> <p>→ Building codes target the construction, alteration, demolition, and maintenance of new and existing buildings nationally.</p>	<p>→ No specific policies or laws explicitly stated</p>	<p>→ Building codes initiated at the local level.</p> <p>→ Building codes implemented at the local level.</p> <p>→ Building codes target those classified as wood-frame and soft-story to reduce property damage.</p>	<p>→ No specific policies or laws explicitly stated.</p>
<p>POLICY CONTENT</p> <p>What strategies are implemented?</p> <p>What topics are reviewed in the policy?</p> <p>What are key policy priorities?</p>	<p>→ Implemented strategies include having one main emergency management plan to address all disaster risk factors for regions and municipalities.</p> <p>→ Policy topics include assessing social, economic, environmental, and cultural objectives.</p> <p>→ Key policy priorities include enforcing zoning laws and administering urban/rural regulations.</p>	<p>→ Implementation strategies include having multiple local plans that address specific issues like climate change and infrastructure.</p> <p>→ Policy topics include sea-level rise, inequities, and infrastructure failures.</p> <p>→ Key policy priorities include reducing risks of flood, heat, and storm impacts, and community mitigation efforts.</p>	<p>→ Implementation strategies include having strong local level influence and seeking technological innovation.</p> <p>→ Policy topics include housing, land-use, transportation planning, and seismic activity.</p> <p>→ Key policy priorities include finding alternate funding sources, reducing natural hazards, and consolidating regulations.</p>	<p>→ Implementation strategies include organizing top-down legislative procedures and plans to disperse across governing bodies.</p> <p>→ Policy topics include droughts, floods, earthquakes, and sustainability.</p> <p>→ Key policy priorities include strengthening regulations and implementing vulnerabilities into urban planning.</p>

Appendix C: Organizational Structure for DRM Matrix

THEMES	CHRISTCHURCH	MIAMI	SAN FRANCISCO	SANTIAGO
Role of National Government	<ul style="list-style-type: none"> The Central Government provides a guideline for local governments through its National Civil Defence and Emergency Management Plan 	<ul style="list-style-type: none"> FEMA-provides funding and broad policy guidelines 	<ul style="list-style-type: none"> FEMA-provides funding and broad policy guidelines 	<ul style="list-style-type: none"> ONEMI - National Civil Protection System provides a policy framework for regions and municipalities.
Role of State Government	N/A	<ul style="list-style-type: none"> Florida Division of Emergency Management- no known information of involvement 	<ul style="list-style-type: none"> The California Governor's Office of Emergency Services-provides guidelines for policies and mandates in addition to funding under certain circumstances. 	N/A
Relevance of Larger Regional Bodies that Facilitate Regional Collaboration	N/A	<ul style="list-style-type: none"> Southeast Florida Regional Climate Change Compact-Climate Action Plan developed from the Regional 	<ul style="list-style-type: none"> Association of Bay Area Governments-serves as a collaborative platform for regional cities. 	N/A
Key governmental actors involved in DRM	<ul style="list-style-type: none"> CDEM Group Joint Committee-consists of the elected Mayor of each from each of the nine territories CDEM Coordinating Executive Group (CEG)- composed of the nine territorial mayors, ministries/ departments, and private/nonprofit organizations. CDEM Emergency Management Office (EMO)-oversees emergency plans. 	<ul style="list-style-type: none"> Office of Resilience Miami-Dade (county)- oversees plans and programs Building and Construction Office (county)-enforces building codes Office of Resilience and Sustainability (city)-oversees plans and programs Building and Permit Office (city)-enforces building codes Office of Emergency Management- oversees emergency plans 	<ul style="list-style-type: none"> The Office of Capital Planning and Resilience- located in the Office of the City Administrator and houses the Chief Resilience Officer. The Department of Emergency Management is responsible for communicating with FEMA to receive disaster relief funds and policy guidance. The Department of Building Inspection implements programming to enforce building codes and retrofit laws. 	<ul style="list-style-type: none"> Regional Civil Protection Office (housed within the Regional Intendency) is overseen by the Regional Director of Civil Protection and Emergencies. This Office coordinates with other public agencies and stakeholders from other sectors through the Civil Protection Committee. These same arrangements exist at the municipal level as well through Municipal Civil Protection Offices and Civil Protection Committees.
External Stakeholders Involved in the DRM	<ul style="list-style-type: none"> Private and Non-profit organizations- serve on the CEG and support 	Each of the following entities participate on government and nonprofit boards that	<ul style="list-style-type: none"> The Lifeline Council-promotes the inclusion of stakeholders from 	<ul style="list-style-type: none"> Businesses involved in basic services and utilities, nonprofit organizations, and

	the execution of DRM efforts.	influence DRM: <ul style="list-style-type: none">• The Miami Foundation• The CLEO Institute• Real Estate Developers• The Florida Regional Interfaith InterAgency Emergency Network for Disasters (F.R.I.E.N.D.)	various sectors.	Neighborhood Councils
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Appendix D: Coordination Matrix

THEMES	CHRISTCHURCH	MIAMI	SAN FRANCISCO	SANTIAGO
Coordination between local and national/federal-level government (vertical coordination between local and national)	No known coordination mechanisms	<ul style="list-style-type: none"> • Miami receives money from FEMA in exchange for maintaining an updated Hazard Mitigation Plan and compliance with other federal regulations. 	<ul style="list-style-type: none"> • San Francisco's Department of Emergency Management receives money from FEMA in exchange for maintaining an updated Hazard Mitigation Plan and compliance with other federal regulations. 	<ul style="list-style-type: none"> • Regional and Municipal Civil Protection Offices coordinate with the National Emergency Office of the Ministry of the Interior (ONEMI) and the National Civil Protection Committee to carry out plans and policies related to DRM as part of the national Civil Protection System.
Bodies in charge of coordinating across governments at the regional level (horizontal regional coordination)	<ul style="list-style-type: none"> • The Group Joint Committee (composed of the nine elected mayors from the nine territories) makes DRM decisions on behalf of their territories. • The Coordinating Executive Group enforces the decisions of the Group Joint Committee. 	<ul style="list-style-type: none"> • Southeast Florida Regional Climate Change Compact (composed of four counties) collaborates in DRM decision-making and created the Climate Action Plan. 	<ul style="list-style-type: none"> • The Association of Bay Area Governments facilitates coordination between San Francisco's Office of Capital Planning and Resilience and other governments in the Bay Area to implement Sustainable Communities Strategies. 	<ul style="list-style-type: none"> • The Regional Civil Protection Office and Regional Civil Protection Committee provide guidance and support to the Municipal Civil Protection Offices and Municipal Civil Protection Committees that make up the Santiago Metropolitan Region.
Bodies in charge of coordinating across government and external stakeholders at the local level (horizontal local coordination)	<ul style="list-style-type: none"> • The Coordinating Executive Group enforces the decisions of the Group Joint Committee. 	<ul style="list-style-type: none"> • Miami-Dade County's Office of Resilience and the City of Miami's Office of Resilience & Sustainability coordinate with the Cleo Institute, Real Estate Developers, The Miami Foundation, and F.R.I.E.N.D through information sharing, funding, and other mechanisms. 	<ul style="list-style-type: none"> • The Office of the Capital Planning and Resilience, spearheaded by the Chief Resilience Officer, oversees the Lifeline Council. • The Lifeline Council connects government departments, private utility companies, and other private organizations to conduct interdependence and other studies. 	<ul style="list-style-type: none"> • For the Santiago Metropolitan Region, the Regional Civil Protection Office works with a variety of public agencies, private basic services and utilities companies, and nonprofit organizations to plan and implement DRM strategies through the Regional Civil Protection Committee. • Municipal Civil Protection Offices also work with a variety of public agencies, private basic services and utilities companies, nonprofit organizations, and

				Neighborhood Councils to plan and implement DRM strategies through Municipal Civil Protection Committees.
Specific collaborative efforts with external stakeholders	<ul style="list-style-type: none"> • The Institute for Geological and Nuclear Sciences provides hazard information and hazard-monitoring data to the Group Joint Committee and Coordinating Executive Group. 		<ul style="list-style-type: none"> • The Applied Technology Council (ATC) performed a study to estimate the effects of future earthquakes and to inform the retrofit process. • Berkeley Seismology Lab supplies the local government with research on earthquakes and predictions for the future. 	<ul style="list-style-type: none"> • The Territorial Planning Laboratory of the Catholic University of Temuco, sponsored in part by ONEMI, developed the KimGenLab: Virtual Laboratory of Natural Risks in Chile. This interactive map promotes citizen learning and knowledge of risks associated with natural hazards.

Appendix E: Information Matrix

THEMES	CHRISTCHURCH	MIAMI	SAN FRANCISCO	SANTIAGO
<p>Risk Maps/Assessment</p> <p>a.) Who created and manages the information?</p> <p>b.) Is the information available to the public?</p> <p>c.) How can the information be accessed?</p>	<ul style="list-style-type: none"> • Geological maps <ol style="list-style-type: none"> a. Managed by a research and consulting business, created in collaboration with government, nonprofits, and businesses b. Available to the public c. Accessed online • Risk Matrix and Hazard Priority Table <ol style="list-style-type: none"> a. Government manages, made in collaboration with a research and consultancy agency b. Available to the public c. Accessed online 	<ul style="list-style-type: none"> • Sea Level Rise Map <ol style="list-style-type: none"> a. Local government manages, created in collaboration with FEMA b. Available to the public c. Accessed online • Flood Risk Map <ol style="list-style-type: none"> a. Local government, created in collaboration with FEMA b. Available to the public c. Accessed online as well as in PDF versions, physical copies can also be obtained but must be purchased 	<ul style="list-style-type: none"> • Berkeley Digital Seismic Network <ol style="list-style-type: none"> a. Academia manages, created in collaboration with Stanford's Geophysics Department and the United States National Seismic Network b. Available to the public c. Accessed online • Community Resiliency Maps <ol style="list-style-type: none"> a. Government runs in collaboration with nonprofits, academic institutions, and community members b. Available to the public c. Accessed online 	<ul style="list-style-type: none"> • KimGenLab: Virtual Laboratory of Natural Risks <ol style="list-style-type: none"> a. National government manages, created in collaboration with nonprofits, and academia b. Available to the public c. Accessed online and as an application for smartphone
<p>Building Information</p> <p>a.) Who created and manages the information?</p> <p>b.) Is the information available to the public?</p> <p>c.) How can the information be accessed?</p>	<ul style="list-style-type: none"> • Register of Earthquake-prone Buildings <ol style="list-style-type: none"> a. Government created and managed b. Information available to the public c. Accessed online 	<ul style="list-style-type: none"> • 311 Data Sets/Violation Maps <ol style="list-style-type: none"> a. Local government created and managed b. Available to the public c. Accessed online 	<ul style="list-style-type: none"> • Building Eye <ol style="list-style-type: none"> a. Created and managed by a for-profit organization b. Available to the public c. Accessed online • The Building Occupancy Resumption Program (BORP) <ol style="list-style-type: none"> a. Government runs in-collaborated with the Structural Engineers of Northern California (SEAONC) and the San Francisco chapters of the Building Owners and Managers Association (BOMA) and private sector companies b. Available to building owners c. Accessed online • Fire Department Inspection Map <ol style="list-style-type: none"> a. Created by a for-profit organization 	<ul style="list-style-type: none"> • Open Government Data Portal <ol style="list-style-type: none"> a. Government managed b. Available to the public c. Accessed online via login portal

			b. Available to the public c. Accessed online	
<p>Other</p> <p>a.) Who created and manages the information?</p> <p>b.) Is the information available to the public?</p> <p>c.) How can the information be accessed?</p>	<p>• Canterbury Civil Defense and Emergency Management Plan</p> <p>a. Government created and managed</p> <p>b. Available to the public</p> <p>c. Accessed online</p>	<p>• 311 Contact Center</p> <p>a. Local government created and managed</p> <p>b. Available to the public</p> <p>c. Accessed online, via calling, in person at a 311 service center, social media, in a mobile app</p>	N/A	<p>• Sistema Nacional de Información Municipal (SINIM)</p> <p>a. Government managed</p> <p>b. Available to the public</p> <p>c. Accessed online</p> <p>• Observatorio Urbano</p> <p>a. Government managed</p> <p>b. Available to the public</p> <p>c. Accessed online</p>

Appendix F: Communication Matrix

THEMES	CHRISTCHURCH	MIAMI	SAN FRANCISCO	SANTIAGO
Emergency Alert Systems	<ul style="list-style-type: none"> • Early Warning Systems: Local hazards identified by local agencies • Early Warning Systems: Central Gov't and Regional Council: Natural hazards (i.e. floods, tsunamis, earthquakes, wildfires, extreme weather) 	<ul style="list-style-type: none"> • Traditional methods: residents receive risk information via TV advertisements, infomercials, and radio stations, and paper mail 	<ul style="list-style-type: none"> • ALERTSF: text-based hazard notification service 	<ul style="list-style-type: none"> • Conventional channels of communication (print media, broadcast tv and radio); National and Local Gov't social media accounts (e.g., Twitter) • Informed by experts • Early Warning Systems: controlled primarily by National Emergency Office
Education & Capacity Building	<ul style="list-style-type: none"> • CDEM “Be Prepared” Resources for preparedness “At Home,” “At School,” “At Work,” and “In Your Community” • Learning about disasters incorporated into school curriculum 	<ul style="list-style-type: none"> • Lack of capacity building: general consensus by nonprofit groups that there is an information gap between the government and marginalized/low-income populations regarding risk communication. 	<ul style="list-style-type: none"> • Building Occupancy Resumption Program: program intended to expedite post-disaster building inspection • Vulnerable Population Working Groups: informs and connect with vulnerable groups on preparedness 	<ul style="list-style-type: none"> • Programs in Academia aimed at the specialization of DRM • ONG Inclusiva informing disabled population
Information that Informs Policy	<ul style="list-style-type: none"> • Online registry of Earthquake-prone Buildings 	<ul style="list-style-type: none"> • The Sea Level Rise Map: tool created by professionals, academics, and local government information tools to facilitate communication needed for preparing for sea-level rise. 	<ul style="list-style-type: none"> • Community Indicator Resiliency Maps: Visually displays quantitative data related to social vulnerability, environmental hazards, and community development 	<ul style="list-style-type: none"> • Disaster Risk Analysis for World Heritage Sites
Coordinating Information	<ul style="list-style-type: none"> • Quarterly meetings with mayors with opportunity for constituent feedback, comment, opportunity to connect the private and nonprofit sector, input on land-use plans, and determination of earthquake-prone registration for 	<ul style="list-style-type: none"> • Informal Methods: a WhatsApp group used by 90 experts in government, nonprofits, and academia to discuss adaptation to risks. • F.R.I.E.N.D. (Florida Regional Interfaith Interagency) 	<ul style="list-style-type: none"> • MyShake App: a citizen science project that allows users to create a global seismic monitoring network • Berkeley Digital Seismic Network: seismic monitoring network based in Northern California 	<ul style="list-style-type: none"> • Civil Society Councils: provide an avenue for organized civil society organizations to provide input on DRM • Meetings in low-income areas to develop Personal Disaster Contingency Plans

	<p>buildings</p> <ul style="list-style-type: none"> • Maori have a separate system for communicating with government 	<p>Emergency Network for Disaster): works with county/county agencies and FEMA to produce the Flood Zone Maps</p>		<ul style="list-style-type: none"> • One-on-one meetings prevalent between local gov't and residents
<p>Risk Communication</p>	<ul style="list-style-type: none"> • CDEM: posts information on risks online and through the newspaper 	<ul style="list-style-type: none"> • 311 Contact Center: allows residents to find information on local government services, make service requests, access risk information, and report problems 	<ul style="list-style-type: none"> • SF72: an online platform for collaborating, building neighborhood capacity, and promoting disaster preparedness 	<ul style="list-style-type: none"> • Local Disaster Risk Management emphasis on one-on-one conversations about risk

Appendix G: Case Study Interviews

Christchurch Interviews:

- Government: Ministry of Civil Defence & Emergency Management
- Nonprofit: START
- Academia: Victoria University of Wellington School of Government
- Business: Southern Dairy New Zealand

Miami Interviews:

- Government: Miami-Dade County Office of Resiliency
- Nonprofit: Florida Regional Interfaith / Interagency Emergency Network for Disaster (F.R.I.E.N.D.)
- Nonprofit: Social Impact Movement
- Nonprofit: CLEO Institute
- Nonprofit: The Miami Foundation
- Academia: University of Miami

San Francisco Interviews:

- Government: San Francisco's Office of Resilience and Capital Planning
- Academia: Berkeley Seismology Lab

Santiago Interviews:

- Government: Municipality of Santiago Civil Protection and Emergencies Office

Appendix H: Case Study Interview Questions

General Questions:

- *What is your title/Could you confirm it?*
- *How long have you been in your position?*
- *What is your role and responsibility in prevention and mitigation?*

Sector Specific Questions:

Government

- Coordination
 - Have you seen any major changes in your field for coordination?
 - Do you work more with city or county agencies?
 - Who are the main decision makers in your city? (decision makers for land use, mitigation, whatever is relevant for your case study)
 - Who leads/influences the mitigation efforts/policy?
 - Who leads/influences prevention efforts/policy?
- Information
 - How do you receive information? From Whom?
 - What tools access to and disseminate info?
- Communication
 - What tools access to and disseminate info?
 - How do you share information with marginalized communities?
- Miscellaneous
 - Have you been affected by any recent budget changes?
 - What success are you seeing in [BLANK]?
 - What challenges are you seeing in [BLANK]?
 - What improvements would you like to see with [BLANK]?

Nonprofits

- Coordination
 - Do you work more with city or county agencies?
 - Who are the main decision makers in your city? (decision makers for land use, mitigation, whatever is relevant for your case study)
 - Who leads/influences the mitigation efforts/policy?
 - Who leads/influences prevention efforts/policy?
- Information
 - How do you receive info? From Whom?
 - What tools access to and disseminate info?
- Communication
 - What tools access to and disseminate info?
- Miscellaneous
 - Have you been affected by any recent budget changes?
 - What success are you seeing in [BLANK]?
 - What challenges are you seeing in [BLANK]?

- What improvements would you like to see with [BLANK]?

Academics

- Coordination
 - Do you work more with city or county agencies?
 - Who are the main decision-makers in your city? (decision-makers for land use, mitigation, whatever is relevant for your case study)
 - Who leads/influences the mitigation efforts/policy?
 - Who leads/influences prevention efforts/policy?
- Information
 - How do you receive info? From Whom?
 - What tools access to and disseminate info?
- Communication
 - What tools access to and disseminate info?
 - How do you make your research/findings accessible and understandable?
- Miscellaneous
 - Who do you see as your audience? Public or government?
 - How are authorities and responsibilities delegated between different agencies? Who does what? Do you feel like it is successful?
 - How did your partnerships form?
 - How do you engage with communities?
 - How does committee/councils work?
 - How are members chosen? appointed/elected? How often do members rotate? formality?

Appendix I: List of Meetings - Mexico City Trip (January 2020)

1. Professor: Institute of Geography, National Autonomous University of Mexico (UNAM)
2. Director of Risk Analysis, Director of Resilience, and Director of Outreach, Training, and Communication: Mexico City Department of Risk Management and Civil Protection
3. Community Leaders: Plataforma 06600
4. Policy Analysts: National Center of Disaster Prevention (CENAPRED)
5. Director of Territorial Services: Commission for Reconstruction
6. Ecological Tour Guide: Humedalia
7. Community Leaders of San Gregorio, Xochimilco: Community of San Gregorio, Xochimilco

Appendix J: Important Links

Christchurch

Plans

- Canterbury Civil Defense and Emergency Management Plan and Risk Profile: The purpose of this document is to provide information on all phases of DRM. Additionally starting on page 25, this document has the risk profile of the region.
 - <http://cdemcanterbury.govt.nz/document-library/cdem-plans/>

Education

- This webpage for the Canterbury CDEM Group provides educational material on how to prepare for a disaster in a variety of different settings such as home, work, and school.
 - <http://cdemcanterbury.govt.nz/be-prepared/>

Information

- This link provides information on the Earthquake-prone Building Register that was mandated by the Central government and implemented at the local level.
 - <https://ccc.govt.nz/consents-and-licences/earthquake-prone-buildings/earthquake-prone-buildings-register>

Miami

Maps

- GIS Portal: The City of Miami has a website that houses different maps including: Miami Zoning, City Officials, City Services, and an Assisted Housing map.
 - <http://maps.miamigov.com/portal/>
- Sea Level Rise Map: The link provides information about sea level rise in Miami-Dade County and includes different interactive maps including: building impacts of sea-level rise & maps showing the progress of all local mitigation strategy projects.
 - <https://www.arcgis.com/apps/Cascade/index.html?appid=6ff1c86445114dc7b82e13b67b439093>
- FloodIQ: This map is not specific to Miami but does serve as a tool for people to enter their address and learn about their flood risk and how to protect their homes.
 - <https://floodiq.com>

Apps

- 311 Direct: 311 is a mobile app which enables the residents of Miami-Dade County and City of Miami to report neighborhood problems and code violations to the 311 Contact Center.
 - <http://maps.miamigov.com/portal/>

Other Mobile Tools

- 311 Contact Center: this website serves as a central location where residents can get information on local government services.

- <https://www.miamidade.gov/global/311.page>

Database/Information Portals

- Next Request: The City of Miami's Portal for Public Record Requests. This database shows all open and closed requests made to get access to public records including anything from EMS records to any records relating to a project carried out by the city.
 - [https://miami.nextrequest.com/requests?requests_smart_listing\[page\]=2](https://miami.nextrequest.com/requests?requests_smart_listing[page]=2)
- Open Data HUB: Open Data Hub provides access to the county's authoritative data, maps and applications for county residents and visitors.
 - <https://gis-mdc.opendata.arcgis.com>

Partnerships

- The Miami Foundation: This nonprofit partners regularly with both the city and county on various disaster efforts, including writing grants for recovery and mitigation strategies.
 - <https://miamifoundation.org>
- The CLEO Institute: This organization works to educate, inform, and engage the public on critical climate issues and the importance of urgent climate action. They partner with the government to provide interactive climate workshops for municipality employees.
 - <https://www.cleo-institute.org/cleo-climate-trainings>
- The Florida Regional Interfaith InterAgency Emergency Network for Disasters, Inc. (F.R.I.E.N.D): This is a Long-Term Recovery Group for Miami-Dade County is a coalition of over 65 local faith and community-based organizations. There is currently no website available for this network.

San Francisco

Maps

- Community Resilience Indicator Maps: The purpose of the community resiliency indicator system is to provide quantitative measurements of resiliency and vulnerability to climate change stressors in San Francisco's neighborhoods.
 - <https://sfclimatehealth.org/maps/>

Apps

- MyShake App (Available on Google Play and Apple App): The MyShake App collects data on, detects, and records seismic activity. It also allows citizens to share their experiences and stay informed regarding nearby earthquakes.
 - https://play.google.com/store/apps/details?id=edu.berkeley.bsl.myshake&hl=en_UShttps://apps.apple.com/us/app/myshake/id1467058529

Other Mobile Tools

- ALERTSF: AlertSF is a Mass Notification service that allows the City and County of San Francisco Public Safety agencies to alert residents in the event of natural disasters and

other emergency situations.

- <https://member.everbridge.net/453003085612609/ov>

Databases/Information Portals

- Building Eye: Building Eye makes building and planning information easier to find and understand by mapping what type of building issues and modifications have happened or will occur around San Francisco. The website provides vital information such as construction plans, maintenance reports, and tenant complaints.
 - <https://buildingeye.com/>
- SF72: A disaster information platform on social media that allows citizens to receive real-time emergency information, safety tips, and action plans.
 - <https://www.sf72.org/>

Partnerships

- Berkeley Digital Seismic Network: Partners with local and state governments to deliver information on Earthquakes and aids the operation of early warning systems. They also created the My ShakeApp.
 - <https://seismo.berkeley.edu/bdsn/bdsn.overview.html>

Santiago

Plans

- Plan Nacional de Protección Civil
 - http://repositoriodigitalonemi.cl/web/bitstream/handle/2012/1683/DTO-156_13-JUN-2002.pdf?sequence=4
- Plan Regional para la Reducción del Riesgo de Desastres
 - http://repositoriodigitalonemi.cl/web/bitstream/handle/2012/1863/P-PRRD-PO-A-RD-04_RM_13.11.2018.pdf?sequence=5
- Plan Estratégico ONEMI 2019-2023
 - <https://www.onemi.gov.cl/plan-estrategico/>
- Santiago's Regional Plan for Coordination between Government and Other Sectors for DRM via the Comité Regional de Protección Civil
 - <https://www.interior.gob.cl/transparenciaactiva/doc/ActosTerceros/1/5540542.pdf>

Maps

- KimGen Lab: Virtual Laboratory of Natural Risks in Chile: The project seeks to strengthen the learning of Geography and Natural Risks, through a national educational, technological platform, to improve the response capacity and decision-making of people in the face of the occurrence of catastrophic natural events.
 - <https://kimgen.cl/>

Information Portals

- Ley de Transparencia de la Función Pública y Acceso a la Información del Estado: The law provides for free access by the citizenry to government documents, public budgets and records of expenses, and any other document produced using public funds.
 - <https://www.consejotransparencia.cl/>
- Sistema Nacional de Información Municipal (SINIM): information is available from 2001 to 2009 in the areas of Administration and Finance, Health, Development, and Territorial Management, Social Aspects and Community, as well as Gender and municipal Characterization
 - <http://www.sinim.gov.cl/>
- Observatorio Urbano del Ministerio de Vivienda y Urbanismo (OU MINVU): Generates knowledge, through the development of studies, surveys, and publications of interest, for decision-making by the authority in the residential and urban sphere.
 - <https://www.observatoriourbano.cl/>

Citizen and Civil Society Inclusion

- Neighborhood Councils (Juntas de Vecinos)
 - Summary of the function and purposes of Neighborhood Councils
 - <https://www.bcn.cl/leyfacil/recurso/juntas-de-vecinos>
 - An example of how these councils are included in DRM via Civil Protection Committees can be found on pp. 78; 114-115. It is important to note that, though these committees are present, they are not formally given significant roles or responsibilities in this plan.
 - <https://www.munistgo.cl/wp-content/uploads/2017/08/PlanComunalDeProteccionCivil-2017-2020-web.pdf>
- Civil Society Councils (Consejos de la Sociedad Civil (COSOC))
 - Structure and functions of the Consejo Comunal de Organizaciones de la Sociedad Civil in the Municipality of Santiago (see the tab “Funciones”)
 - <https://www.munistgo.cl/consejo-comunal-de-organizaciones-de-la-sociedad-civil-2/>

Communication

- Municipal Online Communications Regarding DRM Efforts and Citizen Outreach
 - Online resources for citizens regarding earthquake prevention
 - <https://www.munistgo.cl/emergencias/>
 - Online article regarding the launch of the 2020 Disaster Risk Management Plan and disaster preparedness courses available to citizens
 - <https://www.munistgo.cl/municipio-lanzo-plan-de-gestion-de-riesgos-ante-desastres/>

- NGO Communications about Prevention and Mitigation via a Training in Risk Analysis and Reduction Carried out by the NGO Caritas Chile
 - Article on Caritas Chile's Taller Nacional de Medioambiente, Gestión de Riesgos y Emergencias
 - http://www.iglesia.cl/detalle_noticia.php?id=20926

Education

- KimGen Lab: Virtual Laboratory of Natural Risks in Chile: Educating the Community
 - <http://www.lpt.cl/kimgen-lab-laboratorio-virtual-de-riesgos-naturales-de-chile-hace-entrega-de-sus-productos-a-una-comunidad-educativa/>

Partnerships

- Partnership between ONEMI and ONG Inclusiva produced Inclusive Emergency Management Manual (Manual de Gestión Inclusiva de Emergencias)
 - <https://igrd.cl/manual-de-gestion-inclusiva-de-emergencias-derechos-humanos-de-las-personas-con-discapacidad-durante-emergencias/>

U.S. Accreditations

- Trainings
 - This link provides an overview of the Emergency Management Institute and its purpose within DRM for the United States. It helps train 2 million individuals annually at various levels of government. Oftentimes, positions will ask for or require specific training that EMI provides.
 - <https://training.fema.gov/aboutemi.aspx>
 - The Emergency Management Institute runs all the courses needed for individuals. Some courses can be accomplished online while others are done in-person. The courses can help individuals understand how to construct a plan to position specific training.
 - <https://training.fema.gov/is/>

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