"Don't Let a Good Disaster Go to Waste": Investigating Emergent Desires for Urban Resilience at The City of Calgary

by

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B.A. Sociology (Hon), University of Calgary, 2014

Project Submitted in Partial Fulfillment of the
Requirements for the Degree of
Master of Urban Studies

in the

Urban Studies Program
Faculty of Arts and Social Sciences

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SIMON FRASER UNIVERSITY
Spring 2018

Approval

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Abstract

This study is about urban resilience as an emergent concept at the City of Calgary in the wake of several significant crises. It looks at how the crises affected institutional operations, and whether the changes in operations principles conformed to a theoretically robust conceptualization of urban resilience. Using a mixed methods approach of document analysis and key informant interviews, I examine City staff's desires for a more proactive approach to infrastructure and operations decision-making processes and identify major gaps and tensions in their understanding and use of urban resilience concepts. I present evidence that city staff's vague resilience definitions and priorities conflict with other tensions within the bureaucracy and contribute to the justification and entrenchment of status quo operations. This research contributes to our knowledge of the challenges of navigating resilience concepts and planning for urban resilience at the municipal level.

Keywords: urban resilience; socioecological resilience; urban politics; disaster management; Calgary flood; 100 Resilient Cities

Acknowledgements

I respectfully acknowledge that Simon Fraser University is located on unceded Coast Salish land; the traditional territories of the Musqueam, Squamish, and Tsleil-Waututh First Nations. Additionally, the subject of my research, Calgary, is located on the traditional lands of the people of the Treaty 7 region; the Blackfoot Confederacy (Siksika, Piikani, and Kainai First Nations), the Tsuut'ina First Nation, the Nakoda (Chiniki, Bearspaw, and Wesley First Nations), and Métis Nation of Alberta, Region III.

This project would not have been realized were it not for the influence of Karen Ferguson, Meg Holden, Peter V. Hall, Anthony Perl, Noel Dyck, Matt Hern, and Terri Evans, whose teachings, guidance, and brilliance have been indispensable to me throughout my studies and research.

I am eternally grateful to my supervisor Karen Ferguson, for her guidance and dedication throughout my laborious writing process. Her high standards, thorough feedback, and belief in my success enabled me to produce a thesis I can be proud of.

I would like to acknowledge the interview participants who so generously gave their time for my research and whose stories and insights have shaped my understanding of urban resilience.

I wish to thank all my peers and colleagues in the Urban Studies program with whom I have had the pleasure and privilege of sharing my graduate experience. A special thank you to my fellow graduate association committee members, for lending credence to my leadership abilities and closely supporting me throughout the past year.

My thanks extends to my colleague Liam Cummings at the University of Calgary, who has been an island of wisdom in an ocean of dubiety throughout my academic career. Finally, I would be remiss to overlook my most devout supporters – my parents. Thank you for doing all you could to support me despite the distance.

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100RC	100 Resilient Cities
ACER	Accelerated Capital for Economic Resilience
CED	Calgary Economic Development
CEMA	Calgary Emergency Management Agency
COC	City of Calgary
EOC	Emergency Operations Centre
ER	Economic Resilience Strategy
ROC	Recovery Operations Centre

Introduction

This study is about urban resilience as an emergent concept for the local government in Calgary, Alberta after being affected by recent crises. This study investigates this topic using a two-part research question: "How have recent economic and environmental crises interrupted status quo operations at the City of Calgary?" and "To what extent do these post-crisis operations principles conform to a robust definition of urban resilience?" In order to answer these research questions, I investigate conceptual and institutional changes at the City of Calgary related to the repercussions of the crises and compare elements of the changes to urban resilience theory.

The application of ecological concepts to urban systems through the idea of urban resilience has become a popular topic in academia and professions such as urban planning. The recent flowering of resilience literature makes for lively academic discussion in various fields, but poses challenges to defining and operationalizing resilience in policy relevant applications (Crowe, et al., 2016; Davoudi, 2012). The lack of conceptual clarity has caused resilience to become a "boundary object" (Brand & Jax, 2007) - a concept that is vague enough to bridge different disciplines or academic and political spheres, but also conceal power structures and agendas. Despite the lack of consensus on the standards for measuring urban resilience, and perhaps because of its elasticity as a boundary object, municipalities often adopt the objective of urban resilience without serious consideration of the theory, which sometimes leads to the creation of multiple conflicting priorities and undesirable consequences (Davidson, 2010; Weichselgartner & Kelman, 2014).

Specifically, this study is about how and why urban resilience concepts have entered the discussions, operations, and decision-making processes of the City of Calgary, and in what ways the use of urban resilience concepts creates, exacerbates, or highlights barriers to institutional change. Through key informant interviews, I examine the tensions within a municipal bureaucracy as it tries to cope with disasters and crises, and a changing economic landscape. I uncover the common understandings of resilience concepts at the City of Calgary, and the unique challenges of planning for urban resilience. I compare those understandings to a normative framework of resilience, and identify opportunities for improvement. I contextualize the City of

Calgary's current experience within its political history, and situate the case study within wider trends of urban politics. In order to explain the significance of this case for investigation, I will first present some details.

Calgary is a city of 1.2 million in the foothills of the Rocky Mountains of Alberta, Canada. The city plays a large role in the economy of Alberta due to the success of the oil and gas industry, which centers around Calgary as the site of many energy company headquarters. The rise of the profitable oil and gas industry has shaped Calgary's economy, culture, politics, and built form. High rates of population growth and the proclivity for suburban living has contributed to Calgary's large footprint – it is the size of New York with 1/8th the population - which is challenging for the municipality's infrastructure planning (Howard, 2015). As the price of oil fluctuates, Calgary experiences periods of intense economic growth followed by sudden economic recessions of indeterminate length, which is also challenging for the municipality.

The City of Calgary responded to a string of crises from 2013 to 2015 including a flood, a snowstorm, a fire, and an economic recession. City staff recall these events as having significant impact on their work, the most significant being the 2013 flood, which was the worst flood the City had seen in over 100 years ("Calgary's Most Damaging Flood," 2014). Through experiencing the disaster response to the flood, some City staff gained an urgent desire to make proactive decisions regarding disaster management strategies for Calgary. Currently, some City staff have recognized the utility of the concept of resilience for providing a focal point for the disaster management discourse that emerged after the flood, managing urgent concerns about disaster management, and opening new avenues for dialog between City units.

Calgary is known for being a prosperous, conservative, oil-dependent, pro-business city. The City of Calgary's past progressive urban development endeavours, such as the long term sustainability plan "Plan It", have been met with resistance from the business and development community (Howard, 2015). However, since 2013, support for City urban resilience initiatives has grown without any clear or significant criticism. One possible explanation would be that urban resilience at the City has avoided serious criticism because resilience concepts resonate with a significant proportion of the development and business community. Another possibility is that recent events and political shifts have paved the way for more progressive urbanism. A third

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possibility also exists; urban resilience is not being used to forward progressive urban politics, but to justify status quo procedures. The combination of the political history, recent crises, and sudden interest in resilience concepts make this a worthwhile case for investigating the challenges of planning for urban resilience.

Literature Review

Urban resilience: conceptual origins and development

Enhancing urban resilience has become a crucial strategy for managing contemporary urban concerns such as population growth and the repercussions of climate change (Wardekker et al., 2010; Desouza & Flanery 2013; Caputo et al. 2015). Ideas from ecological resilience models have been applied to urban planning resulting in advancements in "the identification of the unpredictable, non-deterministic processes and disturbances that a landscape or city is vulnerable to" (Ahern, 2011 quoted in Crowe et al., 2016) and strategies for creating opportunities for greater self-organization and community-based action for community wellbeing (Crowe et al., 2016; Wardekker et al., 2010). The literature on socio-ecological and urban resilience is diverse and emergent, which contributes to the usefulness of the resilience concept for various disciplines and applications, but also results in some difficulties for operationalization (Caputo et al., 2015; Davoudi, 2012).

In order to understand the fundamentals of resilience and the roots of some of the challenges of planning for urban resilience, this chapter begins with a discussion of the origins, development and major criticisms of resilience theory and its applications. Since this study will explore how resilience concepts factor into the City of Calgary's (COC) institutional tensions and contradictions, a portion of this chapter addresses major challenges to urban resilience from the literatures of urban resilience and socioecological resilience. I have developed a normative definition and framework for urban resilience based on the research of Meerow et al (2016), Crowe et al (2016), Davidson (2010), Liao (2012), and Tyler & Moench (2012) in order to examine how operational changes at The City of Calgary are connected to approaches to urban resilience. The final section of this chapter details the framework that was synthesized from the literature to aid in the interpretation of the findings.

Resilience was first popularized in 1973 by C.S. Holling in his seminal work *Resilience and Stability of Ecological Systems*. In C.S. Holling's original conceptualization resilience is defined as, "the measure of the persistence of systems and of the ability to absorb change and disturbance and still maintain the same

relationships between state variables (Holling, 1973, p.14). Holling contrasts resilience with a definition of stability: "the ability of a system to return to an equilibrium state after a temporary disturbance" (Holling, 1973, p.14). Holling disputed the utility of the common practice of viewing ecological environments in terms of equilibrium. This view does not capture the behaviour of systems that are not near equilibrium due to natural disturbances or human actions (Holling, 1973). Viewing systems in terms of equilibrium and stability focuses on prediction, maintenance, and avoiding fluctuations (Holling, 1973, p. 21). Holling argued for more focus on resilience as a concept which better explains dynamic system behaviour, and which should not be equated with stability (Holling, 1973). Holling's conceptualization and suggested use of resilience acknowledges the limits to human knowledge and the unpredictability of disturbances and calls for the design of flexible and adaptive systems (Holling, 1973, p. 21). Resilience and stability as separate and incompatible viewpoints remained a theme in Holling's works, but not all current uses of resilience respect this distinction.

An assumption that all definitions of resilience are compatible has significant repercussions for the operationalization of resilience in an urban setting. In order to show how this happens, I'll use another work by Holling which builds on the fundamental distinction between resilience and stability. Holling (1996) contrasts ecological resilience and engineering (also called mechanical) resilience, which are both commonly used in different disciplines, but have very different definitions (Davoudi, 2012; Fiksel, 2007). Ecological resilience is relevant for systems which can have multiple equilibrium states, whereas engineering resilience requires a system with one steady equilibrium state (Holling, 1996, p. 33). Engineering resilience emphasizes "efficiency, constancy, and predictability" as required for the design of "fail-safe" systems (Martin & Sunley, 2015, p. 4). In this definition, the speed at which the system returns to a state of equilibrium is the measure of resilience (Davoudi, 2012). Ecological resilience doesn't require a steady state or equilibrium but instead views a system as having multiple valid equilibria and does not hold value judgements about any given the state of the system (Adger & Brown, 2009; Davoudi, 2012). This is significant since it is possible for a system to be ecologically resilient but no longer productive for human purposes, since all states of the system are natural and not viewed in terms of human desire (Adger & Brown, 2009, p. 111). The difference between engineering and ecological resilience represents a fundamental split in views of system behaviours and functions. One viewpoint sees

urban systems as deterministic and predictable. The other views urban systems as dynamic and complex. In an urban system, aspiring to engineering resilience means quickly returning to normal functions after a disturbance, and emphasizes the stability of status quo operations. Aspiring to ecological resilience means adapting to changing conditions and learning about opportunities for improvement with each disturbance. Going back to Holling's original conceptualization, we see that engineering resilience is about *stable systems*, and ecological resilience is about *dynamic, adaptive systems*. Most urban resilience scholars subscribe to the ecological resilience perspective, since it most closely aligns with Holling's original conceptualization of system resilience and provides more in terms of understanding dynamic urban systems (Adger & Brown, 2009; Meerow et al., 2016; Pendall et al., 2010). I use this fundamental distinction as a theoretical tool to recognize the repercussions of different resilience conceptualizations and approaches at the COC.

Despite the importance of the difference between engineering and ecological resilience, this distinction is not always acknowledged in practical applications designed by resilience planners. Additionally, disciplines such as engineering, supply chain management, and psychology have also independently developed definitions of resilience particular to those fields, which has contributed to the popularity and widespread use of the term and also to the numerous definitions of resilience in existence today (Bhamra et al., 2011). Due to the variety of applications of resilience, there is no single agreed upon definition of resilience in socio-ecological or human systems. Resilience planners have a variety of conceptualizations to choose from. Each definition has a set of assumptions and values that are placed on the system as part of the goals for resilience, which may or may not be recognized and clearly stated. I devote a significant amount of time in this study to illuminating the City staff's understanding of resilience so as to reveal the inherent assumptions and values about the City of Calgary they hold.

Some definitions vary subtly by a few words such as the replacement of "tolerate" with "absorb" or "reorganize" with "transition" (Bhamra et al., 2011, p. 5379). This variance in word choice or emphasis can alter the conceptualization of resilience. For instance, a frequent component of resilience definitions is the notion of "bounce-back" ability, or the ability of the system to quickly return to the "normal" state (Martin & Sunley, 2015; Meerow et al., 2016). Definitions that include properties of "bounce-back ability"

are more aligned with the engineering resilience definition (Martin & Sunley, 2015, p. 3). Furthermore, engineering resilience tends to emphasize reliance on "the strength of individual components" whereas ecological resilience focuses on retaining functionality by increasing "flexibility and diversifying functional dependence", i.e., redundancy (Tyler & Moench, 2012, p. 313). This distinction has significant implications for the measurement and assessment of the properties of the system being guided by a particular definition. Without clearly stating which conceptualization is being followed, resilience planners overlook the complexity of the concept and its application and run the risk of employing conflicting concepts. I pay particular attention to wordings and vocabulary in the interpretation of the findings for this reason.

Given the transdisciplinary and uncontested use of vaguely-defined resilience concepts, many scholars are concerned about the usefulness of the concept of resilience (Brand & Jax, 2007, Caputo et al., 2015; Davoudi, 2012; Pendall et al., 2010; Tierney, 2015). Resilience scholars fear that resilience definitions are "lacking in conceptual clarity and therefore difficult to operationalize resulting in a lack of acceptable supporting empirical evidence" (Simmie, 2014, p. 104). Without an agreed upon definition of resilience and no commonly accepted methodology for measuring resilience some have questioned the validity of the concept of resilience entirely, claiming it is "too vague to be useful" (Davoudi, 2012; Hanley, 1998, p. 248). Still, many advocates of urban resilience find utility in the concept. How resilience planners navigate the numerous definitions and conceptualizations of resilience is understudied. This study explores some examples of how City staff handle the ambiguity and how the lack of conceptual clarity affects the practical use of resilience concepts.

Why resilience concepts are used is also of significance to this study. Where the City of Calgary finds value in employing urban resilience concepts for city planning is not only significant for resilience scholars interested in the use of the concepts, but also for gleaning information about City operations. Some scholars see the popularity of resilience and the vague and conflicting conceptual foundation as indication of the kind of value resilience holds. The meaning of resilience has shifted from its origin as a concept for understanding ecological systems to having a broader meaning as "a way of thinking, a perspective or even paradigm" (Brand & Jax, 2007 n.p.). Some scholars claim that resilience is a "boundary object" - an idea or term that enables communication across disciplines or between science and policy (Brand & Jax, 2007; Tierney, 2015).

Boundary objects are "vague and abstract" which allows "different fields to work together without first having to settle disagreements about exactly what a concept or idea means" (Tierney, 2015, p. 1331). However, these vague concepts with assumed definitions can be exploited to "legitimize the activities of groups" and "hide conflicts and power relations" (Tierney, 2015, p. 1331). While boundary objects such as resilience may facilitate transdisciplinary communication, they do so at the expense of conceptual clarity and become "inherently ambivalent" concepts (Brand & Jax, 2007 n.p.).

This confusion regarding the meaning of urban resiliency fits into a general problem in the field of urban and regional studies to retreat into an abstract territory where concepts lack clarity and are difficult to operationalize (Markusen, 1999). Language choices such as the passive voice and the addition of "-ism" and "-ization" removes the object of study from actors and structures and makes it difficult to know and recognize what is being studied (Markusen, 1999, p. 870). Markusen calls these terms "fuzzy concepts" (1999). To prevent cases of fuzzy concepts, researchers and scholars must be able to "answer the question, 'how would I know it when I see it?'" when proposing new concepts (Markusen, 1999, p. 871).

Resilience scholars have noted that "resilience concepts are sufficiently undefined and emergent to risk considerable 'fuzziness'" (Pendall et al., 2010, p. 80). In this study I comment on both the "fuzzy" and "boundary object" critiques of resilience and the consequences of ill-defined resilience concepts for urban resilience initiatives at the COC. Since resilience concepts have received heavy criticism, scholars are looking at opportunities to strengthen the definition and conceptualization of urban resilience by returning to ecological concepts (Pendall et al., 2010). Resilience, as a fuzzy concept and a boundary object, has the advantage of a strong resilience discourse in ecology in which researchers can find standards for operationalizing the concept and confirming evidence of resilience. Returning to ecology will provide a base from which to devise an understanding of urban resilience that incorporates the flexible, adaptable view of urban systems that Holling (1996) described as the ecological resilience model. By starting with the ecological concepts, the potential to confuse or equate resilience and stability can be avoided, and thus it becomes easier to create a conceptual framework for urban resilience based on an understanding of cities as dynamic systems. The normative position from which I investigate urban resilience initiatives at the COC is based on ecological resilience for these reasons. However, even though ecological concepts can

provide a base from which to develop a thorough and clear framework, operationalizing the complexity of urban systems is not a straightforward task. The next section deals with some of the challenges that arise in the application of resilience concepts to urban systems.

Urban resilience: challenges and limitations

Cities today face many acute and chronic problems such as those that stem from climate change, natural disaster, civil unrest, or social inequality. Urban resilience has emerged as a concept capable of providing a framework for dealing with sudden crises and the complexity of urban problems in a way that previous ideas for progressive urbanism such as sustainability cannot (Spaans & Waterhout, 2017). However, there are many challenges associated with the creation and application of a normative resilience framework for complex, dynamic urban systems. Some of the challenges arise from circumstances born of the history, power, and politics unique to the locale, while others result from difficulties in understanding and operationalizing resilience theory. This section discusses the hurdles and cautions along the road to urban resilience.

As I discussed in the previous section, ecological and socio-ecological resilience theory suffers from a lack of clarity, which many scholars have noted (Brand & Jax, 2007; Davoudi, 2012; Pendall et al., 2010, and others). This drawback becomes magnified as the concept is applied to urban environments and operationalized into frameworks and policies. Local governments have the difficult task of "interpreting resilience and developing meaningful policy answers" (Spaans & Waterhout, 2017, p. 115) for a particular urban context without "reducing it merely to box-ticking assessments" (Weichselgartner & Kelman, 2014, p. 27). The challenge for resilience scholars lies in creating policy relevant understandings of urban systems that planners and politicians can grasp (da Silva et al., 2012).

The unsettled and vague nature of resilience theory is being addressed as resilience theory evolves into clear schools of thought through successive debates and discussions. There is abundant literature critiquing and analyzing resilience theory and applications thereof. This makes the theoretical limitations the "starting point" for using the term and any use of resilience must begin with a thorough discussion and explanation of how the limitations will be remedied (Weichselgartner & Kelman, 2014, p.

28). As resilience continues to undergo "soul-searching in the literature", discussions and debates will help to refine the concept (Weichselgartner & Kelman, 2014, p. 28).

Another big hurdle in planning for urban resilience is the fact that many qualities of urban systems are "unknowable", and yet, the nature of contemporary urban planning is centered on utilizing available information to create plans (Desouza & Flanery, 2013). The current state of the system, the when and where of potential disasters, the effects of interventions, and the optimal desired state of urban resilience are all unknowables that cities must recognize and accept (Marshall, 2012). Everything is subject to change, which makes prediction and planning difficult. Indeed, decisions will be made in uncertainty and lessons will be learned the hard way (Spaans & Waterhout, 2017). In order to reconcile this, resilience managers must focus on process instead of product. A shift to more "evolutionary, selective, generative, and adaptive" ways of managing urban systems will better accommodate for uncertainty and unknowability (Desouza & Flanery, 2013, p. 91). Urban resilience planners must grasp the idea that "preparing to become more resilient is not the same as being resilient" since preparation only goes so far in a complex, dynamic urban system, and therefore urban resilience requires a certain amount of adaptability and resourcefulness in the face of unforeseen circumstances (Spaans & Waterhout, 2017, p. 115).

Other challenges involve the repercussions of certain choices pertaining to the urban system and its boundaries. The scale and boundaries of an urban system are not definite or self-evident, and so questions of who and what is included or excluded, where and when, will greatly affect the nature of urban resilience planning (Beilin & Wilkinson, 2015). Urban resilience planners should be prudent in their choices regarding scale and boundaries since, as Davoudi (2012) warns, "in a social context, a bounded approach soon leads to exclusionary practices" (p.305).

Furthermore, decisions in resilience planning can exacerbate or remedy existing social and environmental problems depending on the agenda and viewpoint of the resilience managers. It's possible for knowledge of the formation and maintenance of social inequalities and injustices to be lost or overlooked in the process of trying to see urban systems "through the lens of ecology" (Davoudi, 2012, p. 306). Defining the terms of desirable resilience outcomes requires making normative judgements, the foundations of which should be addressed and justified lest the structures of power and inequality be

reproduced (Davoudi, 2012). To not address the social ills of a city is to fail at planning for resilience. As Weichselgartner & Kelman (2014) make an argument with the rhetorical question, "if slums, favelas, and ghettos are sustained and made to be resilient, how much does that help the people living there?" (p.27). However, their point is contested since others have argued that pro-poor planning organizations such as Slum Dwellers International do more to improve the lives of marginalized groups than top-down, poverty-reduction strategies (Satterthwaite, 2001). Put simply, resilience planners make decisions that both shape urban challenges and respond to them (Davoudi, 2012).

Beyond the agency of individual resilience planners, there are larger, more diffuse institutional and political power structures impeding the application of urban resiliency concepts. In other words, another challenge of planning for resilience is overcoming the inertia of existing political and power systems when trying to encourage or embrace change (Chelleri et al., 2015, p. 194). An inflexible or "non-responsive" power structure could mean that "communities may have a limited voice or power to create change" (da Silva et al., 2012, p. 128). Going the grassroots way might be an alternative strategy for building resilience. Indeed, the resilience benefits of "co-designed bottom-up knowledge and tools" is sometimes more appropriate and effective than "decontextualized top-down knowledge" that was "produced in a specific science policy setting with particular institutional arrangements" (Weichselgartner & Kelman, 2014, p. 30). However, grassroots strategies, while they may indicate resilient forms of self-organization, can also disguise the neoliberal ideology and political strategy of self-reliance, which is a justification for the substitution of government responsibilities with community resilience (Davoudi, 2012, p. 305).

Additionally, grassroots strategies cannot address the many urban resilience challenges that require city-scale action or the involvement of multiple levels of government (da Silva et al., 2012). For these interventions, diversity is key. Effective large-scale actions are "most effective when founded on strategies developed through multi-stakeholder engagement between government, non-government and civil society organisations, business and academia" (Parker et al. quoted in da Silva et al., 2012, p. 128).

Finally, cities that have not experienced any disasters or disturbances in recent memory will struggle "to keep resilience on the political agenda for a longer period of time and sustain [the] momentum" required to forge comprehensive and diverse plans for urban resilience (Spaans & Waterhout, 2017, p. 115). Indeed, many Canadian cities have concerns about potential disasters and disruptions but have not responded to a significant crisis in recent memory. Calgary, having responded to many crises in 2013-2015, may not struggle with this challenge, and I was cognizant of this during my research.

Urban resilience: research framework

As I recognized earlier, the abundant interest in applications of resilience theory since C.S. Holling's seminal work has led to the coexistence of numerous definitions of resilience, which has had repercussions for the study of urban resilience. In order to achieve conceptual clarity, some scholars have attempted to study, chart, and compare how resilience is being defined and used, and have synthesized new comprehensive definitions and frameworks (Brand & Jax, 2007; Caputo et al., 2015; Davoudi, 2012; Martin, 2012; Meerow et al., 2016; Pendall et al., 2010; Tyler & Moench, 2012).

One of the most well-researched definitions of urban resilience in the literature today comes from Meerow, Newell, and Stults (2016) at the School of Natural Resources and Environment at University of Michigan. In a study of over 25 definitions of urban resilience, Meerow et al. (2016) identified 6 common conceptual "tensions" in the definitions and then incorporated a normative stance for each one into a comprehensive definition. The proposed definition is as follows:

> "Urban resilience refers to the ability of an urban system-and all its constituent socio-ecological and socio-technical networks across temporal and spatial scales-to maintain or rapidly return to desired functions in the face of a disturbance, to adapt to change, and to quickly transform systems that limit current or future adaptive capacity." (p.39)

In essence, this definition states that a resilient urban system requires three abilities in order to meet the requirements for resilience; the state the system returns to in the face of disruption must be a desirable and beneficial state, and not only must the system adapt to change but it must not limit its ability to continue to adapt in the future.

In combining multiple definitions, the University of Michigan group has incorporated some aspects of engineering resilience into the definition by evoking the "bounce-back ability" notion with the "rapidly return to desired functions" component. However, in order to avoid including aspects of stability in an urban resilience definition, they add the qualifier of "desirable" functions. Meerow et al. (2016) emphasize in the explanation of the definition that due to their stance in support of non-equilibrium, they hold that "resilience reflects a system's capacity to maintain key functions, but not necessarily to return to a prior state" (p.46). The definition is open to a post-disturbance state that improves upon the status quo of the system, rather than simply returning to "normal". This is important as a return to "normalcy" is not always desirable. For example, the aftermath of Hurricane Katrina exposed problematic social conditions, the return of which was not desirable. (Pendall et al., 2010). The "desired" functions component forces an explanation of what is worth returning to but is at risk of "fuzziness" (Markusen, 1999) as one group's desired functions may be incompatible with another's, creating conflict and confusion. Additionally, scholars caution that emphasizing normal states shapes the type of actions taken towards building resilience since "bouncing back" is most relevant to cases of sudden shocks and natural disasters, and not more gradual, cumulative changes and stressors which are equally relevant to urban resilience (Tyler & Moench, 2012).

The definition by Meerow et al. (2016) presented above is one of the most well-researched and comprehensive contemporary definitions of urban resilience. This definition of urban resilience forms the base of the normative stance from which the findings of this study are examined. A framework for the major components of this normative view of resilience is also used to interpret the findings. The framework used in this study was not drawn from a single source to be applied to Calgary as a case study. The framework is one I devised after reviewing other frameworks and reflecting on the data I collected.

Since there are no agreed upon standards for resilience research, the current practice in resilience research is to synthesize a framework from multiple studies. Many scholars put forth their own distillations of the literature that vary from discipline to discipline, but there is significant overlap from one study to the next. Some conceptual consistency among scholars about resilient systems include: diversity, efficiency,

adaptability, cohesion (Fiksel, 2003); maintaining controls and structure, reorganization and accommodation, and adaptive capacity (Wardekker et al., 2010).

Since the qualities of systems vary greatly, the researcher must be specific about the context of operationalization. In this study, the context for operationalization includes the unique challenges faced by Calgary, and specifically, the City of Calgary's actors; thus I have devised a framework to suit this context. In my framework, I use a similar operationalization to Tyler & Moench's (2012) in that my framework includes system, agent, and institutional components. The most relevant components of urban resilience for this study are: redundancy, anticipation, resilience opportunism, system change, and collaboration. Together these components address the structures, attitudes, and actions that affect how urban resilience is approached by COC staff. The Tyler & Moench (2012) study concerns urban resilience in cities facing the impacts of climate change, which is appropriate for the Calgary situation considering the recent disasters and crises. I also draw from other studies to reinforce and refine my understanding of urban resilience such as Folke (2006), Davidson (2010), Crowe et al. (2016), and Liao (2012).

Tyler and Moench (2012) have distilled the urban resilience literature into a framework that is divided into systems, agents, and institutions, with characteristics for each component. At the system level, which includes both urban infrastructure and ecosystems, there are 3 main characteristics that contribute to resilience: flexibility and diversity, redundancy, and safe failure. Resilient systems should be diverse and redundant to be able to modify, adapt, accommodate, and buffer different disturbances so as to maintain key functions or assets (Tyler & Moench, 2012, p. 313). A resilient system also needs to be able to absorb both shocks and stresses and take some damage without causing chain reactions of failures in the system.

What Tyler & Moench (2012) address in the "agents" component is a "conceptual layer" that distinguishes ecological and social theories of resilience (Davidson, 2010, p. 1143). The unique ability for people to learn is an essential part of resilience building (Folke, 2006; Holling & Gunderson, 2002; Tyler & Moench, 2012). This element is influential since human "agents, unlike systems, are capable of deliberation, independent analysis, voluntary interaction and strategic choice in the face of new information" which contributes to the appropriate use of resources and information in the face of a disturbance (Tyler & Moench, 2012, p. 314). Capacities of people seen to affect

resilience are responsiveness, resourcefulness, and the capability to learn (Tyler & Moench, 2012, p. 315). However, these capacities are affected by system and institutional variables which can either support and enable or constrain, prevent, and disincentivize the best use of human capacity for resilience (Tyler & Moench, 2012). The institutional level aspects Tyler & Moench (2012, p. 317) include are access to system resources, decision-making processes, and the control and facilitation of information gathering, dissemination, and application.

The components and qualities of urban resilience in Tyler & Moench (2012) have informed the structure of the framework used in this study. I have adapted concepts from the literature to create a framework that is appropriate for the particular context of this study. What follows is the framework for understanding the components of urban resilience that are active in the COC today. In the remainder of the literature review section, I explain and justify each component of the framework individually. A table summary of the framework is included at the end of the chapter. In the second chapter of the findings and analysis, I compare the information collected on the City of Calgary's urban resilience conceptualization and approach to elements of this framework.

Redundancy

One of the most important concepts for resilience building is redundancy. In ecological understandings of resilience, redundancy is sometimes known as "response diversity". Diversity of response affects the resilience of a system since the presence of "multiple pathways of responding to crises will increase the likelihood that a system will recover from a major shock" (Walker quoted in Kaufman, 2012, p.70). In human systems, redundancy takes on more complex forms, and may be regarded negatively in some literatures, especially in public administration or any business management oriented area where redundancy is considered "wasteful and inefficient" (Nowell et al. 2017, p.124).

It is important to understand what type of redundancy is being sought or used in a given scenario, since many types exist. Nowell et al. (2017) distinguish 4 types of redundancy in human systems; backup, cross-functionality, duplication, and cross-check, which are found in the following table.

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Table 1.A typology of redundancy in system designs

Redundancy Type	Description
Backup	A form of redundancy in which units (e.g., teams, equipment, personnel) residing outside the system are brought in and made operational in times of need.
Cross-functionality	A form of redundancy in which a unit is either assigned a secondary role in addition to a primary role or is reassigned from a primary function to serve a secondary function during a time of need. This strategy involves repurposing of something or someone to act in a role that is outside of his/her/its primary role or function.
Duplication	A form of redundancy in which multiple units serve the same function at the same time. These duplicated units are internal to the system and are generally operational during normal operations. In these cases, they represent "slack capacity".
Cross-check	A form of redundancy that involves verification of information or decisions with multiple sources before taking management action.

From Nowell et al. (2017) p. 125

Each type of redundancy is unique in how it contributes to resilience in a given context or system (Nowell et al. 2017). For instance, backup type redundancy secures resources from outside the system to protect against scarcity issues and can be scaled up or down as events unfold. However, anticipating the need for backup is a challenge in itself and the introduction of new resources can lead to confusion and delays once backup arrives (Nowell et al. 2017). Therefore, it is very important to work on anticipating resource needs prior to disturbances and then to quickly identify, employ, and integrate backup in a crisis (See Table 3 in Nowell et al, 2017, p.128).

Caputo et al. (2015) refer to cross-functionality when they discuss how the identification of "synergies" between diverse sectors may help increase redundancy without the creation of new structures or organizations (p.235). Cross functionality involves leveraging existing assets for emerging problems (Nowell et al. 2017, p.128). This can either be done as a last resort when redundancy is needed but not planned for, or as a strategic and anticipatory decision. Exploiting the versatility of people, resources, or built environments uses innovation and ingenuity to create cross-functional redundancy when faced with an unanticipated disturbance, which is another way of "planning for uncertainty" (Caputo, 2015, p.235).

Duplication avoids system failure by creating "excess capacity" internal to a system which can be employed during a crisis (Nowell et al. 2017, p.125). This is

different from backup redundancy which requires excess capacity that is external to a system (Nowell et al. 2017, p.125). Having multiple ways to get something done, multiple pathways for communication, and multiple resources tied to the same function are all part of duplication (Nowell et al. 2017, p.125-6). One common example of this concept put to use would be a building that is at risk of flooding might have access points on higher floors for evacuation (Wardekker et al., 2010, p. 994). However, some forms of excess capacity may reduce efficiency in normal operations or may require special attention to maintain the clarity of information sharing procedures and management of excess capacities (Nowell et al. 2017, p. 128). Care should be taken to weigh the cost and benefits of "slack capacity" versus system failure and ensure "tight coordination and information sharing among duplicate resources" during a crisis (Nowell et al. 2017, p.128).

Cross-checking uses verification to avoid system failure and is common in safety practices (Nowell et al. 2017) -- for instance, having more than one person perform a check or evaluation is a kind of cross-check redundancy (Nowell et al. 2017). This is a common best practice in high risk systems such as airlines (Nowell et al. 2017, p.126). As with many forms of redundancy, cross-checking runs the risk of creating delays that "reduce system capacity to adapt quickly to dynamic situations" (Nowell et al. 2017, p.129). Another more significant issue is the concern that authorities with decision making power become decoupled from the cross-checking individuals who have more knowledge of the situation (Nowell et al. 2017, p. 129). Simulations or drills involving both the authorities and cross-checkers and special attention to the flow of information is needed to prevent mistakes in this type of redundancy (Nowell et al. 2017, p. 129).

We can see how different types of redundancy pose very unique advantages and challenges, and the importance of "clarifying the type of redundancy under investigation...for advancing more robust theory of redundant designs" (Nowell et al. 2017, p.134). Redundancy is one of the more complex aspects of resilience, and it is also one of the most pivotal. Redundancy is crucial because, in a severe and unexpected crisis, redundancy safeguards against total system failure.

Increasing redundancy is important for both the anticipated and surprise crises that the COC deals with. In the case of an unforeseen crisis, crucial systems can be protected with duplication and cross functionality may help adaptation. For Calgary's

known natural disaster concerns such as flooding, redundancy can consist of straight forward actions such as creating multiple barriers and overflow basins. However, building redundancy into a capitalist economy to avoid economic recession is not as straightforward. Overcoming the crises brought on by long term stressors requires less redundancy and more anticipation.

Anticipation

Some crises are more of a surprise than others. Fast-changing system variables such as natural disasters or war may cause traumatic stress on a system, but slow-changing variables such as global warming may cause devastating "predictable surprises" if gone undetected or ignored for too long (Kaufman, 2012, p.82). Anticipation of risk or consequence will increase the ability to sufficiently plan for disturbances, which is said to be better for resilience than "reactive responses" (Kaufman, 2012, p.85).

Many threats to human systems are "not if but when" scenarios that go largely ignored. Bazerman and Watkins (2004) claim that "a combination of individual judgmental biases and institutional failures" cause a breakdown of the ability to anticipate impending crises. These obstacles are outlined in the following table.

Table 2 Individual and institutional obstacles to anticipatory activities

Individual obstacles	Institutional obstacles
Positive illusions Omission bias Status quo bias Inattention to dull data	Lack of resources for data collection about emergent threats Lack of information dissemination Diffuse responsibilities Failure to learn from the past

From Wilson (2012) p.84   *obstacles are in no particular order

On an individual level, we tend to believe that the future holds good things for us (positive illusions), preferring inaction when actions are certain to cause damage however small (omission bias), propensity to maintain the status quo despite calls for change (status quo bias), and a tendency to gloss over data that isn't presented in a vivid and enticing way (inattention to dull data) (Wilson, 2012, p.83). Some individual obstacles also scale up and are present on an institutional level, such as status quo bias.

Individual obstacles compound and contribute to the entrenchment of institutional obstacles. Institutional obstacles to anticipatory behaviour include failing to devote resources to studying emergent threats (lack of resources), failure to disseminate and integrate knowledge throughout the institution or a reluctance due to the perceived sensitivity of the information (lack of information dissemination), diffuse responsibility resulting in a lack of accountability and action (diffuse responsibility), and repeating mistakes due to a lack of institutional memory or poorly understood lessons of the past (failure to learn from the past) (Wilson, 2012, p.84).

Ultimately, "predictable surprises arise out of failures of recognition, prioritization, or mobilization" (Bazerman & Watkins, 2003, p.74). Individual "judgemental shortcomings" combine and compound with organizational and institutional problems to prevent detection, awareness, understanding, and action against predictable surprises (Kaufman, 2012, p.84). Exercising anticipatory behaviour requires foresight, proactive action, and an awareness of obstacles, such as those in the above table.

This component is relevant for the development of the COC's resilience strategies emerging out of the learning from the 2013 flood. City staff noted that Calgary is on a floodplain and severe flooding was not out of the realm of possibility, and yet the City failed to adequately anticipate or prepare for the 2013 flood. This is an example of a well-known, high risk potential disturbance, but there are other risks for Calgary, including those connected to climate change and the global commodity market that have more diffuse consequence and complicated timelines which require more elaborate anticipatory strategies.

Resiliency Opportunism

Resilience scholars recognize that every "disturbance has the potential to create opportunity for doing new things, for innovation and for development" (Folke, 2006, p. 253). Embracing and seeking opportunities for change indicates an understanding of resilience that goes beyond strengthening capacities for maintaining key functions to also recognize the benefits of "renewal, re-organization, and development" (Folke, 2006, p. 253) which come from disruption and disaster (Crowe et al., 2016).

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A less extreme version of opportunism might represent the attitude and understanding most conducive for seizing opportunities for resilience. Most people would classify opportunism as "self-interest seeking with guile" (Williamson quoted in Chen et al. 2002, p. 569). However, if opportunism can be decoupled from this negative interpretation, the concept becomes useful for identifying important behaviours and attitudes conducive to resilience building.

A neutral definition of opportunism is better explained as willingness to seize opportunities as they arise, rather than the calculated efforts to deceive and exploit that is most often associated with opportunism. When the opportunist's agenda is resilience instead of self-seeking, then we have resiliency opportunism.

Devising strategies for greater urban resilience is easier to undertake if there is a common attitude of embracing the inevitability of disturbances and a willingness to look for opportunities for change and improvement. Being able to recognize opportunities that are created through disturbance requires resiliency opportunism. Since many disturbances are surprises or non-linearities, being able to adapt quickly is just as important as being prepared. Resiliency opportunism is conducive to making impromptu changes and reacting to new situations as they arise.

This attitude underlies all other characteristics and aspects of resilience because it illustrates a willingness to prioritize opportunities for adaptation and improvement, even in the face of changing conditions. At a conference on resilience, the United Nations Development Programme (UNDP) expressed the importance of making timely choices by saying:

> "Recovery is a critical stage in fostering resilience. It is the time when countries and communities can either return to the status quo, leaving intact the conditions which led to the crisis, or can seize the opportunity to strengthen society's resilience to all hazards, whilst tackling the underlying causes of vulnerability (including poverty, inequality, and fragility)" (UNDP 2014).

This is especially salient for the COC having experienced disaster response and recovery in the past few years. Many opportunities present themselves during crisis and upon reflection. The attitudes of the COC personnel towards the flood and other disturbances indicate how the organization might respond to disturbances in the future.

The ability of COC personnel to recognize and act on opportunities for change will influence the success of the COC's resilience goals.

System Change

An understanding of system change concepts is necessary for situating resilience in broader spatial and temporal frames (Folke, 2006). Understanding that systems dynamics are cyclical is essential for the creation of influential human interventions on urban system resilience. Illustrating how resilience naturally varies over time according to other system properties and characteristics is made possible with the adaptive cycle model.

The adaptive cycle is a heuristic model used to describe ecosystem changes which has also been applied to socio-ecological and human systems in order to conceptualize nonlinear, complex system changes (Allison & Hobbs, 2004; Davidson, 2010). The adaptive cycle is a metaphor that has played an important role in organizing the understandings of ecological resilience (Crowe et al., 2016; Davidson, 2010; Folke, 2006). While it is not considered a concept that can be empirically operationalized and tested (Carpenter et al., 2001), the value of the adaptive cycle is that it enables an understanding of resilience in which a familiarity with patterns and cycles of change can inform decisions for the future (Crowe et al., 2016).

It is visualised by Holling and Gunderson (2002) as a figure-8 loop in three dimensions to capture how the system's resilience, connection, and resource potential vary in strength throughout the cycle, as seen in Figure 1 below. There are four phases of the adaptive cycle: a period of increasing growth (exploitation or r phase), then stasis and conservation (K phase), a period of collapse and change (omega phase), and then rearrangement and renewal (alpha phase) (Crowe et al., 2016; Folke, 2006; Holling & Gunderson, 2002). It can be simplified as a "fore loop" (growth and conservation) and a "back loop" (release and reorganization) in which the majority of system change occurs in the "back loop" (Carpenter et al., 2001; Crowe et al., 2016). The length of each phase varies but the back loop is usually a shorter phase of rapid change (Folke, 2006). The three-dimensional model provides a visualization for the variance of resilience throughout the adaptive cycle.
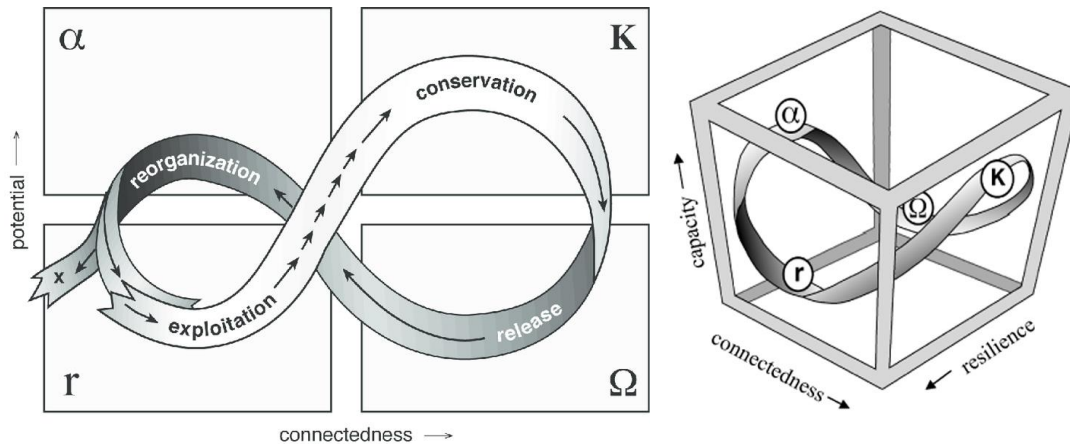
Figure 1 The Adaptive Cycle as depicted in Holling and Gunderson (2002, p.34) and with resilience as depicted in Allison and Hobbs (2004, p.4).

By studying the application of this model to human systems, Holling et al. (2002) have made particular insights related to how human actions affect system change. Unique human capacities such as resourcefulness, responsiveness, and the capability to learn (Tyler & Moench, 2012) will intentionally or unintentionally affect the speed and outcome of cycles. Holling et al. (2002) classify three special qualities of human systems which affect the speed and progression of a human system through the cycle phases. These qualities are foresight, communication, and technology.

In human systems, the use of foresight can alter the speed and outcome of system dynamics. Foresight and intentionality are not present in ecological systems where organisms cannot forecast behaviours and environment conditions and change their behaviour accordingly (Holling et al. 2002). Previously in this chapter, I explained the importance of anticipatory behaviours, such as foresight, for resilience building. The adaptive cycle model adds another layer to the importance of forward-looking behaviours by situating them in a dynamic model of system change.

The use of foresight is a human asset, but does not always bring resilience benefits. For example, economic forecasting informs strategic buying and selling behaviours and allows some to profit, but with rippling effects throughout the market, which may exacerbate social inequality and hinder urban resilience (Holling et al. 2002, p.99). Holling et al. (2002) propose these uniquely human qualities as neutral observations of the human capabilities to intervene in systems. How foresight affects

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system dynamics also has repercussions for systems of power and politics (Crowe et al., 2016; Davoudi, 2012).

Similarly, the use of means of communication can have varied results for resilience depending on the uses of power exercised through mass communication (Holling et al. 2002, p.100). In this context, communication refers to the transfer and storage of experience, which is not present on a mass scale in ecological systems. Humans have the ability to broadcast information, ideas, and experience which can have a positive or negative effect on how crises play out (Holling et al. 2002). Additionally, the power of forms of communication are magnified with human technology. The use of technology has extended the impact of human actions to other environments across time and space since prehistoric times (Holling et al. 2002). Use of technology can amplify the system effects of foresight and communication by enabling actions and informing decisions.

The overall understanding of system dynamics and the basics of the non-linear adaptive cycle model held by the COC staff can illuminate whether their conceptualizations lean towards ecological or engineering forms of resilience. The viewpoint that the resilience advocates have will shape how foresight, communication, and technology come into play to create, or prevent, system change.

Collaboration

When operationalizing urban resilience concepts, some scholars have identified "the need to actively solve problems collaboratively by exercising imagination and creativity" (Crowe et al., 2016, p. 114) and the important role of adaptive governance and civic engagement for the success of collaborative efforts (Vandergert et al., 2016). Research in other disciplines has shown that collaborative forms of learning "facilitate faster and deeper learning compared with learning received through the transmissions of an instructor" (Pelling et al., 2008, p. 872). Since resilience building initiatives require the processing of complex information, collaborative processes help people to organize information and explore complex linkages of actions and their consequences (Kaufman, 2012, p.91).

Collaborative efforts that are relevant to resilience are such things as the participation in conversations and consultations by stakeholders with diverse skills, interests, and values, as well as networking, consensus building, and social learning (Kaufman, 2012, p.90). Some examples of collaborative urban resilience initiatives are "an online crowd-sourcing application for mapping underused spaces" at University College Dublin (Crowe et al., 2016, p. 112) and the TURAS project Community Gains which is an online guide "to help community projects overcome resource barriers" (TURAS, n.d.).

Participation and collaboration contribute to the forging of urban resilience solutions, but they are difficult to maintain at larger scales, like municipal government (Kaufman, 2012, p.71). For this reason, there must also be a degree of decentralization and localization of decision making that goes along with collaborative problem solving. Decentralization and localization move collaborative problem solving efforts to the community scale "where personal relationships, trust building, and co-construction of stories can readily occur" and contribute to processing of complex information (Kaufman, 2012, p.91). Frameworks such as "adaptive co-management" combine aspects of collaborative learning and collaborative management through civic engagement processes to connect government and citizens (Crowe et al., 2016, p. 113).

This study is concerned with the operational changes at the City of Calgary that alter the institution's capacity to affect resilience in the bureaucracy and the city. As the COC enters the first stages of resilience planning, collaborative problem solving and collaborative learning are important for processing experiences, insights, and complex resilience concepts, into agreed upon understandings of the urban resilience situation in Calgary. The institutional obstacles to collaboration at the COC affect the resilience initiatives that address both institutional and wider urban issues.

The five components – redundancy, anticipation, resiliency opportunism, system change, and collaboration – make up the framework for urban resilience used to study the City of Calgary's recent adoption of resilience concepts. Using a conceptualization of urban resilience that is based in ecological resilience theory, I created a breakdown of resilience components that are relevant to the context of this case study, based largely on the framework of Tyler & Moench (2012). Other frameworks and methods for conceptualizing and operationalizing resilience also exist, some of which are explored

earlier in the literature review. It is important to keep in mind that I have detailed the components in a linear fashion in this chapter, but these concepts are intertwined and inseparable, forming more of a web than a list. The information provided in this section is summarized in the following table (Table 3). This table organizes the components according to three classes of resilience components – structures, attitudes, and actions. This classification is intended to help group the components by the functions they have in promoting urban resilience. Again, the separation of these concepts is somewhat artificial and so these categories are not mutually exclusive There is further detail provided in the description and evidence sections of the table, which summarize what is meant by the component name and how it might be recognized in the data. Since I am exploring the nature of resilience concepts employed by City staff, I use this table as a guide for the framework. This study is not a program evaluation, so this table will not be used as a checklist or to inform a performance judgement. It is a concise visual summary of my normative stance on urban resilience I employ to aid in interpreting the findings.

Table 3 Resilience Framework Summary

Class	Component	Description	Evidence
Structures	Redundancy	4 types of redundancy	Which type of redundancy is present? Are the limitations of the redundancy acknowledged or accounted for?
Attitudes	Anticipation	Anticipatory behaviour and attitudes (forethought)	Evidence of actions that foster anticipatory behaviour? Acknowledgement of obstacles to anticipatory behaviour?
	Resiliency Opportunism	Attitude towards disturbances	Are disturbances to be avoided? Or are disturbances expected and thought of as learning opportunities?
	System change	Conceptualizations of change; support for foresight, communication, and technology	Is system change linear or cyclical? What human actions steer system change?
Actions	Collaboration	Participation, collaboration, decentralization, localization	Communication across sectors, units, disciplines? Stakeholder engagement/consultation? Diversity of interaction? Centralized or local authority?

Methodology

This study is designed to investigate the origins, development, and impact of the City of Calgary's use of resilience concepts. The questions I aim to answer are: "How have recent economic and environmental crises interrupted status quo operations at the City of Calgary?" and "To what extent do these post-crisis operations principles conform to a robust definition of urban resilience?"

My approach is informed by mixed methods and emergent design theories. Emergent design approaches are used by some resilience scholars since the literature on resilience is itself emergent and the concepts still lack clarity (Crowe et al.2016; Davoudi, 2012). Using flexible design approaches also reflects the adaptive and evolutionary nature of resilience thinking (Davoudi, 2012). Specific works that inform the methodology and general research process are Donna M. Zucker's guide "How to do case study research" (Zucker, 2009), Miles and Huberman's text on qualitative data analysis (Miles & Huberman 1994), and the work of Robert E. Stake (Stake 1978, 1995) and Robert Yin (Yin, 2002). This project adheres to the first type of case study – the intrinsic case – from the work by Stake (1995). In this design, there is intrinsic interest in the case itself and the case plays the dominant role, in contrast to an instrumental case, where the issue being studied is dominant and the case forms the example.

I develop The City of Calgary's recent urban resilience initiatives as a unique case for investigating the tensions of the City bureaucracy as it responds to crises. To help understand the issues and challenges that develop in this investigation, I rely on socio-ecological and urban resilience theories, specifically those that offer critiques of the employment of resilience concepts in unsuitable scenarios to political ends. Using resilience concepts assembled through a synthesis of diverse research, I investigate the City of Calgary's conceptualization of resilience and endeavour to explain how this explanation is or is not suitable for creating robust urban experience. I identify sources of conflict and tension, and the organizational and ideological structures that have contributed to the City's uneven uptake of resilience.

In order to accomplish this, I use a qualitative mixed methods design consisting of key informant interviews and document analysis. I first conducted an analysis of City

of Calgary documents related to urban and economic resilience, and other supporting documents, which are listed in Table 4. The first document I analyzed was the Economic Resilience (ER) strategy, which reports City actions that are said to benefit economic resilience. Since this document does not contain any action items or measurements of successful economic resilience and focuses on other strategies, plans, and initiatives already in place, I turned my attention to the Economic Strategy. Developed and carried out by Calgary Economic Development, this is the main economic planning document for the City. I sought advice from City staff who were reported to have developed the ER strategy. With the help of some staff insights, I began to investigate resilience as it developed from the disaster events of 2013-2015. I analyzed the Flood Resilience Framework and the 100 Resilient Cities documents: The City Resilience Framework, and the City Resilience Index. The information in this set of documents informed my interview questions and which informants I sought out. I also collected newspaper articles and information from the City of Calgary website related to the initiatives and events in the development of resilience concepts at the City. These sources were obtained through searches on the City of Calgary website and news websites such as CBC, Globe and Mail, Calgary Herald, and also through the Simon Fraser University library.

Table 4 Documents analyzed

Document	Source
Economic Strategy 2008/2014	Calgary Economic Development
Calgary Municipal Development Plan 2009	City of Calgary Planning & Development
Economic Resilience Strategy 2015	City of Calgary Corporate Analytics and Innovation
Flood Resilience Framework 2013	City of Calgary
Community Economic Resilience Fund	City of Calgary
City Resilience Index and Framework 2013	100 Resilient Cities
Newspaper articles related to economic diversification, the 2013 flood, local resilience initiatives, Naheed Nenshi, and the 2015 economic downturn	Various 2010-2016

Then I conducted six semi-structured interviews with key informants in March and April 2016, who are listed in Table 5. I recorded and transcribed the interviews, and then removed identifying information by assigning them numbers. These informants were chosen for their involvement in the development of resilience initiatives and supporting documents and/or participation in flood response and recovery. Each

interview was 50-60 minutes. These were City of Calgary staff, including a strategy director from Calgary Economic Development. Since my interest focuses on changes happening at the City and how and why those changes are related to urban resilience, I chose to interview individuals who would know the most about this process. I know my knew I chose relevant and important interviewees as several of the interviewees suggested that I speak with other people who were also on my list of potential participants. All of the interviewees provided additional important experiences, such as flood recovery or experience in other business units, in addition to their expertise on City resilience initiatives. I sought little outside opinion, as it was difficult to seek out an informant that would know enough about the relevant institutional matters and still provide an outside perspective.

Table 5 List of interviewees and their affiliations

	Institution	Department
1	City of Calgary	Office Resilience and Infrastructure
2	Calgary Economic Development	Research & Strategy
3	City of Calgary	Corporate Economics – economic consultant to ER strategy
4	City of Calgary	Corporate Analytics and Innovation – ACER strategy
5	City of Calgary	Corporate Analytics and Innovation – ER strategy
6	City of Calgary	Housing Office – past ER strategy staff

Note: Interviewees are cited in text with reference to the numbers in this table

The combination of document analysis and interviews provided a variety of official and informal information related to City organizational changes, crisis response, and resilience concepts. I synthesized this information to provide an understanding of the City of Calgary's decision-making process regarding the pursuit of urban resilience. Using frameworks and concepts from the literature on urban resilience, I have also provided an assessment of the findings that draws out how resilience concepts are being employed and to what ends, and compares this to a normative framework of urban resilience.

Background

City of Calgary Political Context

The City of Calgary's recent adoption of resilience concepts and the various institutional elements that support or undermine the best practices of resilience are embedded in a long political history that is tied to the development of the oil industry, prominent private industry influence in city politics, and changing provincial and federal fiscal programs, among other factors. For the purpose of contextualizing this study, I give a brief summary of some relevant political developments in Calgary's local government over the last 30 years.

In recent decades, municipalities have been faced with reduced provincial and federal infrastructure funding and increased welfare responsibilities, leading to the need to secure new sources of tax revenue (Brunet-Jailly, 2012; Howard, 2015; Hudson, 2010). Calgary struggled to keep up with growing and changing infrastructure needs through the 1990's and 2000's, a period when Calgary grew by over 300,000 people. This contributed to the development of the City's "growth first" agenda, and the growing influence of the development industry on City Hall (Brunet-Jailly, 2012; Howard, 2015).

The City of Calgary, dependent on developers to finance civic infrastructure, submitted to the dominance of the development industry's priorities in a situation described by Howard (2015) as "developer-led suburbanization" (p.69). The resulting political institutional discourse assumed that 'growth' was an unquestioned and unspoken "commonsensical public good" and that the developers acted on behalf of "sovereign homebuying consumers" (Howard, 2015, p. 97). With citizens and private industry acting in these roles, unfettered market-based choice and low housing prices became "organizing objectives for public policy" (Howard, 2015, p. 97).

The COC bureaucracy was considered to have managed its programs well in the "growth first" era, but sought little public input into the "business-led negotiations over City policies", until recently when community and neighbourhood groups have become more vocal and the city has become more responsive to them (Brunet-Jailly, 2012, p. 319). The City has engaged with citizens in major projects such as the proto-

sustainability plan, Calgary 2020, the 100-year visioning consultation Imagine Calgary, and the resulting 60 year municipal planning framework Plan-It, which took place in 1989, 2006, and 2009 respectively. However, in the case of Plan-It the business and developer communities denounced the plan and the City changed it to better reflect the views of business and development (Brunet-Jailly, 2012). The Sustainable Suburbs Study also suffered a similar fate ten years earlier. The contradictions and conflicts between the City's interests and the developer interests have stymied the creation and adoption of civic sustainability policies in the past (Brunet-Jailly, 2012; Howard, 2015, p. 97).

Several prominent voices criticized City Council for yielding to the will of the developers on projects and plans such as Plan-It. One of these voices was current Calgary Mayor Naheed Nenshi, known before his election as a professor and founder of the grassroots citizens' group CivicCamp (Howard, 2015, p. 5). In 2010, through a surprising underdog ascension, Nenshi was elected mayor, which some considered a herald of change for City politics, partially due to Nenshi's "vaguely progressive brand of ecofriendly politics" (Howard, 2015, p. 7).

Nenshi's role as a voice against developer hegemony and an advocate for civic engagement is reflected in some of the projects and initiatives created at the COC since 2010. The Transforming Government initiative seeks to instill "a culture of constant improvement" and is a designation for City programs that meet one or more of the following objectives: transparency, accountability, civic engagement, innovation, citizen orientation, and sustainability (City of Calgary, n.d.). However, as I will show in my analysis, despite the apparent change in the city's political culture, many of the institutional objectives and obstacles that contradict or undermine resilience goals have not been addressed or have been reinforced under Nenshi's leadership.

Experience with crisis

Calgary experienced several disasters and crises in a two year period from 2013-2015. Experiencing and responding to these events contributed to what informants describe as a "wake up call" (Interviewee #1) that started conversations around resilience at the City. This section provides more detail about the string of events.

On June 20th, 2013 the Bow River overflowed its banks overnight, causing massive damage from Canmore downstream to High River, the evacuation of 100,000 residents (CBC News, 2014) and the activation of 27 states of local emergency in counties across the province (Government of Alberta, 2013). Downstream from the Bow River, the Elbow River in Calgary flooded 26 neighbourhoods (City of Calgary, 2013) and cost the province 6 billion dollars in damage to homes and infrastructure. Calgary had not seen a flood this size since 1902, and the last major rain event that caused flood damage was in 2005 ("Calgary grinds to a halt," 2014). The 2013 flood was devastating to public assets such as the Calgary Stampede grounds and stadium, light-rail transit system, public library, the zoo, and much of downtown. The state of emergency was lifted on July 4th, just in time for the Calgary Stampede to commence on July 5th. The Stampede fittingly used the slogan "Come Hell or High Water" to commemorate the gallant efforts of the 2300 volunteers and encourage a confident spirit in the city ("Calgary's Most Damaging Flood," 2014).

Just over a year after the flood, residents woke up to a massive snowfall on September 10th, 2014. Leafy deciduous trees were no match for the heavy wet snow, which came at least a month early. Residents were quick to term the disaster "Snowtember" as thousands of downed trees and car accidents caused mayhem across the city (City of Calgary, 2015).

At this time, the previous year's flood was still fresh in the minds of Calgarians and reflections and assessments of the disaster continued to circulate in the media and City reports (CBC News, 2014; Henton, 2014; Vroegop, 2013). "Snowtember" was an unpleasant surprise for most citizens, but paled in comparison to trauma of the 2013 flood. Nevertheless, the devastation was more widespread than the flood, affecting every area in the city and causing a crisis for the COC. The downed trees caused massive power outages including over 100 traffic signals and 3 LRT stations (City of Calgary, 2015). Swift action from the COC was required to clear roads, restore power, and protect citizens. The Calgary Emergency Management Agency was activated to coordinate the response (City of Calgary, 2015).

When asked to reflect on the events that contributed to the COC's understanding and eventual adoption of resiliency planning, City of Calgary employees stated that "Snowtember" is second only to the 2013 flood (Interviewee #4). Both events required a

prompt, coordinated response, difficult and prolonged clean up, as well as assistance from the Province and other cities (City of Calgary, 2015).

Then on October 11th, another kind of disaster occurred. A major underground electrical fire in the western part of downtown caused over 100 buildings with over 1000 residents to be without power for a week (Markusoff et al., 2014). Again, the Calgary Emergency Management Agency was mobilized and the COC led another crisis response. CEMA quickly realized how difficult it was to gain access to several different buildings with different owners and managers and resolved to give the Building Owners and Managers Association a role in future emergency response. This emergency was not as significant as the previous two in terms of damage or trauma, but two informants cited it as an important learning experience nonetheless (Interviewee #4 & #5).

Amidst the ongoing recovery process in the wake of the flood and the other emergencies, another more familiar crisis was brewing. Over the summer of 2014, oil prices steadily declined - a situation worsened by OPEC's decision not to cut output in November. By March 2015, oil prices had fallen to $42 a barrel, an unthinkable low compared to the high of $107 a barrel the spring before (Healing, 2016). The rapid drop in oil prices resulted in significant layoffs – estimated to be 100,000 direct and indirect jobs – which affected all industries and services dependent on the industry. Alberta's unemployment hit 7.0 percent in November of 2015, a 3.4 percent increase from the year before, making it unusually close to the national average of 7.1 percent (Ewart, 2015). The crisis left Calgary with 1.1 million square metres of empty downtown office space – about 40% of the total empty office space in Canada's 10 largest cities (The Canadian Press, 2017).

While this crisis did not require emergency response by the COC, it still impacted how it views disaster management. This is cited by informants as a turning point for resilience discussions at the COC. Previous economic downturns and crises have been met with discussions about the need for economic diversification. Since the 2015 economic crisis, the concept of economic resilience has also entered the economic strategy discussions.

Economic Diversification

One of Calgary's resilience challenges is addressing and navigating the volatile oil and gas economy. Historically, there have been efforts by the Province and Calgary to decrease the reliance on oil and gas and diversify the economy. Economic diversification has continued to be a popular subject of conversation and a significant economic strategy.

In terms of GDP, the oil and gas sector currently makes up 19.4% of Alberta's economy (Government of Alberta, 2017) and 31.5% of Calgary's economy (Toneguzzi, 2015) and has proved unimaginably profitable in the past. Since this industry has been so profitable, there is little monetary incentive to invest in other industries and rely less on oil and gas. Thanks to some deliberate investment by the provincial and federal government in logistics, technology, agriculture, recreation, other energy industries, as well as the acceleration of the real estate and construction industry in economic boom times, there has been a decrease in oil and gas as a share of GDP (Collins, 2015; Walberg, 2013). However, the reliance on a resource "whose market structure and geo-politics are entirely beyond control" remains a concern for Calgary and the rest of the province (Hawkins, 2017, p. 9).

The need for economic diversification has dominated the economic planning discourse in Calgary and Alberta for many decades. Newspaper headlines like 1970's "Calgary's objective is strong diversification" (Special to The Globe and Mail, 1970) continue to echo in 2016, with examples like "...Alberta is trying to diversify its economy" (Bickis, 2016) and "Alberta pursues the Holy Grail of diversification" (Yedlin, 2016). Talk of attracting and investing in sectors like manufacturing, information technology, construction, logistics, warehousing, research and development, and agriculture appear time and time again.

Previous diversification efforts have largely been Provincial initiatives. In 1976, Premier Peter Lougheed created the Alberta Heritage Savings Trust Fund. The Heritage Fund had three objectives: to save for the future, to strengthen or diversify the economy, and to improve the quality of life of Albertans (Government of Alberta, 2007). Money from the Heritage fund was used to fund capital projects with the intention of catalyzing the diversification of the economy. Both Premier Lougheed and Premier Don Getty also

attempted to jumpstart diversification by giving provincial loans to private companies, most of which failed (Milke, 2016).

Although the other orders of government are involved in economic planning, a significant amount of recent economic planning has been done at the municipal level. In 2002, a task force commissioned by Mayor Dave Bronconnier recommended the City create a comprehensive economic strategy. Prior to 2008, Calgary did not have an official economic strategy. Calgary Economic Development was responsible for the creation of the 2008 Economic Strategy, and the second version of the Economic Strategy in 2014. Both of these strategies build a framework for supporting a diverse range of businesses and industries and includes specific goals, targets, and indicators for economic, social, and environmental prosperity. Some other recent City initiatives speak specifically to resilience building, such as the 2015 Community Economic Resilience Fund.

Diversification of Calgary's economy away from oil and gas could be seen as a resilience strategy for adapting to and preparing for a future without oil, and also as a buffer against the volatility of the oil and gas sector. Economic diversification could be sufficient to achieve economic resilience, so both concepts are present in the popular conversation around economic strategy today.

100 Resilient Cities Programme

Several cities and institutions across the globe have begun using resilience theories in various planning documents and initiatives. Examples include the Bay Area Council Economic Institute's economic plan Roadmap for Economic Resilience (Bay Area Council Economic Institute, 2013), the City of Barrie's initiative Building Municipal Resilience in Central Ontario (City of Barrie, n.d.) and the Urban Land Institute's report Resilience Strategies for Communities at Risk (Urban Land Institute, 2014). The City of Calgary has chosen to adopt the 100 Resilient Cities (100RC) strategy as Calgary's official urban resilience initiative. This section discusses the specifics of the 100RC program, strategy, and framework.

The 100 Resilient Cities Programme is the most well-known global urban resilience initiative (Spaans & Waterhout, 2017). Funded by the Rockefeller Foundation,

100RC partnership gives funding and guidance to the member cities for the development of place-specific resilience goals. Each member city designates a Chief Resilience Officer and produces a resilience strategy that suits the unique challenges faced by that area and its institutions. Member cities can share and learn from initiatives and programs in other partner cities around the globe during events such as the Urban Resilience Summit ("The Urban Resilience Summit 2017", 2017).

Canadian partners in the program are Vancouver, Toronto, and Montreal. Montreal was one of the first to join the initiative in December 2014 and Calgary, Toronto, and Vancouver joined recently in May 2016. Currently, the four Canadian cities have chosen their Chief Resilience Officers and began the process of forming resilience strategies. Calgary conducted an initial public forum on March 3, 2017 called the Agenda Setting Workshop to discuss urban resilience in Calgary with a variety of community, business, academic, and government partners (The City of Calgary, 2017).

100RC equips cities with resources to help them gather information, and develop and implement a strategy. The Rockefeller Foundation created the City Resilience Index (CRI) and the City Resilience Framework (CRF) as tools for member cities to use when building their resilience strategies (Arup, 2015, p. 2). The 100 Resilient Cities initiative defines urban resilience as:

> "the capacity of individuals, communities, institutions, businesses, and systems within a city to survive, adapt, and grow no matter what kinds of chronic stresses and acute shocks they experience." ("What is Urban Resilience?", 2013)

Shocks are defined as "sudden sharp events" such as natural disasters or disease outbreaks and stresses are defined as "slow moving disasters that weaken the fabric of a city such as high unemployment or endemic violence ("What is Urban Resilience?", 2013). This definition does not emphasize "predictability, constancy, and stability" or a quick return to equilibrium, which are qualities of engineering resilience. It leans more towards ecological resilience by emphasizing adaptation and unpredictability. However, the definition and framework are vague enough for specific urban strategies to justify the use of actions that would follow either conceptualization, possibly simultaneously.

The framework is based on desired system qualities from the City Resilience Index (CRI), a report done by Arup International Development to provide a research-based, globally relevant detailed index of resilience indicators and measures for the 100 Resilient Cities program (Arup, 2013). The CRI report includes 4 dimensions, 12 goals, 52 indicators, as well as requirements and goals for each indicator. The CRF framework is condensed into 4 dimensions, each with 3 subcategories called "drivers". The 4 dimensions, or pillars, of resilience are: Health & Wellbeing, Economy & Society, Infrastructure & Environment, and Leadership & Strategy (Arup, 2015). Both the CRI and the CRF are based on the same 7 qualities of resilient systems: reflectiveness, resourcefulness, robustness, redundancy, flexibility, inclusiveness, and integration (Arup, 2013).

The CRI and the CRF are not strategies; they are frameworks intended to guide cities as they develop their own place-specific urban resilience strategies. The components and their indicators are broad categories with vague suggestions so as to accommodate a wide range of issues and vulnerabilities that may be faced by cities across the globe. For example, "Promoting Cohesive and Engaged Communities" is considered by 100 Resilient Cities to be a component, or "driver", which would support the success of the dimension "Economy & Society" (Arup, 2015). This driver suggests that actions which strengthen the community's ability to improve and encourage civic engagement in City decisions will contribute to the creation of cohesive and engaged communities (Arup, 2015). However, the framework does not specify what kind of actions should be taken, how success would be measured, or the mechanisms by which cohesive and engaged communities contribute to resilience.

Since 100RC is unparalleled in its global reach and comprehensive framework it is hard to compare the program to other examples of urban resilience strategies. Academics are still devising a standard for operationalizing resilience, and even the resilience literature has few examples of detailed urban resilience frameworks. Much of the COC's understanding of urban resilience is informed by this framework. In the second Findings chapter I will examine the evidence that reveals how the COC conceptualizes urban resilience and assess that evidence against the normative framework.

Findings: Operational Changes

How have recent economic and environmental crises interrupted status quo operations at the City of Calgary?

Calgary experienced a string of crises from 2013 to 2015 which have impacted the way the COC conducts business. Through experiencing abnormal environments and crises, organizations have the opportunity to adjust operations and build knowledge, which contributes to improved coping strategies (Folke, 2006; Liao, 2012; Smit & Wandel, 2006). Several important insights emerged through experiencing the 2013 flood, one of which was the utility of the concept of resilience. Many of the recent organizational reforms at the COC center around resilience concepts. The recent economic downturn reinforced the urgency of the adoption of resilience concepts and alteration of organizational behaviour at the COC. Two business units, Corporate Analytics & Innovation and Resilience & Infrastructure, have helped to bring about certain initiatives and programs that contribute to the spread of resilience concepts at the COC such as the 100 Resilient Cities initiative. The City Manager has also had a hand in the changing organizational behaviour by encouraging a cultural shift through the introduction of new vernacular about decision processes and prioritization paradigms. These new buzzwords help communicate new priorities and also support and contextualize some of the crisis experiences and insights. The interviewees explain in detail the different ways they conceive of and support the changes happening around them.

The Flood and Other Shocks

The flood served as a disruption that brought new ideas and information into circulation at the City of Calgary. The experience of disaster response and recovery, which was unprecedented for most at the City, has made lasting impacts on many COC personnel who worked with the Flood Recovery Operations Centre (ROC) Task Force. Sometimes called the Flood Recovery Team or the Recovery Task Force, the Task Force was a diverse group of City staff who are responsible for creating the Flood Recovery Framework, which guides them as they oversee recovery efforts.

Based on their flood recovery experience, the staff on the Task Force brought new knowledge about recovery operations to their respective business units and shared

it widely throughout the organization. An interviewee from the COC's Economic Resilience (ER) strategy team who experienced flood recovery actively in the Emergency Operations Center (EOC) explained the lasting impact of the disaster:

> The culture of the organization in the last 5 years has really changed... I'll bring up the flood - that was the first time the City had to come together and just do things differently because we had no other choice. Since the flood there's been a lot of talk of sort of recreating that flood culture in different initiatives. (Interviewee #5)

The interviewee noted that there has been a perceivable shift in the culture at the COC since the flood. This person recounted how the flood disaster made the City "come together and doing things differently" and implied that this had a lasting impact on the culture and operations of the COC. In this context, "differently" refers to the cooperation between various staff on initiatives like the Recovery Task Force and the urgent priority of responding to the unexpected and rare situation.

In this quote, the interviewee also mentioned that there is an ongoing conversation about creating an organizational culture, the "flood culture" that is, which will foster the kind of collaborative action and problem solving that was seen in flood response and recovery. The flood has not only had a lasting impact on COC employees, with many viewing positively their efforts to respond. Several other interviewees also noted the recent change in the culture of the organization and point to the flood as an important catalyst in this change. An interviewee from the City of Calgary Office of Resilience and Infrastructure connected the organizational cultural shift and its goals to lessons learned during flood recovery:

> We are very focused on creating a culture that is individually responsible and collectively accountable...it's moving our organization from a place of working in silos [and] working individually to integrate with one another and moving toward a collective good...where we first experienced this was in fact during our flood recovery. (Interviewee #1)

The interviewee explained that there is a shift towards collaboration, integration, and accountability taking place. Those who worked at the COC during the flood response and recovery got a taste of a different way of operating that included more collaboration and communication across business units. The interviewee was noting how the COC is trying to replicate those environments which were found to be beneficial in uniting employees.

During the flood recovery and rebuilding process, the COC started introducing the word "resilience" into their flood recovery narrative. The first published reports of the flood event included the term "resilience" in the descriptions of recovery agendas and future goals:

> "Community recovery must not only address the vitality of the built, economic, natural, and social environments but also reduce the risk of future disaster events in order to build a more disaster *resilient* community. While recovering from the June flood, opportunities to develop and sustain long-term *resiliency* must be explored in order to prepare The City for the next event." [emphasis added] (Calgary Flood Recovery Framework, 2013, p.10).

At this time, the use of "resiliency" was limited to flood recovery and disaster management and had yet to expand into other avenues of urban resilience planning. As stated in the Flood Recovery Framework, opportunities to build resilience were being sought early on in the recovery process.

One interviewee reflected on the recent shocks and recalled that the concept of resilience entered discussions at the COC during flood recovery:

> It was about that time that the conversations around resilience really started. I was in recovery operations then, I can't remember exactly how it came about, but we got in touch with Rockefeller Foundation and found out about 100 Resilient Cities. We went through the first iterations of applying to be part of that network back then. (Interviewee #4)

Pursuing the 100 Resilient Cities designation was one of the first steps the COC took towards resilience building. As I explained in the Background chapter, the 100 Resilient Cities Programme is a well-known Rockefeller Foundation project that offers guidance and connection to select cities wanting to pursue urban resilience. The project took its first round of applicants in 2013, and Calgary applied in the third round in 2015. In January 2016, Calgary became an official member of the 100 Resilient Cities network. The support provided through this program has provided organization, guidance, and resources for the COC's pursuit of resilience building.

A different interviewee from Resilience and Infrastructure also connected flood recovery operations with the first discussions of resilience. As this interviewee recounted, the desire for change and greater resilience expanded outward from recovery operations:

We became very well aware as we were completing our response and undertaking our recovery that we didn't want things to return to the way they were. We wanted to make sure that we were thinking about the future and preparing for future flood type events and disruptions… [thinking about] things like business continuity, infrastructure maintenance, and management of our infrastructure. Also [thinking about] how we worked as an organization [and] how our community was prepared for disruptions in their day to day lives. Those types of resilience conversations started to permeate our discussions as an organization and as a community. It was sort of a groundswell, if you will, of different resilience initiatives that started to happen around the organization, not in any coordinated fashion, just happening in response to our recovery work. (Interviewee #1)

This interviewee spoke on behalf of the Flood Recovery Team when stating that there was a new awareness of the desire to make a variety of improvements in the wake of the disaster. Desire for change produced new lines of thought and conversation in the COC that focused on foresight and preparedness for both the organization and the community in relation to disaster response. The interviewee described the spontaneous upwelling of support for resilience in the COC as a by-product of recovery operations. The experience of the flood disaster and recovery process exposed some COC employees to opportunities for improvement to organizational structures and processes and the concept of resilience provided a vehicle for discussions of change.

The flood was a major crisis that precipitated the introduction of resilience concepts and the shift in operations at the COC, but it was not the only crisis. After the flood, several other crises occurred which kept disaster response and resilience top of mind. An interviewee who worked closely on flood recovery emphasized the significance of the consecutive disturbances the COC dealt with:

Calgary's actually experienced a number of what people in the resilience business call 'shocks' over the last while, and I suppose the biggest shock was of course the flood in 2013...That was a huge wake up call. But then we had an electrical transformer blow in downtown Calgary, and it was a major issue because we had a good portion of our downtown without power for 2 or 3 days, it turned into quite a shock to our system. We also had what we refer to here as Snowtember, which was this massive snowstorm which was unprecedented in terms of the damage and clean up afterwards. And then to top it all off we had the economic collapse, the oil prices [declining] and consequences of that. We've experienced quite a number of what they call shocks in a short period of time, 5 years, which in the life of a municipality is quite short. (Interviewee #4)

The interviewee explained the specific events as "shocks" because they all required an emergency response from the COC. Each of the shocks was significant in terms of the damage and interruption to regular COC services and operations. The 2015 economic downturn, which this interviewee refers to elsewhere as a "stressor," using resilience lingo, is included in the interviewee's explanation of significant disturbances since the economic decline required some changes to the operations at the COC. The interviewee also pointed out the significance of the timing of the events.

This interviewee also went on to explain how the successive crises played a role in maintaining interest in resilience building. The interviewee explained that there was heightened interest in resilience while drafting the application to the 100 Resilient Cities Programme, but shortly after the application was submitted:

> Then interest kind of died a little bit. It's like in any disaster - there's this big wake up call then all of a sudden people start going back to normal life and they have a bit of a short memory. But then with the repeated things [crises], it settled to the point where people sort of think 'well maybe we really, really, really should do something about this'. (Interviewee #4)

The interviewee recognized that one disturbance is often not enough to initiate change. The COC had the fate of experiencing and responding to several disasters, and an economic crisis in a short period of time. Each crisis required a different response from the City, which contributed to wider spread knowledge of resilience concepts and their importance for the COC. The consecutive crises prevented interest in resilience from diminishing and further solidified the need for the COC to take action to plan and prepare for future disturbances.

The flood and other shocks sufficiently sustained interest in resilience concepts in a critical mass of COC personnel. Using resilience concepts to signify the experiences, insights, and goals of those whose perspective was altered by the disturbances, COC personnel were able to communicate across business units and foster organizational change.

The Economic Downturn

The last event in the string of crises is the most recent economic crisis in which oil prices declined rapidly between late 2014 and early 2015. This economic downturn is considered by several informants to be a significant event since it triggered the

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consideration and adoption of resilience concepts in a wider-ranging context, beyond disaster management, within the COC. City employees, already engaged in discussions of resilience in relation to one crisis, seized the opportunity to apply resilience to the recent economic crisis. The COC has explored economic strategy with an eye to resilience through programs like the Accelerated Capital for Economic Resilience (ACER) program and the Economic Resilience (ER) strategy.

The timing of the recent economic downturn coincided with the development of the 2015-2018 City budget planning process and offered the first opportunity to use resilience concepts in a major organization-wide plan. An interviewee in the Office of Resilience and Infrastructure spoke from experience as a senior manager when reflecting on introducing resilience concepts into the budget planning process:

> The City has 4-year business plans and budgets, and as we were building out the 2015-2018 business plan, we began to put this idea of resilience to council; just to create a bit of corporate conversation and community conversation. Without really truly defining what resilience meant, [and] without really truly addressing it with specific resources, we thought, well it'll emerge to that place eventually but we're still very focused on recovery at that time - because we had to build that plan in 2014 which was right after the flood. (Interviewee #1)

The interviewee recognized the opportunity to transfer insight from the flood crisis to the recent economic crisis as budgeting discussions were being conducted. The introduction of resilience concepts explained in this quote comes across as casual and unsystematic, which is in keeping with other informants' accounts of the development of resilience initiatives. Introducing the concept of resilience in an economic context into the discussions with Council and others at the COC was a priority for this informant's group during that time. This interviewee notes that there was no commitment to a particular definition of resilience or formal dedication of resources at that time because it was assumed that those efforts could be postponed until the flood recovery and rebuilding was completed.

The new City budget being coincident with the economic crisis created a situation that resulted in the development of some of the COC's economic resilience initiatives. Both ACER and the ER strategy came about as a result of decisions made concerning the budget in the context of the economic crisis. In the case of ACER, the program was

initiated with the goal of rectifying previous spend-rate issues[1] with the goal of increasing community benefits from municipal investments.

The 2015 economic crisis added extra incentive to address the budgetary efficiency problems in order to save money. An interviewee from the ACER program group recalled how the City recognized that it wasn't spending its entire annual budget and saw this as an opportunity to put more money back into the community during a time of need:

> Historically up until last year we'd budgeted on average about $2 billion every year but only ever spend, actually invest, $1.2 billion. So, there's that ongoing question about 'why aren't you guys spending as much as you're budgeting, what does a budget really mean then if you're not spending it'. So, I guess the way it was looked at was that there's some capacity for us to invest more because of our budget and we just need to find ways to be more efficient and get more money out into the community. In summary, ACER was really borne out of the idea that the City could invest more in the community, and that we had the capacity to invest more in the community to help minimize some of the impacts that were being felt in the general workforce and the economy. (Interviewee #4)

The interviewee recounted how the City recognized that a win-win opportunity was presenting itself. In addressing the budget discrepancy, the COC could increase efficiency while simultaneously creating community benefits. The City views making community investments in the form of municipal projects and programs to be a form of economic resilience building, as evidenced by the development and purpose of the ACER program.

The development of the COC's Economic Resilience strategy was also a result of the budget planning coinciding with the 2015 economic downturn. An interviewee from the ER strategy team summarized the conception of the ER strategy:

> Essentially, we do a four year [City] budget and the most recent one was the 2015-18 Action Plan. [The Action Plan] was developed in the 18 months leading to 2015, being approved in Nov 2014. During that time Calgary was growing fast… the year before we got close to 35

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[1]According to several informants, the budget spend-rate issues – in which the City was budgeting more than they could spend in a given year – have been a concern for a long time, and so has the City's infrastructure debt. As of 2016, the COC has an estimated infrastructure debt of $4.36 billion (Pike, 2017). Money cannot typically be transferred between the operations budget and capital planning budget due to different funding sources e.g., government grants and reserves, property taxes.

thousand people [that] moved here in 2014, so it was a growth budget. Then in the fall of 2014 and early 2015 oil prices started to tank, things were starting to take a bit of a downturn, and as we were just getting into the new budget, it became apparent that the budget that we planned for wasn't going to fit the reality. Really the economic resilience portfolio grew out of the group that was working on the budget. (Interviewee #5)

This interviewee noted how the timing of the economic crisis resulted in a need to revise the City budget. The COC's initial budget plan was based on trends from previous months in which the city was growing in population. Another interviewee, a City economist, confirmed this by saying, "the fact that we have a four year budget" is the reason why the Economic Strategy needed to be created, i.e., the budget needed to be amended to reflect recent economic changes. Creating the ER strategy was one way the COC responded to the discrepancy between the "growth budget" and the situation caused by the economic downturn.

The recent economic crisis caused the resilience discussions at the COC to turn a corner from an environmental context to an economic context. Experiencing the stressor of the economic decline in conjunction with the previous shocks further solidified the importance of resilience as an important concept for City strategies. An interviewee from Resilience and Infrastructure described the progression of resilience concepts from disaster management to economic development:

We found that as a city we were recovering from the shock of an environmental disaster and we were then experiencing a stress of an economic downturn, which sort of solidified this idea [that] resilience means being prepared and being able to ride the wave of both stresses and shocks. So, we began to talk about resilience from an economic lens, not just an environmental lens and we started to talk about the importance of not understanding how long the economic downturn would be. (Interviewee #1)

Stresses and shocks, and the differences between the two, are foundational concepts in theories of resilience. The interviewee explained that experiencing both shock-type disruptions and stress-type disruptions in a short period of time increased the relevance and significance of resilience concepts for the Resilience and Infrastructure group. Applying resilience concepts to the economic situation also led to the informant's group acknowledging the significant uncertainty of this disruption in particular.

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The interviewee pointed out the uncertain duration of the economic decline because the COC considers it to be unlike other previous economic downturns. Later, when speaking to the opportunity for new discussion created by the economic crisis, the interviewee explained how this crisis is different, "It's a structural downturn, this is not a boom and bust situation, this is 'the future of our economy needs to look different' kind of discussion." (Interviewee #1)

The interviewee implied that this most recent downturn is not a result of the cyclical nature of oil prices, but more likely the beginning of the long term decline of the oil industry. An interviewee from Corporate Economics only suggested that this is a possibility by saying, "there's questions [at the City] about what will happen to the price of oil this time, we [economists] have a lot of arguments about that" and "oil price forecasts are a dime a dozen" (Interviewee #3) which indicates that it may be difficult to come to consensus on the future direction of the economy.

However, the situation is perceived to be unique enough to spur discussions at the COC about creating a long-term economic strategy to cope with the eroding foundation of the Calgary economy. In the past, these kinds of economic strategy discussions have centered on the need for economic diversification, which has now been integrated into resilience discussions. While the COC engages in discussions about such economic strategies, the COC relies on CED to do the work of economic strategizing. As a City economist explained, "Calgary Economic Development tries to sell the [Calgary] economy to outside interests. They're an arms length entity to the corporation, and our focus inside [the COC] is internal budget." (Interviewee #3)

Since the COC doesn't carry out economic planning, the economic crisis discussion at the COC focused on other aspects of city planning. According to the Resilience and Infrastructure interviewee, COC personnel began to open up the discussion of economic resilience into a broader discussion that includes future city planning as a whole. Reflecting on the progression of resilience concepts during the budget planning the interviewee claimed, "This is where...economic resilience as being more of a response to the downturn has now shifted into a longer term investment strategy for our city." (Interviewee #1)

The application of resilience concepts to economic matters as part of the response to the budget mismatch further solidified the utility of resilience planning for the COC. This interviewee claimed that COC employees have begun to use resilience concepts to inform long term investment strategies. The priorities of these investment strategies come from both the COC in how they manage operations and infrastructure assets, and Calgary Economic Development through their work on the Economic Strategy, according to the interviewee.

Another interviewee from the ACER program confirms that resilience concepts have entered economic discussions and vice versa. During a discussion of the meaning of resilience, the interviewee pointed to the oil and gas industry as a long term challenge for the city's resilience:

> Resiliency is about being prepared, but also planning, it's planning and making preparations and having actions to achieve whatever your resiliency goals are. Potential shocks will be different wherever you are, the stressors are going to be different too - the more chronic long term things. Here in Calgary it's sadly kind of a one horse town, with oil and gas being king, we're very buoyant when there's oil and gas money flowing in, but then there's a big decline when oil and gas investment tails off, and there's nothing to buffer that. So that's more of a long term stressor, this heavy dependence on one industry, it's less than it used to be, but still very prevalent. (Interviewee #4)

This interviewee highlighted the need to tailor resilience measures to the unique set of vulnerabilities of a particular location. In Calgary's case, the economic cycles are difficult to predict and prepare for, so adjustments need to be made to avoid harsh ups and downs. The stressful nature of the boom and bust cycle is not news, but viewing economic structure as a threat to urban resilience is a new development for the COC.

An interviewee from the Resilience and Infrastructure unit echoed the importance of economic resilience as a long term plan by highlighting the precarious nature of the single-sector economy, "How do we manage future stresses and shocks to our economic strength when we know that [Calgary is] a city that relies on a certain homogenous type of economy - oil and gas? It's going to give us issues in the long term." (Interviewee #1)

Other informants have also echoed this acknowledgment of the challenge of building resilience in an economy reliant on a non-renewable resource. The interviewee

also posed a question of how the COC will reconcile long term economic planning with the predominant oil and gas industry. In one way or another, all the interviewees have posed this question, but none have provided an answer. While there are many different possible answers to this question, some of the discussions with other informants shed light on the COC's approach.

There is a strong focus on limiting the impact of external forces and preventing the negative consequences of oil industry cycles. Like the Resilience and Infrastructure interviewee, the CED interviewee focuses on the undesirability of unpredictable fluctuations in the market and aims to protect Calgary from such disturbances through economic diversification. CED takes a specific approach to economic diversification in the Calgary context, as explained by an interviewee:

> I would say that it is economic diversification, but it's economic diversification at the margins. Our approach to economic diversification is to take what were already good at and try and make it stronger. Our approach is not to say 'oh wow this isn't working let's start making licorice twizzlers'. We're not trying to say, 'here we are today it's not working let's go there', what we're saying is 'we've got this and we've got this other stuff so let's build out from there'. So, I would say that it is economic diversification, [and] people may look at it and become frustrated because they'll see that it's incremental change and incremental growth at the margins, but the reality is that's the way it always happens. (Interviewee #2)

The interviewee added a qualifier to economic diversification to emphasize the calculated and patient strategy that is required to shift the economy in a more resilient direction. According to CED, strengthening the economy will hopefully be accomplished through building strategic relationships between industries to focus less on oil and gas as a driver of the economy. The interviewee stressed that the goal is diversification, not radical transformation.

The interviewee also emphasized that the speed of change may not be acceptable for some citizens. Invoking the notion that Rome wasn't built in a day, the interviewee went on to liken Calgary's economic development journey to the decades-long development of the Silicon Valley. In some form or speed, economic diversification is at the core of how CED deals with the need to manage the negative consequences of Calgary's frequent economic disturbances. The need for diversification has been a theme in Calgary and Alberta's political discourse for decades. Rather than challenging

the dominant strategy of diversification, resilience has offered other ways to justify the need for diversification as part of the broader goal of building a resilient city through plans to "build off [Calgary's] other strengths" and "stimulating economic growth" (Interviewee #2).

Despite not being responsible for economic planning in Calgary, the COC has created some new economic-specific strategies. However, the Economic Resilience (ER) strategy, despite being a new strategy created in response to the recent economic downturn, actually does not contain any new City actions. The ER strategy, which consist of 7 points related to City actions that foster economic resilience, is a collection of pre-existing initiatives and plans. An interviewee from the ER strategy summarized how individuals from the budget planning team came up with the ER strategy:

> Normally they disband after the budget is done, but this group stayed an extra 3-5 months to work on this economic resilience strategy. [The group was] basically taking a look at 'what are the things that we planned for in the budget that we're going to do anyways that are focused on economic resilience'. (Interviewee #5)

The ER strategy is different from other organizational initiatives which typically have a set of new actions or approaches to an issue. The ER strategy is a strategic gathering of existing operations, plans and principles that illustrate how the COC is prepared to deal with the economic crisis. Repackaging existing systems and actions is not uncommon in the municipality as stated by the ER strategy interviewee:

> It's kind of like the whole Smart Cities thing that's out there right now... A lot of the funding is tied to having a Smart City Strategy. We had a digital strategy we passed through Council in 2014 which is essentially pretty close to what they're doing with Smart Cities…We're not doing a whole lot of new things but we've taken an inventory across the City of who's doing automated lighting and so on. We didn't have a Smart City Plan [to begin with], we've had a technology plans, we've had digital strategies, but now we've wrapped it up and we have a Smart City Plan. So again, we're not doing a lot different. We've always been doing things in the right way it's just a matter of sometimes, in order to get grant money and things like that, you need to package it differently. (Interviewee #5)

In the case of plans like the ER strategy and the Smart City Strategy, no changes are made to the operations or structures of the COC and the outcome of the strategy is largely status quo. As the interviewee explained, the COC consolidates and repackages

things that fit a certain model or framework to achieve some benefits. Another interviewee from Corporate Economics claims this is a pattern at the COC:

> A lot of the stuff [City initiatives] has been after the fact rationalized. We came up with the "something needs to be done" [initiative], and then it's after the fact rationalized as, "How can we justify this? What kind of academic or other avenue can we say we're following?" … [the ER strategy] was done in house, and then we looked at what everybody else is doing - "Oh, we're kind of matching up with what everybody else seems to be doing" (Interviewee #2).

This observation can either indicate that the COC selectively chooses urban planning strategies and theories to justify their status quo operations, or indicate that the COC's operations are unintentionally in tune with several sources of justifiable comparison. More research into the COC's strategy and decision-making process is needed to know which situation is closer to the truth. However, statements that show how decisions are justified after they are made is evidence that the COC sometimes does not deliberately use standards, examples, or theories at the outset of preparing strategies and initiatives. This is a concern for initiatives that are proposed as new solutions but may in fact be similar procedures with new justifications.

Furthermore, some interviewees illuminate the COC's tendency to respond to rather than control situations and events. The recent economic downturn has had, to a certain extent, a noticeable impact on COC operations, according to some informants. An ER strategy interviewee affirmed the significant impact of the crisis by saying, "I don't think we'd have an economic resilience strategy had oil not gone from a-hundred-and-whatever dollars a barrel to whatever it's at now." (Interviewee #5)

This sentiment might indicate that the recent economic crisis has spurred the COC to react to the familiar experience of an economic bust phase in a new way. However, this can also indicate a pattern of failure to use foresight during boom times which results in history repeating itself with respect to economic cycles. Another interviewee from Corporate Economics made a similar claim by saying, "When you're making big money you have no interest in diversification - there is zero talk of resiliency when oil hits $100 a barrel, [there is] no incentive at all." (Interviewee #3)

As this interviewee indicates, new ideas and discussions around economic reforms are a reaction to economic recession, and are shelved when the economy

eventually rebounds. Whether or not the economic resilience discussion will endure in spite of economic cycles, only time will tell. The City economist interviewee offered more insight into the institutional barriers that may contribute to an inability to use foresight:

> We do the best we can to respond; respond to a changing population, very responsive organization here. Not very proactive, but very responsive. And as long as I've been here, people have said "we need to be more proactive", and I just don't think that we can. Certainly, it has been touted that we should be more proactive, but I will say this: This organization is incredibly responsive. If there's an emergency, we can move fast and well. Proactively? Not so much, don't have the resources. It's absolutely a resource issue. Foresight [is present], but lack of resources to make it happen. (Interviewee #3)

This interviewee is not hopeful that the City can take action to prevent crises or plan for changes and cites a lack of resources as an overwhelming obstacle. However, the interviewee also noted that the COC seems to excel at responding to crises. The difference between a proactive approach and a reactive approach is, according to this interviewee, resources.

In addition to resource problems, it's possible that the degree to which the COC can be involved in economic planning is limited by its role as a publicly funded service provider. Most of the interviewees express an understanding of the long term issues with the oil and gas industry but remain focused on building resilience through the COC's services. The interviewee from the Office of Resilience and Infrastructure explained the COC's priorities following a disruption:

> There's a crystallized prioritization that occurs when you are A) responding to a significant event but then B) trying to recover from it, and we're finding that's very similar for the economic downturn. We know that citizens expect services to continue for them even though they might be meeting hardship in the community, we know that if we are to take a dollar from our citizens through their taxes then they expect a service for that. (Interviewee #1)

Providing services for citizens is the most fundamental purpose of the municipality, and as the interviewee explained, maintaining those services despite disturbances is the COC's main focus. The timely economic crisis has solidified the value of resilience as a City strategy and created impetus and opportunities for new long-term planning approaches and insights to circulate. The informants also shed light on the institutional obstacles that resilience strategies come up against. Ultimately, the

evidence shows that the COC acknowledges urban resilience as an avenue for change, but remains focused on acting on the matters that align with its express purpose.

Pursuing Resilience

The impacts of the recent string of crises has introduced and then solidified the value of resilience concepts at the COC. However, the uptake of resilience in the institution is uneven - some business units are more aligned with resilience ideas than others. Resilience discussions began at the COC during flood recovery in a "groundswell" type process without much coordination. The unorganized fashion with which resilience has been introduced in the COC has resulted in a patchy landscape of resilience advocates in the organization.

The idea of resilience "pockets" at the COC was first introduced to me by an informant from the ACER program. When explaining the shifting culture of the COC and the new ideas for approaching infrastructure decisions the interviewee noted, "It's not just me talking about these things. I think if you talk to other pockets in the organization, maybe not exactly the same things would be expressed in the same way, but very similar concepts." (Interviewee #4)

The interviewee believes that the concepts and sentiments around organizational reform for greater resilience are shared to some degree by others at the COC, but also conveys an element of isolation with the word "pockets". "Pockets" are a euphemism for "silos", which this and other interviewees mention also. Resilience discussions are siloed in the organization, but the interviewee doesn't seem to be discouraged by this. The interviewee later stressed that the uneven uptake of resilience concepts shouldn't be heavily criticized because many small victories have already occurred. Here the interviewee described the success that the resilience advocates have had thus far:

> We're still continuing down our resiliency journey, and it's really just happening in pockets. But I shouldn't sound negative - the fact that [resiliency discussions] are even being held now is huge, the fact that our administration leadership team they got on board with it and supported it, and City Council and the Mayor supported it. And now we're part of this 100 Resilient Cities network - that wouldn't have happened 5 years ago, I don't think. (Interviewee #4)

According to the interviewee, the COC has made substantial progress in considering and supporting resilience concepts in the upper levels of management.

Since this study was conducted in 2017, the comparison "5 years ago" likely refers to 2012, or the pre-flood situation in the organization. The interviewee is trying to convey that the 2013 flood is responsible for creating a political and institutional environment that is more willing to plan for resilience.

The interviewee stressed the support from Mayor and Council for resiliency planning, which indicates that resilience is supported in the organization vertically, but perhaps not horizontally. Other business units besides the Office of Resilience and Infrastructure and Corporate Analytics and Innovation have not shown as much support for resilience goals, perhaps due to siloing. The same interviewee from ACER confirms that institutional silos may be part of the problem, "The way I'd put it is that those resiliency decisions are happening very much in small silos. I'm not sure that it's really percolated yet into the DNA of the corporation and our planning." (Interviewee #4)

Resilience, maybe, has not yet become part of the organization's fundamental principles. However, the interviewee points out that since many people likely support the idea of resilience, the main barrier to the widespread adoption of resilience concepts is the siloed structure of the organization. The interviewee explained this point:

> I actually don't think there are many people that disagree with the fundamental concept of resiliency. I think the real issue is that it's just not top of mind or really front and center in discussions going forward. I think the other barrier we have to resiliency is cultural, we have a very much siloed organization today. This is something I know the City Manager has been trying to deconstruct; this silo mentality where transportation does their thing, utilities does their thing, parks does their thing, recreation does their thing - how can we be more integrated? (Interviewee #4)

The interviewee recognized the potential for new arrangements that overcome the institutional silos and increase communication that can encourage widespread resilience support. The interviewee pointed to the City Manager as a source of support for greater integration between business units. Later, the interviewee also recognized the challenges of exhaustively considering resilience in all COC operations:

> Maybe it's just because I've experienced the flood, but for every project we do why wouldn't we consider that project in the context of resiliency, and consider it in the context of whether if it's critical infrastructure or isn't it critical infrastructure. Shouldn't we be thinking more comprehensively and planning our infrastructure to accommodate resiliency, than we do today?... I realize that for every

project we undertake at the City that would be burdensome, so it's probably not realistic...but I think that's where resiliency starts to have real value, when those conversations happen. (Interviewee #4)

At this point in time, the interviewee doubts the institution's ability to sufficiently alter processes to achieve greater resilience. A comprehensive adoption of resilience concepts would provide the greatest benefit to the organization, but the interviewee believes that the amount of effort required to achieve an adequate consideration of resilience is unrealistic. This somewhat defeatist comment reveals the discouraging hurdles faced by those who work to further resilience goals in the institution, as well as the challenges faced by even resiliency advocates within the city to imagine a viable future COC with resiliency at the core of its planning, programs, and operations.

Despite the deterrents inherent in the organization, the interviewee also recognized how the crisis of the flood required people to overcome typical obstacles in order to cope with the disaster. In this excerpt the interviewee returned some optimism to the discussion:

> I don't want give the wrong impression. I experienced firsthand through the flood how willing people were to come together; we had parks people and roads people and water resources people all collaborating on projects…. the choice was made to collaborate, and I think people saw the value in that. I don't want to give the wrong impression that we're horribly siloed and we have no clue how to work together, but the point I want to make is there are opportunities to collaborate more, and build on that model. That's one of the things we're trying to achieve with this new organization Resilience and Infrastructure Calgary. (Interviewee #4)

Experiencing the crisis of the flood required some individuals at the COC to operate in different configurations and chains of command. The interviewee saw an opportunity to capitalize on individuals' experiences with collaboration during the flood and create structures that support pursuing resilience goals. The interviewee pointed to the Resilience and Infrastructure office as one example of structural collaboration that has already happened. Additionally, the interviewee believes that the combined business unit bodes well for the integration of resilience into other planning decisions. As they put it, "Actually I think…a good way of summarizing our journey [is] the fact that there is a titled Director for Infrastructure and Resilience, and the people [from both units] are now part of the same organization... I think that's a prelude to having that come together,

having resilience become wound into our infrastructure planning and delivery." (Interviewee #4)

To the interviewee, the official title represents an important step in the right direction. Ideally, in the interviewee's perspective, the combined business units will allow resilience concepts to become integrated in the infrastructure decisions of the future.

One of the most promising actions for bringing about resilient changes to the COC that the informants mentioned was the 100 Resilient Cities initiative. Being part of the 100RC programme has given legitimacy to the resilience movement at the COC and given the resilience advocates a tangible initiative to focus on and champion. An interviewee from the Resilience and Infrastructure unit has been heavily involved in the 100RC initiative at the COC and spoke at length about the decision to pursue the membership and how it ties into the goals for the business unit:

> We knew we could contribute to the network of 100 Resilient Cities but also knew there would be a lot to learn from other cities that had gone through either catastrophic disasters or economic downturns... There were things to learn from other cities, and thing to share with other cities... Resilience and Infrastructure Calgary was established to both deliver on the resilience strategy for the community as well as deliver on the capital plan, that would be tied to our investment and value decisions going forward. (Interviewee #1)

Currently, the Resilience and Infrastructure unit is responsible for resilience related strategies as well as the City's capital investment plan, and the 100RC programme is another project altogether. However, this interviewee hopes to see the responsibilities of the business unit aligned with the goals of the resilience plans by 2019:

> We're just heading into the beginning of our resilience strategy planning with 100 Resilient Cities, and all of that will be aligned with [Resilience and] Infrastructure Calgary and with our next business planning cycle, at least that's my big hairy goal going forward from here. (Interviewee #1)

The interviewee noted the personal and ambitious nature of the goal, which may indicate a lack of support for integration of resilience concepts. The interviewee also stressed the importance of remaining dedicated to the 100RC programme. When discussing the potential for the 100RC initiative to create opportunities for open communication and discussion, the interviewee said, "[there are] lots of lessons as we

face these 21st century urban stresses and shocks [and] that to me is the value of the 100 Resilient Cities opportunity; it's not about the million bucks you get over two years, there's so much more than that." (Interviewee #1)

For the interviewee, the most valuable aspect of 100 RC membership is being allowed an opportunity to discuss a wider range of future urban challenges that wasn't previously available. "So much more" is all the support, information, guidance, and opportunity that 100RC brings in addition to funding for a Chief Resilience Officer. The 100RC initiative and the combined business unit Resilience and Infrastructure are considered the best examples of serious resiliency adoption and the most promising sites of future organizational innovation at the COC by the interviewees.

Language and Culture Shift

Recent changes at the COC, such as the adoption of resilience concepts, have been supported by a language and cultural shift encouraged by the City Manager and senior management team. The current City Manager joined the COC in 2014 - shortly after the 2013 flood. This timing coincides with the increased interest in resilience and shifting organizational language at the COC. Several interviewees have directly attributed what they perceive as a cultural shift at the COC to the actions of the City Manager.

Several unique phrases came up repeatedly in the interviews. This specialized language is used to signal certain ideas, perspectives, and priorities to the employees when receiving instruction from upper management. The phrases are repeated by several informants and they indicate that the phrases are becoming common parlance in the organization.

Regarding the flood event, one interviewee from the Resilience and Infrastructure unit said that the disaster has created what the City Manager likes to call a "permission space" or an "authorizing environment" (Interviewee #1). These words are used in similar contexts in relation to the flood. The Resilience and Infrastructure informant used both phrases when reflecting on the flood crisis:

> Another word the City Manager uses is "authorizing environment" if you will, so because we had this massive flood experience we now have the authorized environment to talk about resilience.

The other word he uses is "permission space", maybe that's more appropriate than authorizing environment. [The flood] granted us the permission to have these kinds of conversations, because they're set in real time now. (Interviewee #1)

These phrases put a convenient name to the idea that new opportunity can be found in disasters. The flood has given employees at the COC a reason to talk about improvement, sustainability, disaster preparation, and resilience concepts. Prior to the flood there was little incentive to discuss disaster management and resilience at the COC, but the severity of the crisis has raised the priority of those topics. In the institution, experiencing a disaster gives employees "permission" to discuss disasters as well as ideas about change.

Another significant phrase used by the City Manager is "value and investment". Multiple interviewees put an emphasis on creating "value" through City infrastructure decisions, which are also known as "infrastructure investments" or just "investments". This comes from a conscious effort on the part of senior management to shift the language used to talk about the COC's decision making process from "tax and spend" to decisions of "value and investment". An interviewee from the ACER program explained the reasoning behind changing the language:

It is a theme that our City Manager has been pushing on administration. Traditionally when it comes to any level of government, people complain about tax and spend models, you know, "you get taxes from me, you spend stuff, but I really have no idea what I'm getting as a taxpayer". So, our City Manager has come forward with a message saying, "I really want to get away from this notion of tax and spend, that's not very productive for anybody", that's why he talks about investment and value. (Interviewee #4)

The interviewee explained that the terms "tax" and "spend" are antiquated and create feelings of distrust in the citizens. As a model, "tax and spend" doesn't communicate the COC's desired understanding of public works to the citizens and therefore it's not a useful concept. The "tax and spend" model understands City decisions in financial terms, while "value and investment" fosters prioritization of long-term goals and more nuanced understandings of the "value" an asset has in the community. When money is "spent" on an asset, the narrative stops with the completion of the project. When the City "invests" in an asset, another narrative which includes the concept of "return on investment" is possible. In a "tax and spend" discussion there is little room for discussing a wide array of benefits in terms of a project's impact.

An interviewee from Corporate Economics provided some insight on why this language change might be significant. At least one department is now having to find ways to cope with changing management styles, as the interviewee explained:

> Their [planning department] previous director was under the impression that money didn't matter - or I should say, economics didn't matter to him. His idea was "make no small plans, ignore the money, make a plan", so they're having a hard time coming to grips with reality. The recession thing [necessitates] a limited budget, so the planning department has had some issues. (Interviewee #3)

This interviewee noted how some staff have had to cope with changes in upper management and the repercussions of the economic downturn. It is possible that the new language might help to recenter priorities on economic aspects while helping staff overcome the situation caused by the recent economic downturn which has caused previous plans to disintegrate.

The "value and investment" language leaves more room for interpretation when it comes to decision making priorities. While the "value and investment" model offers more opportunity to contemplate the reasoning and benefits of a particular decision, it moves away from quantifiable standards. "Value" is a subjective concept that reflects the user's standards of worth and importance. The interviewee from ACER was not able to explain how the COC measures value:

> In private industry, it's easy to look at value. You put together business cases, go through finance and do your ROI and your Net Present Value and all sorts of stuff and you can tell pretty quickly if it's a good financial investment for your shareholders and the organization. In a municipality or any level of government it's more complicated. There certainly is a financial aspect to it, but the value you're getting from any particular investment isn't easy to quantify, so I can't give you a definitive answer. (Interviewee #4)

The interviewee contrasted the complexity of the COC's decisions with more straightforward metrics in industry to illustrate that assessing "value" to a municipality is more than a financial decision. The question of how the COC decides which type of non-monetary "value" is worth prioritizing, and to whose benefit, still remains unanswered.

The last set of new phrases is also widely used by the informants despite being somewhat vague. Many interviewees talk about making "purposeful" and "intentional" decisions and believe this is an improvement on the previous decision-making schema.

The words "intentional and purposeful" are introduced to capture the level of effort and planning that upper management associates with scrutinizing operations and seeking opportunities for improvement. By emphasizing "intentionality" and "purpose", the COC's senior management is asking the employees to orient themselves to a new set of priorities. Asking employees to consider the purpose behind their actions gives the possibility of orienting to a new decision-making framework.

An interviewee from the ER strategy team explained how upper management uses this phrase to ask employees to set clear objectives for their programs and business units. The interviewee gave a few examples of how this is applied in various "focused" business units:

> We're just taking different types of focus… the City Manager likes to call it "intentional management". So [we ask ourselves] what are those things you're paying attention to. During Build Calgary we were paying a lot of attention to 'how are we working with industry' and 'we want to be the city of choice that developers want to come and build in'. With Analytics Calgary we are being more intentional about how we use and what we do with all the data we have at the city. [The purpose of] Infrastructure Calgary is being more intentional about how we manage our capital budget and build infrastructure and plan infrastructure. (Interviewee #5)

Towards the end, the interviewee's explanation becomes circular when laying out how Resilience and Infrastructure Calgary achieves "intentional management". However, the interviewee conveys the notion that Resilience and Infrastructure is intended to change the management of capital planning. The interviewee's examples illustrate the emphasis on giving careful thought to how the work of each business unit can be improved.

Another interviewee from the Resilience and Infrastructure unit used the phrases to explain the decision to spend more of the allocated budget. When it was realized that the City was spending less than the approved budget, the interviewee recounted: "We started to really look at our capital planning, this is where the infrastructure part comes in... [we said] 'we have to be more intentional and purposeful in meeting a target'." (Interviewee #1)

The interviewee used "intentional and purposeful" in the narrative of the budget reform to highlight the realization that extra effort would be required to achieve a higher

spend rate. The phrasing "intentional and purposeful" indicates an area for improvement or a new way of prioritizing. As the COC moves forward with goals for improved operations, they use these phrases to signal a shift away from the status quo in decision making processes. In Resilience and Infrastructure this means altering the way infrastructure plans are designed and delivered so as to also consider resilience goals. For individuals at the COC to assess the resilience potential in any given infrastructure decision they must first give up the typical decision-making process and consider aspects of resilience.

Finally, combining phrases results in further obfuscated understanding. An interviewee from Resilience and Infrastructure used both "value and investment" and "intentional and purposeful" to explain the priorities of the Capital Investment Plan: "Our main priorities are to be intentional and purposeful with our funding, with our investment, and our value to citizens." (Interviewee #1)

According to my deduced understanding of these phrases, the interviewee is implying that Resilience and Infrastructure strives to be thoughtful and proactive in infrastructure budgeting and planning decisions in order to achieve benefits which can be justified to tax paying citizens. While some of the examples of the new City parlance indicate emphasis on new discussions, perspectives, and procedures, this last quote does not. Diligent use of public funds for public works and accountability to taxpayers is a fundamental priority for most municipalities. In fact, what the interviewee says fits with the "organizational efficiency" goals of the Leadership Strategic Plan which aims to "Produce optimum results for municipal investment or expenditure. Create value." (City of Calgary, 2015). This indicates that the objectives of Resilience and Infrastructure still follow the typical institutional efficiency paradigm. In defence of the interviewee, it is unlikely that the interviewee was employing these phrases to disguise typical procedures as a new approach to prioritization. However, this quote illustrates the possibility for these phrases to be employed to serve the status quo, knowingly or not.

Outside the municipality

The flood and other crises have caused the COC to take a closer look at its own operations and procedures. Through discussions of resilience building, the COC has also realized the importance and advantage of working in and with the community on various tasks related to resilience. As one interviewee from ACER explained, the series

of shocks has brought the COC to a new awareness of its potential to build resilience in the community:

> I think the resilience thinking has really evolved along with all these shocks we've experienced, it's really been an amalgamation of those things. And it's a realization too that we as a municipality can play a big role in ensuring that not just the administration is resilient, but partner with others outside to achieve larger resiliency benefits. (Interviewee #4)

In order to achieve "larger resiliency benefits", the COC has been seeking partnerships with other organizations, bodies, and industries. Having close relationships with industry is slowly becoming a feature of the COC's resilience building efforts. In their role as municipal service provider, the COC tries to stay one step ahead of the growing needs of the city and has built up relationships with community and private industry partners in order to do this. An interviewee from the Resilience and Infrastructure Office explained how the COC interacts with the community to achieve its goals:

> We really wanted to leverage other investment opportunities so we looked very closely at provincial and federal budgets. We've maintained really good relationships with the other orders of government [and] we've worked with our development industry to understand what their growth management strategies and or their investment strategies are. We're really trying to maximize the relationships we have in place, to understand where people are wanting to invest to hear what our citizens are saying they need for services, and to help deliver on that. (Interviewee #1)

The interviewee noted how the Resilience and Infrastructure keeps a close eye on the activity of other orders of government while also keeping a finger on the pulse of the development industry and citizens' needs. Maintaining these external relationships and lines of communication will help to maximize the COC's capability to predict and respond to the changing needs of the city. The interviewee mentioned this in the context of resilience planning to show the potential to infuse resilience goals for the development of Calgary into the work done for infrastructure capital planning and budgeting.

Other interviewees revealed a closer relationship with private industry that is more business-like. This interviewee from the Economic Resilience strategy team explained the importance of communicating with private industry to learn what actions the COC can take to avoid burdening industries with red tape:

Were always trying to be continually improving in the way that we can work with industry to help move those things along…. we've got industry liaison positions, people who are just making sure we are easy to do business with, [asking] 'are we a client of choice'. A lot of times if you're doing large 100 million-dollar projects out to tender, if you're known to be tough to work with, there's a cost to being difficult to work with. We intentionally try to communicate and engage with industry to make sure we are easy to work with because at that point you become a preferred customer, and they'll price accordingly. (Interviewee #5)

The interviewee noted how working efficiently with private industry can save the COC money on big projects. The interviewee mentioned this in the context of resilience because improved industry partnerships are considered an innovation of operations which will increase efficiency so as to speed up projects that may stimulate the local economy. In order to deliver services and complete public works, the COC needs to partner with businesses and companies and thus has taken steps to operate in a business savvy way. The interviewee also mentioned a strategy dedicated to this goal: "Our Open for Business strategy, that's more about being an easy place to do business with; from everything from planning and approvals to inspections and that sort of thing." (Interviewee #5)

As the ER strategy informant explained, the COC has a designed strategy to better position the organization as a good business partner. In this context, this implies that if the COC understands and cooperates with development and business industries, they can play a bigger role in shaping the development of the city, and possibly its resilience.

Managing, encouraging, and predicting growth is a major function of the City which affects the City's interactions with the community. Present in all the COC's efforts to innovate and strategize towards greater resilience, there is a common acceptance of the desire for continued growth in Calgary. The "growth first" approach that makes economic development the primary objective of municipal government has been attributed to the need to obtain more tax revenue in the face of reduced provincial and federal funds and increased social responsibility (Howard, 2015, p. 22).

However, urban growth, especially sprawl, can come into conflict with some aspects of resilience and similar concepts such as sustainability. In a discussion on

economic resilience, an interviewee from CED merged desires for both sustainability and growth in a comment on managing economic stressors:

> When we think of sustainability in economic development, it's smoothing out the ups and downs, working towards a state of comfortable controllable growth where we're able to kind of spread the wealth. (Interviewee #2)

The interviewee recognized the need for moderate and equitable growth in contrast to the sudden and intense growth the city has seen during past economic booms. Certainly, reducing the degree of economic volatility and "spreading the wealth", i.e., reducing economic inequality, would put less stress on Calgary and the COC. However, the interviewee views "comfortable controllable growth" as not only compatible, but necessary for resilience.

Some theories of sustainability require economic stagnation or even de-growth, but most modern economies require some level of growth to function. In the above quote, the interviewee is using sustainability to refer to the *ability to sustain* business function into the future. Indeed, scholars have criticized the ways in which sustainability has become "a debate about the preservation of a particular social order rather than a debate about the preservation of nature per se" (Harvey quoted in Howard, 2015, p. 8). It is unclear how many of the COC's goals for improvement and increased resilience also abide by this definition of sustainability. Focusing on resilience rather than sustainability might shift the narrative from ecological preservation, which is incongruent with the success of the oil and gas industry, to manufacturing a more robust and fail-safe economy, which is more compatible with the continuance of oil and gas.

Findings: Urban resilience

> To what extent do these post-crisis operations principles conform to a robust definition of urban resilience?

In this section, the information on the COC's operational and management changes is examined using the urban resilience framework I developed in the Literature Review (see table below) based on a synthesis of urban and ecological resilience literature.

Table 3. Resilience Framework Summary

class	component	description	evidence
structures	Redundancy	4 types of redundancy	Which type of redundancy is present? Are the limitations of the redundancy acknowledged or accounted for?
attitudes	Anticipation	Anticipatory behaviour and attitudes (forethought)	Evidence of actions that foster anticipatory behaviour? Acknowledgement of obstacles to anticipatory behaviour?
	Resiliency Opportunism	Attitude towards disturbances	Are disturbances to be avoided? Or are disturbances expected and thought of as learning opportunities?
	System change	Conceptualizations of change; support for foresight, communication, and technology	Is system change linear or cyclical? What human actions steer system change?
actions	Collaboration	Participation, collaboration, decentralization, localization	Communication across sectors, units, disciplines? Stakeholder engagement/consultation? Diversity of interaction? Centralized or local authority?

The resilience framework distills the many aspects of resilience into 5 components: redundancy, anticipation, resiliency opportunism, system change, and participation & collaboration. These components fall into 3 classes: structures, attitudes, and actions.

The components of the resilience framework have been chosen through synthesis of the literature of socio-ecological and urban resilience theories, with special attention to the Calgary context. There are numerous ways to dissect and measure

resilience since it has various applications from ecology to psychology, but this framework was designed using urban resilience and socio-ecological literature only. This resilience framework is meant to aid in the analysis of the development of resilience concepts at the COC.

Since resilience concepts have been introduced to the COC only recently, heavy emphasis is put on assessing evidence related to laying the groundwork for resilience such as understanding of the concepts and supportive mindsets.

The evidence from informant interviews and document analysis is presented according to the 5 sections of the framework. Each section compares key concepts of resilience theories to examples of understandings and manifestations of resilience as communicated by COC personnel. Several components in the framework overlap each other, support each other, or depend on each other. Resilience cannot be neatly broken down since many behaviours and structures contribute to resilience in complex ways. Some themes such as communication will be relevant in all components.

Redundancy

In the Literature Review chapter, I introduced the typology of redundancy concepts. Nowell et al. (2017) distinguishes 4 types of redundancy in human systems – backup, cross-functionality, duplication, and cross-check. Regarding the value of this typology, the authors claim that:

> "By having a clearer understanding of the potential risks and challenges associated with different redundancy strategies, public managers are better equipped to proactively manage these risks and therefore to more effectively leverage redundancy in their response efforts move towards the creation of more resilient systems" (Nowell et al., 2017, p. 134)

If redundancy is approached one dimensionally without a firm grasp of the variation in types of redundancy and the requirements and drawbacks of each type, the system managers will be inadequately prepared to leverage resources appropriately in response to threats. Understanding what kinds of redundancy strategies are being employed is essential to risk management, and therefore needs to be part of this discussion of the COC's understanding of resilience in their operations.

Efficiency and resilience are conceptually at odds. Redundancy contributes to resilience through "the co-existence of diverse options fulfilling the same purpose and

ensuring functionality in the event of the failure of one of them" (Caputo et al., 2015, p. 234). Highly efficient or "nonredundant" systems are notably more vulnerable to even small disruptions (Bar-Yam quoted in Kaufman, 2012, p.70). Nowell et al. (2017) note how redundancy is often considered wasteful and inefficient in public administration literature (p.124). Creating efficient and streamlined processes may create larger profit margins and increase competitiveness for some organizations in the short term, but creates vulnerability to crises in the long term.

Efficiency at the COC is a major priority. The COC's Leadership Strategic Plan (LSP), which is a strategy that aligns the City's actions with the community's expectations and Council's direction, is working to achieve "a modern municipal government" through a "shift in culture" and "organizational efficiency" (City of Calgary, 2015b). The LSP has a supplemental "Road Map" which organizes the actions taken towards the LSP's goals and defines "organizational efficiency" as having two main goals, which are to:

> "Address structural efficiency - Improve the formal system of task and reporting relationships that manages employees to achieve the corporation's goals and objectives. Promote productive and positive behaviour. Help people understand the purpose behind the tasks they perform, enabling greater performance efficiency. Develop cohesion between groups, teams, divisions and departments."

> And

> "Strive for cost efficiency - Produce optimum results for municipal investment or expenditure. Create value." (City of Calgary, 2015a)

Thus, efficiency at the COC is both a measure of performance and a measure of cost effectiveness. When attempting to make changes and improvements within the organization, efficiency is a major parameter by which procedures and operations are measured. While the COC attempts to look for opportunities to build resilience in some units like Infrastructure, greater efficiency remains a top priority across the organization.

The Office of Resilience and Infrastructure and the Office of Corporate Analytics & Innovation (CAI) are the site of most of the COC's resilience discussions and planning. CAI Various initiatives at CAI impact resilience indirectly as an unintended consequence of actions in pursuit of another goal. The CAI is reducing redundancy, particularly duplication redundancy, in some areas and improving anticipatory behaviour elsewhere,

which is ineffective from a resilience standpoint and indicates that the mechanics of building resilience may not be well understood within this unit.

It appears that most of the CAI's initiatives are focused on increasing cost efficiency at the COC. The origin story of one of the CAI's economic resilience programs, ACER, is detailed by an interviewee who currently works on this program. This interviewee said ACER was intended to find ways to spend money in the budget that wasn't being used, but the "change in economic fortunes" during the last economic decline gave the program a cost efficiency focus. As the interviewee shows, the main impetus for the internal research that led to creating ACER was financial:

> One of our new initiatives is a program called ACER, [which stands for] accelerated capital for economic resilience. That was a very intentional thing, we knew that we have a lot of capital in the corporation [the COC], and we haven't really been able to spend more than 1.1-1.2 billion dollars a year, so we put our heads together, [and asked ourselves] "what is it that we can do?" We had some people go around and do some business process mapping and interviewing people [regarding] when you're doing a capital project, what are those "choke points" and where are the places in the project that we can speed things up. (Interviewee #4)

As the interviewee explained, the COC decided to put effort into liberating more money to fund capital projects, and created ACER to focus on this goal. Since the budget reform coincided with the 2015 economic downturn, the extra capital was intended to stimulate the economy through additional City programs and projects. Through this reasoning we see that the COC equates economic stimulus with economic resilience. Moreover, the ACER program liberates capital by pursuing cost efficiency. ACER has "resilience" right in the name, but the program's focus on cost efficiency is incompatible with an essential component of resilience, i.e., redundancy.

Other initiatives under the CAI unit strive for cost efficiency also. According to one interviewee who works with Economic Resilience Strategy, the CAI business unit has done research using data science to find ways to optimize the labour the COC uses and reduce labour costs. The interviewee gave an example of an important insight gained by using "Big Data":

> So, in the last year we've hired a data scientist and a few other people working with him, solving those problems that are sometimes problems you didn't know you had ...we've created a dashboard for our recreation group that does staffing optimization for the recreation

centres based on the weather. The funny thing is, you'd assume that if it's a cold day, people would be going to the rec centers, but it wasn't - the strongest correlation wasn't to weather it was to visibility. We have a lot of cold clear days in Calgary, and it's the days when the visibility is low that you get less people. So again, trying to save money in the way we staff our recreation centres. We're taking that model and we're using it in different areas, we're looking at our 311 call center right now, same kind of thing, because of the union contracts we have, if you bring someone in, I think the minimum you have to pay them is 3 hours, so if you can avoid bringing them in in the first place, you're saving on your labour costs. (Interviewee #5)

In this example, the interviewee showed how the COC uses certain tools for "staffing optimization" as part of the pursuit of efficiency. This has the effect of decreasing duplication redundancy. In a City Recreation Centre, removing duplication redundancies may not have dire consequences for the resilience of the COC. The interviewee notes how successes in one area of the COC services are attempted in other units. However, not all units are equally crucial to the functioning of COC operations under stress. For instance, compare Recreation Services to the 311 Department which handles service calls to the City. Fewer 311 call center employees may pose a significant issue during a sudden crisis, such as the Snowtember event of 2014, during which the 311 centre received more calls than during the 2013 flood crisis.

The opportunities for redundancy are further complicated by some attempts to create efficiency that results in decreased redundancy while also contributing to other aspects of resilience. Depending on how efficiency is pursued, increased efficiency may not hinder redundancy, or may actually unintentionally improve other aspects of resilience. Cost efficient measures that reduce the number of City staff decrease duplication redundancy and may create vulnerable systems that rely on a few individuals to operate. By contrast, increasing efficiency through business process mapping and similar strategies may result in aiding anticipatory activities which can contribute to the organization's resilience in other ways. Born out of the "work simplification" field in the early 1900's, process mapping involves defining the activities of a business or component thereof, establishing responsibility, best practices, and defining success (Graham, 2004, p. 2). While the explicit purpose of process mapping at the COC may be to uncover inefficiencies, the task of process mapping yields crucial information about how sections of the COC function and interact. Process mapping can yield information that can be repurposed to contribute to a better understanding of opportunities for resilience in organizational processes, greater sharing of information, and increased

collaboration, which are all important for informing other redundancy designs such as cross-functional redundancy. The innovation of City operations through actions such as process mapping brings insights that can be used to increase other aspects of resilience such as anticipatory behaviour. The CAI focuses on creating "innovative and collaborative solutions" for City service delivery by "collecting, analyzing, managing, and presenting" information about COC operations and services, which makes CAI a major resource for important knowledge about the inner workings of the COC (City of Calgary, 2010).

It is also the case that CAI strategies for operational efficiency sometimes do bolster redundancy. An interviewee from the ER strategy noted that in pursuit of efficiency, the CAI doesn't just look for places to cut down on staff, they also add staff strategically. This has the effect of increasing duplication redundancy. A project undertaken in CAI has found that utilizing fewer consultants and more full-time staff will increase the retention of what the COC deems crucial information. More full-time staff can contribute to building up the COC's knowledge base and internal circulation of ideas. The interviewee from the ER strategy explained this project:

> There's another [initiative] around corporate consulting. That's a look at how much money we spend on consultants. Do we spend too much on consultants and have that knowledge leave the building when the project is done? Just [taking] a whole look around, [and asking] what kind of consultants do we use, when do we use them, would it be more efficient to have more staff in house doing that kind of work? (Interviewee #5)

In this example, the COC staff conducting the project recognize that information and knowledge has a monetary value in the institution and should also be a part of calculations of cost efficiency. However, the COC has chosen to increase City staff, and likely spend more money on labour, for the long-term benefit of knowledge retention and the cost savings associated with that. The resilience outcome in this case is increased duplication redundancy.

Even from a financial perspective, the CAI recognizes the weight and importance of the resources the COC staff represent and wants to conserve and fortify their knowledge. Retention of knowledge is also important to another key aspect of resilience - anticipation. Retention of knowledge is a logical prerequisite for knowledge sharing, participation, and other activities that contribute to anticipatory behaviour.

The interviewee has also noted examples of times when the CAI made "little" changes like strategically adding a few staff to increase efficiency by increasing the speed by which key tasks are completed:

> [It's the] little things like a few extra staff in our supply group, a couple extra lawyers in the law area, because [it was] found that reviewing RFP's and contracts was slowing things down from getting to market, simple things like that. (Interviewee #5)

The interviewee implied that increasing labour costs is a small price to pay for increased processing speed for proposals. For some operations, the rate of completion, approval, or processing is an essential component of cost efficiency. Faster business means more business, which is the impetus behind the Open for Business strategy and other attempts to be a "client of choice". Once again, redundancy is supported as an unintended consequence of an action in pursuit of efficiency.

Redundancy can be built into operations deliberately and explicitly, but there are some key structural and cultural changes that can also take place to help complex processes like building redundancy become more attainable. Efforts to encourage more collaborative processes are crucial for laying the groundwork for resilience concepts like redundancy. Through communication and collaboration with diverse individuals, new opportunities for cross-functional redundancy and cross-check redundancy can be discovered or created. For example, separate business units may find potential to repurpose or reassign resources, or other sources of information for decision making. In these cases, the knowledge of how to increase redundancy was only made possible with insights that came from increased communication and collaboration.

Some efforts at the COC that are conducive to building redundancy are actions that increase intra-organizational communication and decrease institutional siloing. Increasing interconnection between units of the COC builds a multiplicity of pathways intersecting the hierarchy and chain of command that can be leveraged when necessary to repurpose units or resources to serve other functions. Better interconnection and communication within the organization aids in creating cross-functionality types of redundancy. One example of a cross-functional redundant design is the "matrix structure" which was employed during flood recovery and response in 2013.

Simply put, the "matrix" structure or model interviewees talk about is the reporting structure used during a crisis in which the Emergency Operations Center is handling the crisis and directing the response and recovery actions. An interviewee from the ER strategy team explained what the COC wants to emulate about the matrix structure during a conversation about "flood culture":

> Since the flood there's been a lot of talk of recreating that "flood culture" in different initiatives. That's what we've done with Build Calgary, Infrastructure Calgary, Analytics Calgary - we've taken that "matrix" reporting, where the leader at that point [in time] was the leader of the Emergency Operations Center. It wasn't the Mayor, it wasn't the City Manager, they were there, but the ICS structure - the In Command Structure - is very different during an "activation". I was a director working in the emergency operations center, but I wasn't really a director, I was just another person in the emergency operations center doing whatever it was that they told me I needed to do. Your stripes don't matter, it's just a matter of coming together and doing what needs to be done. It's less hierarchical, more so flat. (Interviewee #5)

As the interviewee noted, the matrix model of organization and management contrasts with typical hierarchical structure of the COC. Leaders are different, priorities are different, and how people work together is different. For City employees who are used to a lot of routine, hierarchy, and bureaucratic process in their daily working lives, witnessing the matrix structure or "in command structure" of the Emergency Operations Centre during a disaster or "activation" can be a very eye-opening experience. This same interviewee, who has now experienced another way of organizing people and tasks in a crisis, is now also more open and supportive of changing the way the COC structures operations, which is illustrated in this anecdote:

> I left a meeting this morning where I gave up one of my guys for 18 months to go work on [a City partner's project]. He's still my employee, but he's more of an embedded employee with a service level agreement saying, "80% of your time you're going to be there, 20% of the time you're back here". And he'll be paid through us but we'll get a recovery from them. So, we have to work the system differently. but it exposes people to more things and you're less likely to get that sort of silo mentality. (Interviewee #5)

This interviewee saw the value in removing barriers to interconnection and collaboration and has made decisions to support these values. While only a small subset of City employees experienced the organization of the Emergency Operations Centre, some individuals with influence, such as this interviewee, are able to share their

experiences and promote more diverse and creative options for innovating the COC's structure and processes.

Moving towards a "matrix structure" can facilitate interconnection between sectors of the organization and increase resilience in two ways: increased communication and collaboration can aid in anticipatory efforts to "plan for uncertainty" as well as create cross-functional redundancy by building more "pathways" for responding to crises. Support for the matrix structure is one of the more promising changes happening at the COC in early stages of resilience planning that could eventually support greater cross-functional redundancy within the institution.

System change

Recognizing and understanding that entire systems may change, transform, or collapse when faced with a disturbance is relevant to building resilience. Acting to steer system change rather towards adaptation and resilience requires an understanding of large scale processes and the strategic leveraging of resources. According to Holling et al. (2002), human systems have the special qualities of foresight, communication, and technology which can shape the adaptations of human systems. These qualities also work together to maximize the effects of human actions.

<u>Foresight</u>

In human systems, the use of foresight and intentionality can alter the speed and outcome of system dynamics. Foresight is not present in ecological systems where organisms cannot forecast behaviours and environment conditions and change their behaviour accordingly (Holling et al., 2002). A discussion of foresight and intentionality appears in some form in every section of this research framework because it is crucial to most components of resilience. Foresight is required for anticipatory behaviour, resiliency opportunism, and perceiving risks that call for increased redundancy.

Many interviewees mentioned the importance or use of foresight in planning, preparation, and risk assessment. One COC interviewee from the ACER program detailed the necessity of preparedness for resilience building:

> Resiliency is about being prepared, but also planning, it's planning and making preparations and having actions to achieve whatever your resiliency goals are. Potential shocks will be different wherever you

are, the stressors are going to be different too -- [stressors meaning] the more chronic long term things. (Interviewee #4)

The interviewee explained the importance of using foresight to assess different risks and vulnerabilities in order to create strategies for dealing with future disturbances. Since the potential disturbances are contextual to the setting of the system, the goals for resilience will also be contextual. Foresight is needed to create relevant resilience goals for a given system.

Resiliency planning, essentially taking the necessary steps to be prepared to respond to possible risks to system functions, is more straightforward when dealing with a shock like a flood. The interviewee notes the presence of long-term disturbances or stressors also, which are harder to address, due to several individual and institutional obstacles to anticipatory behaviour such as believing that good things are waiting for us in the future (Table 2). Using foresight is a major component of anticipatory behaviour.

Another quality related to foresight is intentionality. According to a few interviewees, upper management at the COC is said to have pushed new paradigms for operations through using new verbiage like "intentionality", which is the concept of using deliberate and concerted actions towards a goal. Intentionality is used to signal a divergence from status quo procedures. Such ideas are being introduced as part of a larger culture shift the City Manager is trying to catalyze at the institution, which is discussed in the first Findings chapter. Multiple interviewees mentioned "being more intentional" as one of the major recent changes in their decision-making process.

The COC interviewees have given some very concrete and tangible examples of not only the importance of foresight and intentionality for resilience, but also what it might look like in practice. One interviewee gave an example of the kinds of decisions that they would hope to see being made in the COC in the future:

> This is something I read about in another community, but when they build their pathways, for parks for recreational use, they actually design them in some parts to handle vehicular traffic, which gives them another way in and another way out in the event of a disaster... or allows emergency response vehicles another path in and out. It's those kinds of decisions [that need to be made], so when parks builds a pathway... do they talk to CEMA or Fire or CPS, to say 'well, is there anything we should consider in building this pathway to improve resiliency?' (Interviewee #4)

The interviewee is suggesting that new or adjusted infrastructure is assessed using foresight and considers multiple points of view and purposes in order to maximize the potential for the infrastructure to aid in resilience building. The example above illustrates an idea that using foresight and intentionality could improve disaster response and alter the outcome of a crisis. The more prepared a system is for various disturbances, the less likely it is that a disturbance will cause a system failure. This example also relies on another feature of human systems which is addressed next - communication.

<u>Communication</u>

In this context, communication refers to the transfer and storage of experience, which is not present on a mass scale in ecological systems. Humans have the ability to broadcast information, ideas, and experience which effect how crises play out (Holling et al., 2002). For the COC, communication has shaped the response to and recovery from the flood, and how resilience has been conceptualized in the organization.

One COC interviewee from the ACER program discussed how changes could be made to communication within the organization to help spread knowledge of resilience and also improve resilience. This person thought that ideally the City should be:

> ... increasing the level of awareness and having [resilience] become more integrated into our planning, almost to the point where we really don't have to have it as a special category - it's just something we consider it automatically. Coupled with that is just breaking down the barrier a little bit and having broader discussions about how we can achieve resiliency through partnerships and people working more closely together. (Interviewee #4)

The interviewee would like to see widespread communication of resiliency principles and more integration in all units of the institution. It is important to note that even quality, accurate information requires good communication structures to be useful.

In the anticipatory behaviour section of this chapter, I have discussed how, since the 2013 flood, the COC has recognized the need to retain, organize, and utilize valuable knowledge for the purposes of institutional efficiency. The initiatives of the CAI to increase knowledge retention and bolster social memory aids in supporting anticipatory behaviour but also can improve the ability of individuals to communicate important information and affect system change.

These components - retaining, transferring, storing of experience and information - in conjunction with foresight and intentionality, are essential to leveraging the uniqueness of human systems in order to adapt better to system change and disruption. If an organization is using foresight and communication to influence the adaptive cycle, then technology is the remaining human asset to be leveraged.

<u>Technology</u>

Shaping environments with technology is one of the most important things that separates humans from other animals. Ever since the Stone Age, the use of technology has extended the impact of human actions to other environments across time and space (Holling et al., 2002). Technology can be used to improve foresight or increase communication and influence system change to move towards greater resilience.

Staying up to date with advances in information technology can help the COC maximize the impact of the foresight and communication components on influencing the adaptive cycle. An interviewee who works on the Economic Resilience Strategy has provided many examples of how the CAI unit tries to innovate with technology. In this example, the interviewee talked about some current initiatives and touches on not only technology, but foresight and communication too:

> We created an initiative called Analytics Calgary, which has several pillars underneath it, with one area around Open Data. We already had an open data portal but, again, being more intentional about it, there have been some studies around start-up and tech companies and how having open data can help them. There's another [initiative] around corporate research, which is taking a look at all the research we do in this city and basically sharing it better within the corporation - it was more siloed [in the past], and this is one of those intentional things [we created], we have a centralized research library searchable by keyword now. (Interviewee #5)

Here the interviewee explained that data technology is employed, with intentionality, to increase communication and sharing of information within the institution as part of a CAI initiative. The improved access to information will inform individuals as they exercise foresight and overcome barriers to widespread communication. Initiatives like this one are examples of some ways the COC uses foresight, communication, and technology as they strive to innovate and improve operations.

Resiliency Opportunism

We can discuss the attitude that is most conducive to the prioritization and pursuit of increased resilience by using a modified definition of opportunism. Resiliency opportunism is a positive redefinition that replaces self-interest with resilience. Fundamentally, resiliency opportunism is a recognition that "crisis equals opportunity, for those who are ready to use it" (Lakey, 2015).

Continually looking for opportunities to improve and better cope with disturbances helps systems find innovative solutions to problems and be more proactive in addressing threats and vulnerabilities. A system of resiliency opportunists will be primed to seize opportunities for building resilience at any point in the timeline of a disturbance.

Most of the interviewees have explicitly noted the opportunities for change that are opened up by disturbances. An interviewee from the Office of Resilience and Infrastructure explained the atmosphere in the city and the province, and the importance of capitalizing on the current popularity of resilience:

> Alberta has had its share of wildfire and flood also, so this whole notion of community as being prepared and ready and able to withstand shocks and stresses permeates throughout our province. It's not hard to bring up a resilience discussion in our province right now. That's an opportunity we're trying to capitalize on while we can... I don't want to say that we're blessed - because we've had to deal with the flood and an economic downturn - but we're extraordinarily grateful for the opportunity that being part of the 100 Resilient Cities network offers to us, it's a little bit of a lift that we just genuinely need, and we're very thankful and grateful for it, so we want to make the most of that. It's very timely for our community. (Interviewee #1)

The interviewee explained that the desire to better cope with future disruptions is felt not only in Calgary but across the province. Disaster management and resilience is on a lot of people's minds and relevant to the lives of many citizens. The interviewee thinks there is an opportunity to gain recognition and support for resilience initiatives as long as this atmosphere remains.

However, the interviewee expressed mixed feelings towards the disaster. The disaster has uncovered valuable insights for the COC, but at a great cost to some citizens. The interviewee recognizes that if it weren't for the flood, the COC might never

have pursued the 100 Resilient Cities designation, which has become a valuable project. There is a determination to succeed that is borne out of the misery of learning a hard lesson about preparedness expressed with the phrase "making the most" of it.

In another reflective moment this interviewee recalled the phrase "don't let a good disaster go to waste". This is a counterintuitive phrase since, by definition, disasters are not usually described as "good". The interviewee goes on to expand on the phrase in more detail:

> It's that idea that we learned a lot about ourselves by experiencing both the shock and the stress. That's the value of the process - allowing that conversation dialog and then action. Unless you have a resilience platform to do that how do you actually conduct that kind of conversation? We had a flood which then created that [platform]. (Interviewee #1)

The interviewee used "ourselves" to mean the COC and the operations thereof. Again, the interviewee communicated that the flood is viewed as a learning opportunity and has spurred more dialog about resilience. The interviewee saw benefit in the "process" of disaster recovery because of the increased opportunity for new conversations which also lead to action. The flood has opened a space in the institutional discourse for conversations about resilience. The reflection on past events that this interviewee engaged in in these quotes is important for resiliency opportunism. It shows a desire to avoid repeating past mistakes, which is a step towards willingness to seek opportunities to change.

Supporting and sustaining these discussions that encourage resilience opportunism at the COC also needs to be realized. Creating a combined business unit of Infrastructure and Resilience bodes well for the growth of resilience opportunism. In a conversation about the reasons for merging the units, an interviewee from Resilience and Infrastructure discussed capitalizing on the opportunity to bring resilience into infrastructure planning:

> As we look at our infrastructure investment going forward, our infrastructure investment decisions also need to be resilient so I think it's a bit of sharing that lens. I think actually from a resilience point of view, having the opportunity to add a resilience lens to our infrastructure decisions is a unique moment in time. (Interviewee #1)

The interviewee noted that the COC recognizes the importance of considering resilience in future infrastructure decisions. Resilience is described as a "lens" that can be applied to the infrastructure-related decisions, which indicates that the interviewee believes resilience can be applied to different contexts. Viewing resilience as a versatile lens can encourage the application of resilience concepts in many decisions or projects at the COC and support the resiliency opportunism attitude. Additionally, the merging of the two units provides a structural space within the organization where COC personnel can practice resiliency opportunism regularly:

> One benefit of the resiliency opportunism attitude is expanding the reach of resiliency discussions and decisions to capitalize on different opportunities. An interviewee from the ACER program notes how far the organization has come in understanding the potential for the institution itself to lead Calgary's resiliency journey: I think the resilience thinking has really evolved along with all these shocks we've experienced. It's really been an amalgamation of those things, and it's a realization too that we as a municipality can play a big role in ensuring that, not just the administration is resilient, but partner with others outside to achieve larger resiliency benefits. (Interviewee #4)

This interviewee sees resiliency discussions leaving the confines of the COC to pursue greater resilience beyond the organization and its operations. The opportunity to form external partnerships to facilitate resilience building is recognized as well. There is some evidence here to indicate that some individuals at the COC are recognizing opportunities for planning for resilience in the city as a whole.

The resiliency opportunism attitude is important for all the other aspects of resilience. Participation and collaboration is also an aspect of resilience that requires resiliency opportunism in order to recognize opportunities to create new partnerships and capitalize on the potential of the citizens to get involved. The previous quote from the ACER informant shows how these associations are being formed at the COC.

There are, however, some barriers to the growth of resilience opportunism at the COC. The interviewee from the ACER program had some ideas for taking advantage of opportunities, and also some concerns about the uneven distribution of resiliency opportunism at the COC. When recalling how poorly the COC handled opportunities for innovation and improvement in the past, the interviewee stated:

> I think we've learned from [our previous lack of foresight], but I guess the way I'd put it is that those resiliency decisions are happening very

much in small silos, I'm not sure that it's really percolated yet into the DNA of the corporation and our planning… Maybe it's just because I've experienced the flood, but for every project we do, why wouldn't we consider that project in the context of resiliency, and consider it in the context of whether it's critical infrastructure or isn't critical infrastructure, shouldn't we be thinking more comprehensively and planning our infrastructure to accommodate resiliency than we do today? (Interviewee #4)

Exercising foresight is an important characteristic of resiliency opportunism because foresight is the foundation of other important concepts like anticipation, preparedness, and redundancy. However, this interviewee indicated that resilience is not considered ubiquitously in all COC projects. The interviewee asks the question of why there is a lack of comprehensive consideration of resilience, given that the COC acknowledges the repercussions of overlooking such measures. Not addressing a known lack of foresight illustrates an inability to capitalize on opportunities for improved resilience and discredits other claims of resilience opportunism.

Moreover, the issue of institutional siloing also prevents the spread of resilience opportunism. This interviewee states that resilience decisions are only taking place in certain small groups at the COC and support for resilience is not yet prevalent in the institution. Widespread support of resilience concepts is needed to facilitate the growth of the resilience opportunism attitude and enable more opportunities to be seized.

This interviewee also expressed pessimism around the idea that comprehensive resilience consideration can happen at the COC: "I realize that for every project we undertake at the city that would be burdensome so it's probably not realistic...but I think that's where resiliency starts to have real value, when those conversations happen." (Interviewee #4)

The interviewee thinks it would be too much work for the organization to seriously consider resilience universally, but also noted that universal consideration of resilience promises the most benefit. As much as this interviewee does support resilience concepts, this interviewee is unable to fully embrace resiliency opportunism. Those who support pursuing resilience at the COC face structural, cultural, and conceptual barriers to implementing true resiliency opportunism.

Just like the flood, the recent economic crisis also created opportunities for building resilience. However, the current economic arrangement is still a good

opportunity for making profit, which draws attention away from opportunities to create resilience. An interviewee from CED explained the reluctance to move away from oil and gas despite the drawbacks:

> Why haven't we moved on? Why do we still depend on oil and gas? Because our per capita GDP is 40% higher than every other city in Canada. So, despite the downturns, we're way above the rest of the country. Two years of recession and our GDP per capita is still way above any other city in this country. So sure, we're hurting, but we were so far ahead of everyone else before we went into this downturn. So that's why we're always putting all of our eggs into oil and gas, because it has made us ridiculously wealthy. And other cities like Vancouver or Montreal which are more far diversified don't have nearly the economic power that we do. So, to abandon [oil and gas] today is foolish. It's still an economic powerhouse, but let's leverage it so that next time it doesn't hurt so much. (Interviewee #2)

The interviewee explained that the profitability of oil and gas has discouraged effective diversification in the past. Despite the hardships, Calgary is still doing well economically in comparison to other Canadian cities. The interviewee does indicate that there are opportunities to strategically influence the economy to prevent drastic economic declines.

Efforts from both the COC and CED to address the economic resilience challenge have produced incremental or no change to the official economic strategy. Some of the adherence to the status quo in this regard is reflected in the informants' understanding of resilience concepts. Simply coping with economic disturbance is understood by COC employees as a resilient outcome. Previously an interviewee from Resilience and Infrastructure was quoted saying "resilience means being prepared and being able to ride the wave of both stresses and shocks" (Interviewee #1), which indicates that an increased capacity to endure, cope, or tolerate the negative consequences of an economic disturbance is the goal of economic resilience for this interviewee.

Similar sentiments have been echoed by an interviewee from CED during a discussion of resilience in an economic context:

> Resilience, I think also, in the Calgary context, is about those ups and downs. How do we weather the storm, how do we strengthen the core of who we are and what we do so that these things out there that we don't control don't have such a huge negative influence on us. Somewhere out there it was decided that the price of oil is going to go

from $118 to $24, [and] because of that happening in the span of 6 months it had a pretty huge impact on the city. We saw a decline of GDP of 3.7% in 2015. So, when we talk about resilience, it's how do we build from our core strengths in building a city that does not experience those [cycles], especially the down cycle. (Interviewee #2)

In terms of a thorough understanding of urban resilience, this thinking falls short. "Riding" out a crisis is not the same as adapting, improving, and embracing opportunities for change. While the work CED does to promote economic diversification involves finding, creating, and seizing diverse opportunities, the organization is not explicitly focused on building resilience and has not embraced resilience opportunism.

A City economist told me, "we do economic forecasting - it's not a planned economy, it's an open economy" (Interviewee #3) and therefore the COC tends to focus on plans and strategies for controlling its own operations rather than the larger economy. The COC has little control over the economy but is using the abilities they do possess to strategically shape the development of land in Calgary in the hopes of influencing the economy. An interviewee from the ER strategy team explained this process:

The City owns a lot of land...we have an industrial land commercial developer as part of the City [staff]. So, what we're trying to do is to make sure there's a good mix of land available ...we're trying to further the COC's municipal development plan and our transportation plan to try and make sure that we're doing the kind of city [planning] we need. So, we're emphasizing things like transit oriented development, nodes and corridors, more density, mixed use, that kind of stuff. By having that group within the city that can do those kinds of deals we can somewhat influence, without changing the market, we can influence it. (Interviewee #5)

As the interviewee explained, the COC acts on the physical form and organization of the city and believes this will influence the economy. Even with this slow and indirect method of shaping the economic makeup of the city, the interviewee does not indicate how this can improve resilience.

Other interviewees have more optimistic, but laissez-faire views of economic resilience. The experience of living through many economic cycles can inform such an attitude. An interviewee from Corporate Economics shared an insight that explained this:

What's interesting is that economies tend to evolve in spite of government actions rather than because of them. When oil prices are down, that tends to spur people. It tends to be a time period when

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things pop up. There's a lot of churn underneath the surface right now. Is that sustainable? No. Is it resilient? Yes. (Interviewee #3)

This is an approach shared by some politicians in Alberta's history such as Premier Ralph Klein, who put an end to provincial business subsidies in 1996 and shortly thereafter witnessed one of the most significant periods of economic growth in Alberta's recent history. However, the most interesting part of the interviewee's preference for free market solutions is the claim that it creates resilience. All the other interviewees cited the economic woes as a stressor and challenge for resilience planners, whereas this interviewee sees adversity and hardship as the source of urban and economic resilience. This is a completely different brand of resilience opportunism.

In summary, the success of resilience opportunism may be limited by the types of control the COC has, or perceives it has, depending on the approach to and understanding of urban resilience concepts.

Anticipation

Many disaster risks are "not if but when" scenarios that are ignored for various reasons. The following table (Table 2) of individual and institutional obstacles to anticipatory activities lists some of these reasons. These obstacles combine to result in failures to recognize, prioritize, or act upon issues that lead to "predictable surprises".

Table 2. Individual and institutional obstacles to anticipatory activities

Individual obstacles	Institutional obstacles
Positive illusions Omission bias Status quo bias Inattention to dull data	Lack of resources for data collection about emergent threats Lack of information dissemination Diffuse responsibilities Failure to learn from the past

From Wilson (2012) p.84

At the time of this writing, the COC is in the early stages of embarking on a "resilience journey", as it's called by an ACER interviewee. Fostering anticipatory behaviour at an individual and institutional level is an essential undertaking at this stage of resilience building. There is evidence that the COC has taken steps to prevent a failure to learn from the past, which is an institutional obstacle to anticipatory behaviour. The informants involved with Flood Response and Recovery and the recent commitment to pursue resilience have reflected upon the events of the past few years, and are ready

to exercise foresight to improve the COC's resilience. However, these individuals and others like them face challenges on an institutional level that hinder their anticipatory behaviour and their ability to support anticipatory behaviour of others.

One of the most concrete examples of anticipatory behaviour in action came from an interviewee from the ACER program who has also been involved in Flood Recovery Operations. In the wake of the flood disaster, some decisions have been made at the COC in anticipation of another similar flood event. The interviewee explained how the City exercised anticipatory behaviour by initiating a project to prevent future flood damage to the municipal building: "There's a separate project that our buildings group initiated, installing a large cistern just outside the municipal building, which will mitigate, if we have another flood off the Bow or Elbow [rivers], that cistern will take a lot of the water and minimize the kind of damage we saw before." (Interviewee #4)

The interviewee's example shows one disaster mitigation action the COC has taken. Ideally, anticipation results in calculated, proactive actions. Tangible examples of proactive decisions being made to reduce the impact of future disasters are a good indicator of the presence of anticipatory behaviour.

In order to prevent future disasters, individuals and organizations must be able to learn from the past. Increasing institutional memory helps to ensure that important lessons and knowledge continue to circulate in the organization. The Corporate Analytics and Innovation unit has conducted a lot of internal research that has gleaned important insights for resilience, including anticipatory behaviour. An interviewee who works on the ER strategy commented on the COC's recent recognition of the importance of institutional memory and the value of institutional knowledge. The interviewee noted the significance of asking certain questions like, "Do we spend too much on consultants and have that knowledge leave the building when the project is done?" (Interviewee #5) that contribute to the weight the COC puts on institutional knowledge. The answer to that question is yes, and has resulted in more full-time staff and comprehensive business process mapping. Asking questions like this appeal to the financial agenda of the organization and still support anticipatory behaviour through the protection of social memory, which helps to prevent repeating past mistakes.

Effective sharing of information is an important remedy for certain institutional obstacles to anticipatory behaviour. Several informants have recognized the need for new structures and arrangements that are more conducive to widespread communication so as to encourage the adoption of resilience concepts such as anticipatory behaviour. Silos and the silo mentality has been mentioned already more than once previously in this chapter and several other times by the informants in their interviews. One interviewee from ACER plainly said "we have a very much siloed organization today" and expressed concerns about siloing as a "cultural barrier" to resilience (Interviewee #4).

The structural isolation of the COC's various offices and units prevents widespread communication of important insights about future risks. A "failure to disseminate and integrate knowledge throughout the institution" is one of the institutional obstacles to anticipatory behaviour included in the typology by Wilson (2012). The business unit structure of the institution is administratively efficient but not conducive to information dissemination.

However, there are some examples of COC actions that work to improve how information is collected and shared. For example, the Office of Corporate Analytics and Innovation's mission isn't specifically resilience, but some of its innovations help to support anticipatory behaviour the institution by changing how information is shared and knowledge is accessed, utilized, and stored. An interviewee from the ER strategy team listed some CAI initiatives, one of which was focused on sharing research and information more broadly and efficiently:

> There's another [initiative] around corporate research, which is taking a look at all the research we do in this city and basically sharing it better within the corporation. It was more siloed... this is one of those intentional things...we now have a centralized research library searchable by keyword. [We're] giving people better access to stuff we already have. (Interviewee #5)

This initiative improves access to information for City employees which allows for a greater breadth, diversity, and quality of information to be used for anticipatory behaviours and other resilience decisions. Institutional silos can be detrimental to the sharing of information that is needed for accurate and effective anticipation measures. The COC may not make the explicit connection between breaking down silos and

anticipatory behaviour but there are some initiatives working to overcome the negative aspects of the silo structure.

Other initiatives at the COC have addressed the structural issue of siloing by changing how business units operate. The structure of the ER Strategy team allows the employees to collect and disseminate information widely throughout the organization and avoid becoming another siloed business unit. An interviewee from that unit first introduced to me the concept of the matrix structure and noted that the ER strategy group utilize it in their own team, telling me that, "...rather than making a new group that could become its own silo, were doing that [matrix structure] …" (Interviewee #5)

There are just a few employees on the ER strategy team and, except for the interviewee who leads the team, the employees work across multiple business units. This organization is the reason why the Economic Resilience Strategy is not the Office of Economic Resilience. Preventing this unit from becoming its own silo upholds the resilience objective on an institutional level by creating a team that can more easily exercise anticipatory behaviour.

Similarly, the Office of Infrastructure and Resilience has a combined structure to increase integration and communication, which helps circulate knowledge used for anticipatory behaviour. The Resilience and Infrastructure interviewee noted how the combined unit is an example of leaving the silo mentality in the past by "moving our organization from a place of working in silos [and] working individually to integrating with one another and moving toward a collective good." (Interviewee #1)

The increased integration, improved access to information, and increased information dissemination will to some degree help to overcome the silo barrier to anticipatory behaviour. Since the COC is just embarking on the path to greater resilience, it is important to remember that opportunities to share and discuss ideas and information and opportunities for organizational innovation are some of the first steps towards fostering anticipatory behaviour and resilience.

Collaboration

Collaborative efforts that are relevant to resilience are such things as the participation in conversations and consultations by stakeholders with diverse skills, interests, and values, as well as networking, consensus building, and social learning

(Kaufman, 2012, p.90). Since resilience building initiatives require the processing of complex information, collaborative processes help people to organize information and explore complex linkages of actions and their consequences (Kaufman, 2012, p.91).

Some interviewees have displayed a willingness to engage in communication and collaboration efforts in pursuit of resilience. Opportunities for new working partnerships or collaborative projects were discussed in the context of resilience building. Some examples of collaboration such as the 100 RC agenda-setting workshop show COC employees that collaborative processes play an effective role in bringing about robust and diverse resilience discussions. An interviewee from the Office of Resilience and Infrastructure recalled a surprising turnout at a workshop for setting priorities for the 100 Resilient Cities initiative:

> When we had our agenda-setting workshop, it was on a Friday in March, we scheduled it to go to 3:30... well we had to kick people out of the room at 3:40, and I think that says a lot about the community spirit we have here. It says a lot about the can-do attitude we have in Calgary, it shows so much commitment and care by our citizens and our community and our government, it shows that people want to be asked to be part of the dialog and the solution building. That was such an inspiring event for all of us that attended. It's added more fuel to our justification or validation of this discussion and the need for a resilience strategy. (Interviewee #1)

The agenda-setting workshop involved bringing together various community leaders and stakeholders to talk about building resilience and give insight for the development of the COC's resilience agenda. As the interviewee recalled, they did not have high hopes for the turnout to the event. However, their expectations were exceeded and they found the level of interest and participation of the guests to be inspiring. This experience solidified the importance of sharing dialog with community partners and stakeholders, and strengthened the justification for the work being done for the 100 Resilient Cities initiative. This is an example of a successful use of the collaborative process facilitated by the COC.

Other interviewees didn't give concrete examples of using collaborative processes but did express a willingness and desire for more communication and collaboration on resilience initiatives and offer ideas for achieving this. An interviewee who from the ACER unit proposed creating closer ties with some stakeholder organizations for the purpose of collaboration on resilience efforts:

Maybe there should be more close working relationships between the City and groups like Calgary Economic Development, Tourism, Calgary Airport Authority, which is key in terms of this idea of Calgary being an inland port, and even private industry like CP rail, perhaps there's opportunity to have bigger discussions as we become more mature. That's not to say that [those relationships] don't happen at all, they do, but I don't think we're really good yet at putting it all together. (Interviewee #4)

This interviewee recognized an opportunity for increased collaboration in resilience discussions about Calgary. However, the interviewee tepidly suggests this by saying "maybe" and also recognizes the shortcomings of the COC to organize such collaborative processes.

Initiatives such as the one the interviewee suggested are good for widening the COC's circles and would be a good first step towards collaboration. However, participation and collaboration for resilience is intended to bring a diverse set of voices to the table, so as to deconstruct and process complex information from a variety of views and create innovative solutions. While this informant talks about making these links, they do so in limited terms that only includes other quasi-governmental agencies and large corporations, and not non-profit, community and neighbourhood groups. Resilience scholars see broader diversity as key to truly resilient collaboration, claiming that including groups representing a broad range of unique interests will achieve more diversity of viewpoint, information, and solutions, compared to only municipal government and their subsidiaries coming together.

The interviewee from Resilience and Infrastructure also spoke about using collaborative measures in creating the capital investment plan and choosing the direction of the business unit's strategies:

[City] Council has been very much involved. We conducted focus group sessions with the community to ensure that we were hearing what community had to say, we participated in several economic discussions with our community, very much in partnership with CED. (Interviewee #1)

The interviewee noted the actions the Resilience and Infrastructure team took in order to get a variety of input, including consulting with City officials, City partners, and the community in different events. The interviewee is mentioning this to stress the

importance the business unit gives to seeking different inputs and collaborating with others in the creation of their strategies.

There is evidence that the interviewees value collaboration and want to use collaborative processes for various goals within in the resilience building process. However, the understanding of the components of good collaboration is limited and the informants did not discuss any current strategies the COC has for utilizing collaborative processes for increasing resilience.

Discussion and Conclusion

The first research question dealt with recent changes to the COC's organization - either structural or cultural - that are said to have originated, at least partially, from the experience of recent urban crises. The second research question examines the COC's recent changes related to urban resilience in a framework informed by resilience theory. Together this information illuminates how cities are inclined to plan for resilience in the wake of disaster, but lack of conceptual clarity about resilience, combined with significant institutional obstacles, leads to marginal actionable resilience priorities, default to status quo operations, and the dilution of the urban resilience concept.

The experience of the flood and other crises upset normal routines long enough for insights about alternative operations and the need for disaster preparedness to circulate. In the transition from disaster resilience to economic resilience, and in the applications of resilience concepts to urban issues, tensions and conflicts between different priorities and decision-making processes appeared. Conflicts, such as the desire for efficiency which contradicts redundancy, and tensions such as the desire for economic change but no mandate for intervention, contribute to confusing priorities and ineffective urban resilience action.

Resilience concepts provide a new direction for economic discussions at the COC but are also used strategically in "after the fact rationalized" (Interviewee #3) initiatives for purposes of justification, such as in the case of the ER strategy. Resilience is employed to provide additional justification for the decades-old economic diversification approach without questioning the past failures of this approach to sufficiently prevent or buffer economic stresses.

In addition to justifying status quo economic strategy, there is evidence that resilience has begun to be employed to support and justify priorities of institutional efficiency. Efficiency conflicts with fundamental aspects of robust resilience such as redundancy, and also aligns closer with engineering resilience than ecological resilience – the foundation of my normative definition. Mixing engineering and ecological resilience concepts indicates a lack of understanding of the fundamentals of resilience theory.

In some of the places that show the most promise for successful resilience planning, obstacles such as institutional siloing and the supremacy of efficiency priorities undermine key processes and changes necessary for comprehensive resilience planning. Siloing prevents communication and collaboration that is required for all five of the resilience components in my framework. Moreover, areas that have success in counteracting siloing still run up against efficiency priorities and entrenched status quo operations principles. The Resilience and Infrastructure Office, for example, has an integrated structure that prevents the Resilience office from becoming its own silo, but also upholds the efficient use of taxpayer dollars as the primary objective like every other business unit. These obstacles also discourage some individuals and limit the scope of their ability to plan for resilience and conceive of radically new ways of operating. Some individuals are committed to the idea of resilience, but frustrated by perceived limitations and obstacles. Others are not convinced that resilience offers a better approach to city planning than current operations. The obstacles to the adoption of a robust resilience plan at the COC are numerous.

The City is moving towards a future in which the 100RC programme shepherds Calgary's urban resilience approach. It is unclear whether 100RC is capable of, or willing, to draw attention to, or provide solutions for, the institutional obstacles that prevent a comprehensive adoption of resilience planning. Since they are high level, versatile frameworks, the CRF and CRI may be employed to further justify status quo operations under the guise of resilience planning at the COC. The 100RC framework is relatively new, and not enough research has been conducted on the efficacy of this urban resilience approach, or the ability of the 100RC programme to reinforce standards of resilience planning.

The most promising aspect of the COC's recent changes is the openness to discussion of the need for greater urban resilience that is expressed by the informants. The disasters have created opportunities for discussions of new operational structures and approaches that were not previously present. A recent significant disaster is a unique experience that not all cities pursuing urban resilience have the benefit of drawing from. The recent memory of the crises in Calgary can maintain momentum in the resilience movement and keep resilience on the political agenda – relieving a concern regarding challenges to urban resilience from the literature.

Additionally, it can be argued that, despite the lack of understanding of resilience concepts, the COC is, as a result of experiencing crisis, developing a predilection for resilience concepts. Resilience scholars might be interested in studying the tendency for disturbed systems to explicitly or inexplicitly seek resilience, or resilience concepts by another name.

Some of the COC's issues stem from the political history of the city and bureaucracy and are only applicable to the Calgary context, but other issues are a result of the complex and ill-defined field of urban resilience. The literature on urban resilience offers a rich, new paradigm for conceiving of urban systems and urban issues, but is also a minefield of potential misunderstanding. There is a compounding quality to the conceptual and theoretical issues and institutional barriers faced by the COC that contributes to the overall difficulty to effectively plan for urban resilience. Calgary's case reveals insights about the challenges that municipalities and other institutions face when trying to operationalize resilience concepts and support resilience theories in practice. Reconciling the desire to apply resilience concepts to contemporary urban problems with deeply ingrained incongruous institutional structures may be a plight shared by other municipalities embarking on resilience journeys.

Areas for future research could explore how other cities have approached building resilience, and how those city staff have knowingly or unknowingly navigated, influenced, or were affected by the structures of the institution in the process of building resilience concepts into city operations. In this research, certain groups of city staff have been integral to the progression of resilience concepts at the COC. More research is needed to discern whether this group has also influenced other ideas for progressive urbanism in the past, and whether they are meeting the same obstacles time and time again. The relative influence of the organizational structures and systems of power at the COC on the pursuit of urban resilience is also unknown and could be looked at further.

Additionally, there is opportunity to use some of the City's own work on process mapping and business continuity plans to help illuminate organizational politics that influence resilience planning. The new institutional vernacular introduced by the leadership of the City manager was only touched on in this research and needs further exploration in order to fully understand the impacts of the changing narrative within City operations.

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