Identifying Valued Community Resilience Indicators and Dimensions for King County

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Abstract

Identifying Valued Community Resilience Indicators and Dimensions for King County

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King County, Washington is challenged by a variety of potential shocks, such as earthquakes, and stresses, such as rising income inequality and climate change. It is therefore essential to strengthen community resilience. Community resilience refers to the ability of communities to work together to proactively limit risk and stress, and adapt to changing circumstances. In order to develop and implement effective resilience programs, there should be agreement on how to simplify this concept into components, or dimensions, and measure these dimensions with indicators. However, there is no strict consensus in the literature about which dimensions are most important and which indicators are most effective at measuring resilience.

Through this research, I aim to identify the most valued community resilience dimensions and indicators for King County, and understand how resilience perceptions change based on race, gender, and professional sector. I collected data with a survey that asks respondents who live and/or work in King County to rank resilience dimensions on a Likert scale

of importance, select important indicators for measuring resilience, and provide demographic information.

I found that all community resilience dimensions were either highly or most valued. This supports that a multi-pronged approach to building resilience is most effective, rather than one that focuses on a single dimension. I found that the most valued indicators were those that are fundamentally important, such as drinking water reliability. The majority of indicators derived from the Seattle Resilience Strategy were highly valued instead of most valued. The least valued indicators concerned demographics, such as high English-language competency. Although resilience literature generally argues that demographic indicators are important for assessing resilience, there is no ethical or practical program that would seek to limit diversity. My findings support that perceptions change depending on professional sector, race, and gender, but further research is needed to assess perceptions, as my response was not diverse or controlled for each demographic. This knowledge is important for implementing equity-based resilience strategies that seek to strengthen resilience for underserved populations.

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Definitions of Key Terms

Community: a group of people defined by geographic proximity, or a common attribute, such as a shared language

Community resilience: a community's ability to work together to proactively limit risk and stress, and adapt to changing circumstances

Community resilience dimension: a component of community resilience

Community resilience indicator: proxy variables that provide a way to analyze resilience spatially by comparing the resilience of different geographies, and temporarily by analyzing trends that affect resilience over time (Cutter et al., 2008)

Shocks: acute disruptions or disasters, such as earthquakes or landslides (100 Resilient Cities, 2016)

Socio-ecological systems: systems that consist of interacting human and natural actors (Alberti & London, 2016)

Social capital: strong, trusting social networks within a community that enable positive and effective action

Stresses: chronic issues that can weaken a community's well-being and effectiveness (100 Resilient Cities, 2016)

1. Introduction

General Statement of the Problem

For the first time in history, more than half of the global population lives in cities. At the same time, we face unprecedented climate change, which is causing extreme weather around the globe. The Puget Sound Region faces a variety of challenges, including shocks such as earthquakes, and stresses such as rising income inequality and population growth (City of Seattle, 2014). These trends make building community resilience essential. 100 Resilient Cities is an organization that is helping cities around the world achieve resilience by providing tools curated by a variety of public, private, academic, and nonprofit partners, as well as opportunities to collaborate with other member cities. Members of the 100 Resilient Cities Network, such as the City of Seattle, develop resilience strategies that outline goals to increase resilience by addressing community-specific challenges and leveraging strengths (100 Resilient Cities, 2016).

Resilience is a broad concept, and current frameworks lack the comprehensiveness to define and assess it (Cimellaro et al., 2016). To develop and implement effective resilience programs, there should be agreement on how to simplify this concept into dimensions, and what resilience indicators will be most effective in assessing progress. However, the literature does not specify which resilience dimensions are most important, and there is no consensus over which indicators are most effective in measuring resilience. To make it more challenging, measurements of resilience change based on scale, and geographic and temporal factors.

Significance of Research

This study aims to identify the most valued community resilience indicators for King County and investigate public perceptions about the following common resilience dimensions: social and community, economic, infrastructural, institutional, and environmental. Additionally, this research makes an effort to understand how demographic factors, such as profession, race and gender, can impact resilience perceptions, which is a gap in the current resilience literature. This study aims to inform county-wide resilience efforts.

Research Questions

The following research questions will guide this study (Figure 1):

1. Are community resilience dimensions perceived as equally important in King County?
2. What are the most valued community resilience indicators in King County?
3. How are resilience perceptions in King County influenced by professional sector, race, and gender?

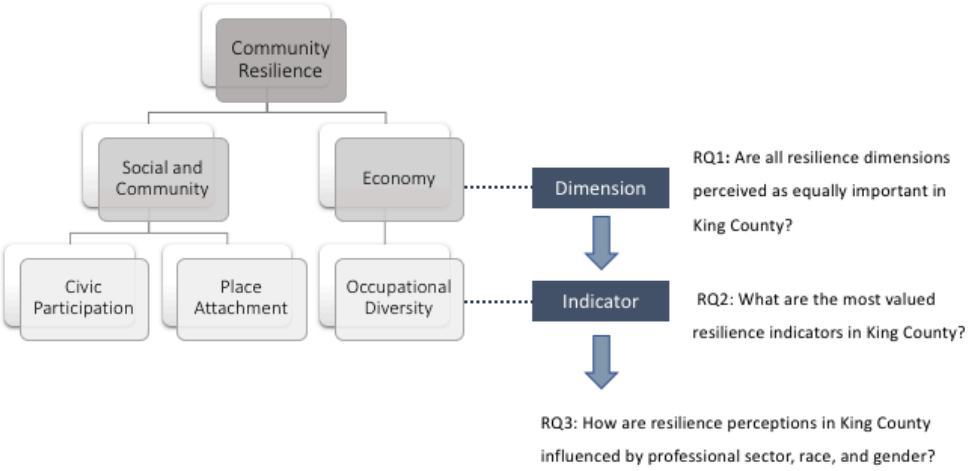


Figure 1: Conceptual diagram of research questions

Document Overview

The Literature Review, Chapter Two, outlines an evolution of resilience theory, including ecological, social, and community resilience. Additionally, I analyze six community resilience frameworks to identify common resilience indicators presented in the literature. In the Methods Section, Chapter Three, I describe the survey instrument used to test the research questions. The survey population includes those who live and/or work in King County. Respondents were asked to analyze the importance of each resilience dimension, and choose important indicators for measuring resilience in King County. I describe and discuss survey results and make recommendations for further research in the Findings and Discussion section, Chapter Four. The Conclusion provides a summary of the most salient points of my research, focusing on the broader implications of these results on planning and policy.

Limitations

I relied heavily on social media and email to distribute my resilience survey. My social networks largely consist of college educated people who have access to a computer with internet. Although some respondents distributed the survey to their own networks, the survey results likely reflect this response bias. A more diverse response could have been achieved if I had used both print and digital methods to distribute the survey, and if a team of diverse individuals helped to distribute the survey to their networks. However, due to time and resource constraints, these distribution techniques were not used.

2. Literature Review

Ecological Resilience

The concept of resilience encompasses a diverse number of meanings and has evolved over time (Bahadur, Ibrahim & Tanner, 2010). Resilience was first discussed in the field of ecology by Holling (1973) who described resilience as the ability of a system to persist despite shocks that impact key system functions. Holling elaborated on the differences between resilience and stability: stability is the ability of a system to return to its equilibrium condition after a shock, and resilience describes the system's ability to persist within its domain of attraction, which is defined by multiple stable equilibrium (Holling, 1973). A transition out of this domain of attraction would constitute a regime shift, or a dramatic change in system behavior, composition, or structure (Alberti & London, 2016). The tipping point in which a system enters a new regime is known as the threshold.

System states are maintained by interrelated fast and slow variables. Fast variables change relatively quickly, while slow variables react gradually to longer-term processes, which makes them harder to measure and detect than fast variables (Alberti & London, 2016; B. H. Walker, Carpenter, Rockstrom, Crépin, & Peterson, 2012). Fast variables in socio-ecological systems (systems that consist of interacting human and natural actors) include changes in land composition, loss of plant life, pollution emissions, and other factors with fast turnover rates; slow variables often refer to the ability of natural bodies, such as lakes and soil, to retain pollutants, water, and nutrients as well as ecosystem dynamics, such as competition between and within species(Alberti & London, 2016). When a slow variable reaches a threshold, or

tipping point, a regime shift can occur. For example, lakes near urban areas and agricultural fields experience fluctuations in phosphorus and nitrogen input from fertilizer use, but extreme algae growth only occurs once a certain level of nitrogen or phosphorus is absorbed in the water (Alberti & London, 2016).

Resilience, especially that of socio-ecological systems (SES), is influenced by states that are above and below the focal state (Walker, Holling, Carpenter & Kinzig, 2004). For example, when determining the resilience of a lake, it is important to consider the coarser scale, such as human land use that can impact water quality, as well as the finer scale, such as the resilience of the individual populations that live in the lake (Figure 1). This cross-scale influence on resilience is known as "panarchy" (Walker et al., 2004).

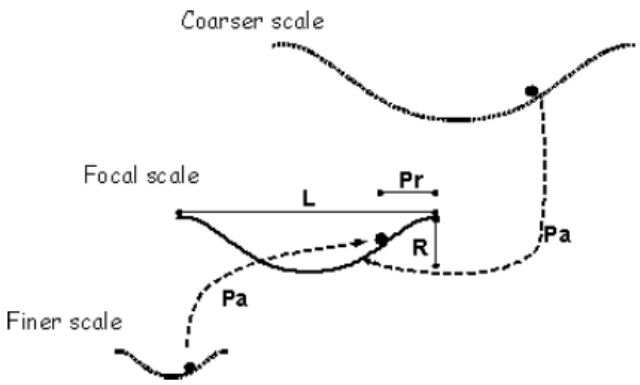


Figure 2: Depiction of the cross-scale influences that occur in 'panarchy' (Walker et al., 2004).

The concept of panarchy is useful for understanding the complexity of the adaptive cycle. The adaptive cycle is used to outline the future states of a system and the journey it takes in response to shocks and stresses: the "forward loop" of this cycle consists of growth or exploitation phase, in which the system is very adaptable and consumptive, followed by a conservation phase in which the system is much less flexible and adaptable (Walker et al.,

2004). The backward loops lead to inevitable collapse and release phases, followed by a reorganization phase that may lead the system into a similar, or completely new state (Walker et al., 2004).

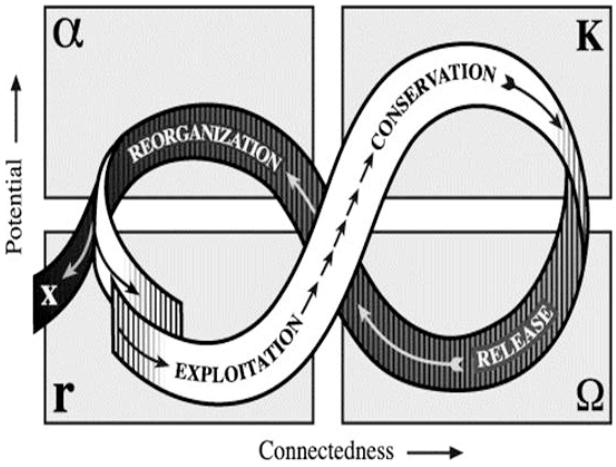


Figure 3: The four phases of resilience: exploitations and conservation (the forward loop) and release and reorganization (the backward loop) (Alliance, n.d.).

Social Resilience

Although ecological resilience focused on socio-ecological systems (SES), there was not a strong focus on what made the human systems resilient. As the concept of resilience evolved, social resilience became a stronger focus. Adger (2000) examined social resilience as it relates to the environment, particularly focusing on resource-dependent communities, such as coastal villages that depend heavily on fishing. Social resilience, which is defined as "a community's ability to withstand shocks to its social infrastructure" is affected by ecological resilience (Adger, 2000). For example, the decision to convert Mangrove swamps into aquaculture ponds in coastal Vietnamese villages increased income inequality and rearranged important social structures, therefore reducing social resilience at the household and community levels. Functional diversity, degree of resource dependence, income stability and distribution,

mobility, migration, and displacement are all important indicators of social resilience (Adger, 2000).

Similarly, Gunderson (2010) compared ecological resilience with community resilience and found that ecological resilience and community resilience share characteristics; both types of resilience are built by forms of capital, such as social or natural capital that are bolstered during phases of growth, and both are strengthened by functional diversity (Gunderson, 2010). Additionally, ecosystems and human communities can undergo phase shifts, in which system properties and characteristics experience dramatic change, such as in the case of neighborhood redevelopment (Gunderson, 2010).

One key difference between these two types of resilience is that human societies can learn from the past and anticipate future events, while there is no evidence that ecosystems can do the same (Gunderson, 2010). Therefore, learning and flexibility are essential traits that can help human communities deal with uncertainty and complex challenges through techniques like adaptive management (Adger, 2000; Alberti & London, 2016; Gunderson, 2010). Much of the literature agrees that flexible and adaptive management techniques should be prioritized over management techniques that try to promote stability and reduce uncertainty, which is not always possible depending on the problem (Adger, 2000; Alberti & London, 2016; Gunderson, 2010; Holling, 1973). Scenario planning is a tool that can promote institutional flexibility by allowing decision-makers to plan for multiple futures instead of one probable future (Alberti & London, 2016).

Resilience and sustainability are closely related; therefore, a society that is resilient will likely have a more sustainable relationship with nature (Dovers & Handmer, 1992). According to

Walker, Holling, Carpenter, & Kinzig (2004), three important system attributes facilitate sustainability: resilience, adaptability (the capacity of human actors in a system to increase system resilience), and transformability (the ability to move to a more desirable state due to changing conditions). Governments and other organized services need to recognize external factors that influence these attributes, as well as help to promote resilience, adaptability, and transformability within their communities (Walker et al., 2004). For example, after soil conditions degraded significantly in Zimbabwe due to extensive cattle-ranching and severe drought, land use patterns were transformed from small ranches to large conservancies in which cattle was managed collectively (Walker et al., 2004). Thus, a more sustainable community was created.

Community Resilience

Academic and practitioner focus is shifting to community resilience as a way to strengthen communities' preparedness, response, and recovery to abrupt shocks, such as landslides, or longer-term stressors, such a climate change. "Resilience, especially community resilience, is becoming the de facto framework for enhancing community-level disaster preparedness, response and recovery in the short term, and climate adaptation in the long-term" (Cutter, Ash, & Emrich, 2014). Like ecological, social, and hazards resilience, community resilience is bolstered by adaptive capacity, and is closely linked with sustainability. For example, Wellington, New Zealand emphasizes the importance of adapting to changing climatic conditions, and using resources efficiently in their Resilience Strategy developed in partnership with Rockefeller Foundation's 100 Resilient Cities (City of Wellington, 2017)

Community resilience is often used to indicate how quickly a system can return to a previous, and good state (Bahadur et al., 2010) or in other terms, "bounce back". Additionally, community resilience is seen as a process, not an outcome (Norris, Stevens, Pfefferbaum, Wyche, & Pfefferbaum, 2008). Cutter et al (2008) view resilience as "a system's capacity to absorb disturbance and reorganize into a fully functioning system. It includes the ability of a system to return to the state or multiple states that existed before, and to advance these states through learning and adaptation." In this report, community resilience is defined as the ability of a community to work together to proactively limit risk and stress, face challenges, and adapt to changing circumstances.

Another important theme in community resilience literature addresses the relationship between resilience and vulnerability. There is much debate over whether resilience and vulnerability are opposite concepts (Cutter et al., 2008). Resilience models are often tested against vulnerability models, such as the Social Vulnerability Index developed by Susan Cutter. Results show that vulnerability and resilience are negatively correlated, and there is some overlap between the two concepts; however, they are not opposites (Cutter et al., 2014; Sherrieb, Norris & Galea, 2014). While the literature thoroughly covers vulnerability, it does not emphasize the need for social justice as much as it should. Academics and practitioners should view resilience efforts through a social justice and equity lens in which efforts are focused on helping groups experiencing inequities based on factors such as race, ethnicity, gender, age, sexual orientation, socioeconomic status, and immigration status. These inequities can create barriers for individuals and communities to engage in preparedness and resilience efforts. It is

important to address societal inequities before a disaster as these inequities will likely be sustained or exacerbated during rebuilding efforts after a disaster.

Breaking Community Resilience Down

Although there is no strict consensus about the fundamental dimensions that comprise resilience, community resilience is often broken down into social, community, economic, infrastructural, institutional, and ecological dimensions. This section outlines the importance of each of these dimensions in building resilience.

Social and community capital is considered essential to building community resilience. Community capacity and social capital are often considered as separate dimensions; however, the distinction between these two categories is convoluted because they are so closely related. For this report, social and community capital have been placed into one category. In communities with strong social capital, community members are better able to work together to address challenges and develop community solutions, such as sharing of resources and skills after a disaster (Aldrich & Sawada, 2015). Social and community capital is strengthened when community members have access to resources and information, and have the opportunities and understanding of how to participate in public and community processes. Common indicators for social and community capital include demographic measures, participation in civic and social activities, and access to transportation and communication devices (Cimellaro, Renschler, Reinhorn, & Arendt, 2016; Cutter et al., 2014, 2010). Research shows that social and community capital will bolster resilience immediately after a disaster when government resources are stretched thin, and during recovery. Aldrich and Sawada (2015) assessed the mortality levels of 130 Japanese cities after a major earthquake triggered a nuclear reactor

explosion in 2011, and found that cities with lower mortality levels had higher trust and social interaction when other confounding variables were controlled for.

The economy influences community resilience. The local economy should be diverse in order to sustain employment opportunities for a diverse population, and withstand impacts of stresses and shocks, such as an economic crisis or natural disaster. Economic development can be broken down into resource level, resource equity, and resource diversity; indicators for each subcomponent include employment rate, income equality, and occupational diversity respectively (Sherrieb, Norris, & Galea, 2010). Economic indicators should help assess social equity, by looking at the distribution of income and resources across different demographics.

Infrastructure provides a framework that helps to strengthen social capital and community capacity. Redundancy of operations, such having multiple sources of power, and efficient resource use are practices that will help to ensure that infrastructure systems continue operating despite shocks and stresses, or are restored quickly after disaster. There is a stronger emphasis in the literature on resilience to flooding rather than earthquakes, as floods are more common in many of the study areas. However, King County is in an earthquake-prone region, so infrastructure resilience greatly depends on earthquake engineering (City of Seattle, 2014). Common indicators for infrastructure resilience include housing condition and age, and evacuation potential based on principle arterial road miles (Cutter et al., 2014, 2010; Department of Homeland Security, 2016).

Institutional capacity is characterized by a community's ability to increase adaptability, reduce risk, and increase social capital and community capacity (Cutter et al., 2010). Planning, mitigation, and political factors all influence a community's institutional capacity (Cutter et al.,

2010). Common institutional indicators include hazard mitigation planning, and flood insurance coverage for individuals and businesses located in flood-prone areas (Cutter et al., 2014, 2010; Department of Homeland Security, 2016). There is some overlap between the institutional and infrastructural dimensions. Many institutional indicators directly affect infrastructure, including building codes, flood and earthquake insurances, and hazard mitigation planning. Although these dimensions are often separated in the academic literature, and will be for the purposes of this study, a practitioner may consider infrastructural and institutional indicators to be too closely related to separate into distinct categories.

Environmental services contribute to community resilience in many ways. Natural infrastructure can help increase the adaptive capacity of communities. To illustrate, bioswales improve stormwater management and absorb atmospheric carbon. Additionally, access to nature in any form can improve mental and physical health, especially in underserved communities with little access to nature. Urban gardens can provide nutritious food to communities who have limited access to healthy foods. Surprisingly, the literature neglected to cover the importance of environmental equity in promoting community resilience. Common indicators in the literature for assessing environmental resilience include natural flood buffers, such as percent wetlands (Cutter et al., 2014; Department of Homeland Security, 2016) and air, water, and soil quality (Cimellaro et al., 2016).

Climate change is altering the environmental conditions in which we depend, and is a threat to community resilience. Climate change impacts in the Pacific Northwest include changes in the hydrological cycle, ocean acidification, increased heat events, and sea level rise (Climate Impacts Group, 2000). King County is working to adapt to these changes, as well as

mitigate climate change by reducing greenhouse gas emissions. Therefore, climate indicators are essential in assessing resilience.

Measuring Community Resilience

Much of the literature agrees that assessing resilience is a crucial step in transitioning from conceptualization of resilience to implementation and assessment of resilience. As stated by Bahadur et al., "Operationalizing resilience helps to promote resilient development" (2010). Resilience indicators provide a useful tool for determining priorities, measuring progress, and helping in decision-making processes (Cutter, Burton, & Emrich, 2010). Resilience is abstract and hard to assess without proxy variables, such as indicators, that provide a way to analyze resilience spatially by comparing the resilience of different geographies, and temporarily by analyzing trends that affect resilience over time (Cutter et al., 2008). Good indicators adequately represent a particular resilience component, and should be measurable based on available data, or data obtained through new methods (Albert & London, 2016; Cutter et al., 2008). Indicators should also be robust, reproducible, relevant, and simple to understand. There are a few limitations of indicators, including the subjectivity of selecting and weighting each indicator, problems with scaling (e.g. indicators for national progress versus local progress), and validating the accuracy of the indicators (Cutter et al., 2008).

Many cities are using indicators to assess the progress of government and community resilience-building efforts. San Francisco, a member of Rockefeller's 100 Resilient Cities is experiencing challenges similar to Seattle, incorporates multiple indicators in their City Resilience Strategy. San Francisco faces challenges similar to Seattle, including shocks such as earthquakes and mud slides, and stresses such as economic inequality and climate change. One

goal from San Francisco's Resilience Strategy is to seismically retrofit weak buildings, adapt to sea-level rise, and mitigate green-house gases (City and County of San Francisco, 2016). Key indicators for measuring progress towards this goal include retrofitting 180,000 homes, completing a disaster-resilient waterfront by 2035, and reaching greenhouse gas reduction goals by 2040 (City and County of San Francisco, 2016).

Community Resilience Indicators

I reviewed five documents to identify common community resilience indicators associated with the resilience dimensions. These articles were chosen due to the clarity and comprehensiveness of dimensions and indicators presented, and included academic papers and government publications. Generally, the frameworks were broken down into variations of the five common dimensions of resilience, including economy, social and community, infrastructure, institutional, and environment (Table 1).

Table 1: Resilience Dimensions of the five reviewed frameworks (shaded dimensions are included in the framework)

	Social and Community	Economy	Infrastructure	Institutions	Environment
Sherrieb et al., 2010					
Cutter, Ash, & Emrich, 2014					
Cimellaro, Renschler, Reinhorn, & Arendt, 2016					
Department of Homeland Security, 2016					
The Seattle Resilience Strategy (exp. 2018)					

Community resilience can be seen as a way to prevent disaster-related health problems in community members (Norris, Stevens, Pfefferbaum, Wyche, & Pfefferbaum, 2008). Norris et al. (2008) conducted a literature review focused on research related to stress, adaptation resource dynamics, and wellness to determine four networked adaptive capacities: economic development, social capital, information and communication, and community capacity (Norris et al., 2008). These capacities focus on wellness and quality of life as a way to bolster community resilience, and are more narrowly focused than frameworks developed by Cutter et al (2014), and Cimellaro et al. (2016). Two years later, Sherrieb et al., (2010) sought to

identify and measure the capacities in the Norris et al. community resilience framework with archival and publicly-accessible indicators relating to Mississippi Counties; however, only economic development and social capital capacities had enough data for measurements. Sherrieb et al., (2010) started by defining the following sub-elements of each capacity: resource level, resource diversity and resource equity for economic development, and social participation, social support and community bonds for social capital. Then, indicators were developed for each sub-element using the following criteria: if the indicator made sense based on literature review and pilot studies, if the magnitude and direction of the indicator correlated with known patterns, and if the indicators correlated with the Social Vulnerability Index (SOVI). Over 80 indicators were put on a wish list, and seventeen indicators were included in the analysis, mainly due to data availability. I used this list of indicators to develop the master list for this study (Table 2).

The Cutter et al., (2014) framework for resilience includes the six following capitals: social, economic, community, institutional, housing/infrastructure, and environmental. This research expanded on Cutter's previous work, including the Disaster Resilience of Place (DROP) model that examined factors affecting a community's ability to prepare for and respond to disasters and adapt to post-disaster conditions (Cutter et al., 2008), as well as Cutter's Baseline Resilience Indicators for Communities (BRIC), which included five subcomponents of resilience: social, economic, community, institutional, and infrastructural resilience (Cutter, Burton, & Emrich, 2010). Environmental resilience was excluded from the earlier BRIC framework due to difficulty in developing representative indicators of environmental conditions for diverse study areas (Cutter et al., 2010).

Cutter et al. (2014) developed a list of 61 indicators to measure the six capitals. These indicators were justified with reasoning from previous research. Social capital indicators measure demographic variables that facilitate knowledge, communication and mobility (i.e. transportation access); economic variables measure community economic factors, such as diversity and equity; community indicators help to assess the ability of community members to work together; infrastructure variables focus on housing capacity and infrastructure that can help in an emergency (i.e. evacuation potential); institutional indicators focus on disaster policies and planning; finally, environmental indicators mainly assess flooding and natural resource use. The authors eliminated some variables because they were very similar to other variables, and others because they required reasoning that was not consistent with the majority of other variables.

The PEOPLES framework, developed by Cimellaro et al. (2016) includes seven dimensions for measuring resilience: population and demographics, environment and ecosystem, organized government services, physical infrastructure, lifestyle and community competence, economic development, and social-cultural capital (Cimellaro et al., 2016). The PEOPLES framework is meant to be applied to communities of different geospatial scales (i.e. local, federal), as well as at different temporal scales (i.e. response, recovery, and redevelopment). One unique characteristic of this framework is that it includes population and demographics as a separate component, which allows for easy recognition of varying demographic influences on community resilience.

The Department of Homeland Security Mitigation Framework Leadership Group (MitFLG) developed a draft framework for community resilience that is composed of ten core

capabilities and associated indicators (2014). This framework was created to address the need for national-level community resilience metrics, and serve as a basic framework for defining measurement tools at the local, regional, state, and federal levels. Six of the ten core capabilities relate to infrastructure or mitigation, while only one capability focuses on community resilience. This ratio demonstrates a strong focus on the physical and political side of disaster resilience, and a tendency to undervalue the social and community side of resilience. Additionally, natural and cultural capital are combined, when they should be separated in order to get the emphasis each requires. One strength of this framework is its detailed assessment of infrastructural and institutional dimensions, including hazards identification, risk assessment, and planning.

The Seattle Resilience Strategy is expected to be released in the summer of 2018. This strategy includes important community resilience indicators for the City of Seattle that were collected through an extensive community engagement process. The engagement process culminated in a list of indicators that related to each of the resilience dimensions: social, community, economic, environmental, institutional and infrastructural. Important indicators in this draft strategy include housing affordability, racial equity, adaptation to climate change, government alignment with community goals, seismic retrofitting, and transportation infrastructure (M. Barnett, personal communication, December 12, 2017).

I created a table that outlined my master list of common indicators by dimension, example measures for each indicator, and the source in which the indicator was found (Table 2). I included indicators that were referenced by two or more papers or documents; however, a few indicators that were referenced by two or more authors, such as social participation and

disaster volunteerism, were not included due to overlap with other indicators (e.g. social participation was very similar to civic participation). It is important to note that many indicators can be classified under multiple dimensions resilience; for example, health access, can be classified under economic resilience (Sherrieb, Norris, & Galea, 2010) and social resilience (Cutter et al., 2014). I used my judgement to categorize these indicators.

Some indicators that were not referenced by two or more authors were also included to fill important gaps in this literature. For example, very few studies discussed environmental equity directly (although air, water, and soil quality can measure environmental equity indirectly). Given the importance of environmental equity in urban communities, an environmental equity indicator was added to the list. Indicators relating to seismic retrofitting were added to the list, as seismic retrofitting is crucial in western Washington. An indicator assessing carbon emissions was also added to the list.

Differences between geography and scale created minor issues when compiling indicators from multiple sources. Most of the frameworks reviewed were developed on a county-wide scale, which is the same scale used in this study. However, the Department of Homeland Security's indicators were developed on a national scale, and the Seattle Resilience Strategy indicators on a city-level scale, which alters the specificity of these variables. Indicators developed at the county-level were often developed for different regions of the United States, such as those generated by Cutter et al. (2014), for counties in the south-eastern region of the United States. Differences in geography and scale can account for the lack of indicators addressing important issues in King County, such as seismic retrofitting.

Table 2: The master list of common resilience indicators used for this study

Indicator	Example Measure	Source
Social and Community Dimension		
High volunteerism	Number of volunteer hours in the past year	(Cimellaro et al., 2016; Department of Homeland Security, 2016)
High political participation	Percent voter participation in the 2016 presidential election	(Cutter et al., 2010; Sherrieb et al., 2010)
High civic participation	Number of civic organizations per 10,000 capita	(Cutter et al., 2014; Sherrieb et al 2010)
Advocacy (not included in survey)	Number of social advocacy orgs/ 10,000 capita	(Cimellaro et al., 2016; Cutter et al., 2014, 2010)
Social participation (not included in survey)	Number of arts, recreation, and entertainment orgs/ 10,000 population	(Cimellaro et al., 2016; Sherrieb et al., 2010)
High religious participation	Number of religious adherents/ 10,000 population	(Cimellaro et al., 2016; Cutter et al 2014, 2010; Cutter et al 2014; Sherrieb et al 2010)
Low average age	Percent non-elderly population	Cutter et al. 2010; Cimellaro et al., 2016; Cutter et al 2014
High English language competency	Percent of individuals who speak a language other than English at home	Cutter et al 2010; Cutter et al 2014; Cimellaro et al., 2016
High transportation access	Percent population with access to a vehicle	Cutter et al 2010; Cutter et al 2014; Cimellaro et al., 2016
High communication capacity	Percent population with a smart phone	Cutter et al 2010
High place attachment	Net internal migration into community (County, city)	(Cimellaro et al., 2016; Cutter 2010 and 2014; Sherrieb et al 2010)
Healthy behaviors (not included in survey)	Percent of adult population participating in leisure time activities	(Department of Homeland Security, 2016)
High health access	Physicians per 10,000 Population	Cutter et al 2010; 2014; Sherrieb et al 2010
Economic Dimension		

Indicator	Example Measure	Source
High employment	Employment-to-population ratio	(Cimellaro et al., 2016; Cutter et al., 2014, 2010; Department of Homeland Security, 2016; Sherrieb et al., 2010)
High occupational diversity	Percent population employed in non-dominant industries	(Cimellaro et al., 2016; Cutter et al., 2014,2010; 2014; Sherrieb et al., 2010)
High median income	Median household income	(Cimellaro et al., 2016; Department of Homeland Security, 2016; Sherrieb et al., 2010)
High racial equity	Equal pay for equal work across racial groups	Seattle Resilience Strategy
Income inequality (not included in survey)	GINI coefficient	(Cutter 2010 and 2014; Sherrieb et al 2010)
High housing affordability	Percent of households that are cost overburdened (housing costs, including utilities) exceed 30% of monthly income.	(Department of Homeland Security, 2016); Seattle Resilience Strategy
High housing capital	Percent homeownership	(Cimellaro et al., 2016; Cutter et al., 2014, 2010)
Low poverty	Percentage of population living below poverty line	(Cimellaro et al., 2016)
High educational equity	Ratio of the percent population with college education to the percent population with no high school diploma	(Cutter et al 2010; 2014; Sherrieb et al 2010)
High diversity in business size	Ratio of small to large businesses	(Cutter et al 2010; 2014)
High creativity and innovation	Percent employed in creative class occupation (designers, engineers, artists, and architects)	(Cutter et al 2014; Sherrieb et al 2010)

Indicator	Example Measure	Source
State and local government revenues (not included in survey)	Property tax revenue/ local gov	(Department of Homeland Security, 2016)
Infrastructural Dimension		
Sturdy housing condition	Percent housing units that are not mobile homes.	(Cutter et al 2014, 2010; Department of Homeland Security, 2016)
Housing age (not included in survey)	Housing units built before 1950	(Cutter et al 2014, 2010)
High access/ evacuation potential	Principle arterial miles per square mile	(Cutter et al 2014, 2010; Department of Homeland Security, 2016)
High sheltering capacity	Hotels/motels per 10,000 people	(Cimellaro et al., 2016; Cutter et al 2014, 2010)
High density	Housing density of single family homes	Cimellaro et al., 2016
High transit connectivity	Percentage of public transportation passenger terminals with intermodal connectivity	(Department of Homeland Security, 2016); Seattle Resilience Strategy
High accessibility	Percentage of transit stations in compliance with ADA requirements	(Department of Homeland Security, 2016)
School restoration potential (not included in survey)	Public schools per 10,000	(Cutter et al 2014, 2010)
High internet access	Percent population with access to Broadband Internet services	(Cimellaro et al., 2016; Cutter et al 2014)
High rates of seismic retrofitting	Number of bridges/tunnels in need of seismic retrofitting	Seattle Resilience Strategy (exp. 2018)
High dam safety	Percent of high hazard potential dams with an updated Emergency Action Plan	(Department of Homeland Security, 2016)
High drinking water reliability	The quantity of water in rivers and lakes during the summer season	Developed to fill in gap

Indicator	Example Measure	Source
High medical care capacity	Percent population within one mile of a hospital	(Cutter et al., 2014)
Environmental Dimension		
High environmental equity	Percent of neighborhoods within 1/2 mile of a park or recreation field)	Developed to fill in gap
High soil quality	Number of earthworms per square foot	(Cimellaro et al., 2016; Department of Homeland Security, 2016)
High air quality	Air Quality Index	(Cimellaro et al., 2016; Department of Homeland Security, 2016)
High water quality	Type and distribution of aquatic bacteria	(Cimellaro et al., 2016; Department of Homeland Security, 2016)
High natural flood protection	Percent land in wetlands	(Cutter et al 2014; Department of Homeland Security, 2016)
High water conservation	Per capita water use for all domestic uses	(Cutter et al 2014; Department of Homeland Security, 2016)
Efficient Energy Use	Megawatt hours/capita	(Cutter., 2014)
High forest conservation	Percent change in tree cover canopy since 2000	(Department of Homeland Security, 2016)
High renewable energy use	Percent of energy that comes from renewable sources	Developed to fill in gap
Low sea level rise	Measure as mm/ year	Developed to fill in gap
Low carbon emissions	Measure as metric tons/ capita	Developed to fill in gap
Institutional Dimension		
High emergency response	Number of available response units per capita	(Cimellaro et al., 2016)
Disaster-resistant building codes	Percentage of communities that are subject to seismic, hurricane, or flood hazards that have adopted responsive building codes	(Department of Homeland Security, 2016)
High jurisdictional coordination	Number of government and special units/ 10,000 population	(Cutter et al 2014, 2010)
Strong hazard mitigation planning	Percent of population covered by a hazard mitigation plan	(Cutter et al 2010; Department of Homeland Security, 2016)

Indicator	Example Measure	Source
High flood insurance coverage	Percent population covered by flood insurance	(Cutter et al 2014, 2010; Department of Homeland Security, 2016)
High earthquake insurance coverage	Percent population covered by earthquake insurance in earthquake-prone areas	Developed to fill in gap
High health insurance coverage	Percent population covered by a health insurance plan	(Cutter et al., 2014, 2010)
Planning integration	Goals and policies of community plans align with hazard mitigation plans	(Department of Homeland Security, 2016)
High emergency preparedness	Percent population that has participated in preparedness skills training	Developed to fill in gap
High mitigation investment	Ten-year average per capita spending for mitigation	(Cutter et al 2014; Department of Homeland Security, 2016)

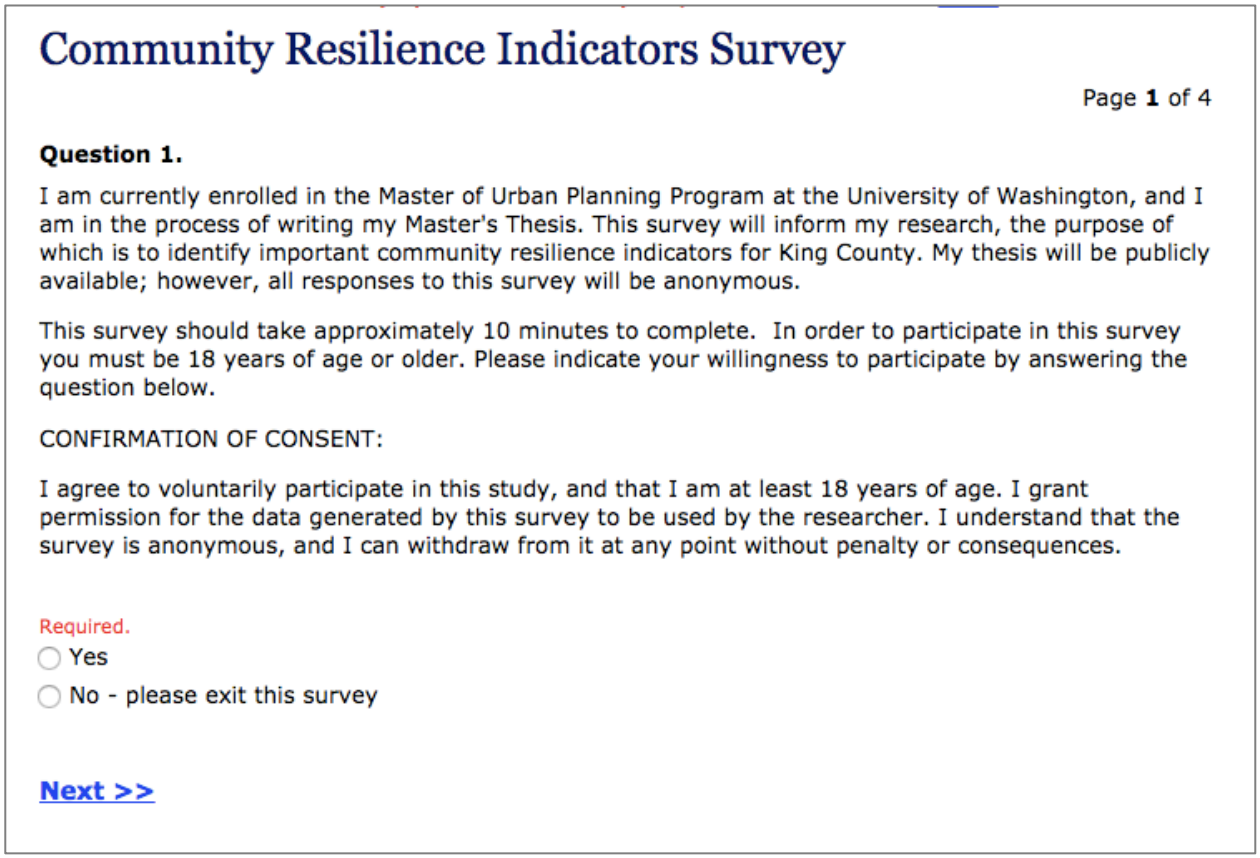
3. Methods

This research aims to identify valued community resilience indicators and dimensions in King County, and assess how demographic factors, specifically race, gender and profession, influence resilience perceptions. These research questions were informed by an anonymous, cross-sectional survey instrument described in detail below. I chose to use a survey instrument because surveys are easy to distribute. Oftentimes, when local governments facilitate focus groups and community meetings, the attendees who participate are the very civically active, and their voices are heard more than other members in the community. A survey provides an opportunity to hear from respondents who may not come to in person engagement events, such as meetings or focus groups.

Instrumentation and Data Collection

Survey Population

I distributed the survey through email and social media to residents of King County who were 18 years of age or older. The first question on the survey confirmed that respondents were legal adults and granted permission for their responses to be used by the researcher (Figure 4).



Community Resilience Indicators Survey

Page **1** of 4

Question 1.

I am currently enrolled in the Master of Urban Planning Program at the University of Washington, and I am in the process of writing my Master's Thesis. This survey will inform my research, the purpose of which is to identify important community resilience indicators for King County. My thesis will be publicly available; however, all responses to this survey will be anonymous.

This survey should take approximately 10 minutes to complete. In order to participate in this survey you must be 18 years of age or older. Please indicate your willingness to participate by answering the question below.

CONFIRMATION OF CONSENT:

I agree to voluntarily participate in this study, and that I am at least 18 years of age. I grant permission for the data generated by this survey to be used by the researcher. I understand that the survey is anonymous, and I can withdraw from it at any point without penalty or consequences.

Required.

○ Yes

○ No - please exit this survey

Next >>

Figure 4: Preview of confirmation of consent

I attempted to engage a diverse audience in terms of race, profession, age, gender, educational background and city of residence. I posted the survey link on my general Facebook and LinkedIn feeds, as well as Facebook groups such as the Master of Urban Planning student's 2018 page (Figure 5). I also emailed the link to my co-workers at the City of Seattle. A few of my peers

helped to distribute the survey to their networks, which included residents of Burien, Washington, City Builders, LGBTQ groups, and Microsoft.

Before distributing my survey, I submitted an application to the University of Washington Institutional Review Board (UW IRB) to determine whether my research qualified as human subjects research. Due to the nature of my distribution methods, the UW IRB determined that the survey did not involve 'human subjects' as defined by federal regulations. Therefore, my thesis did not require an Institutional Review Board review, or a status of exemption.

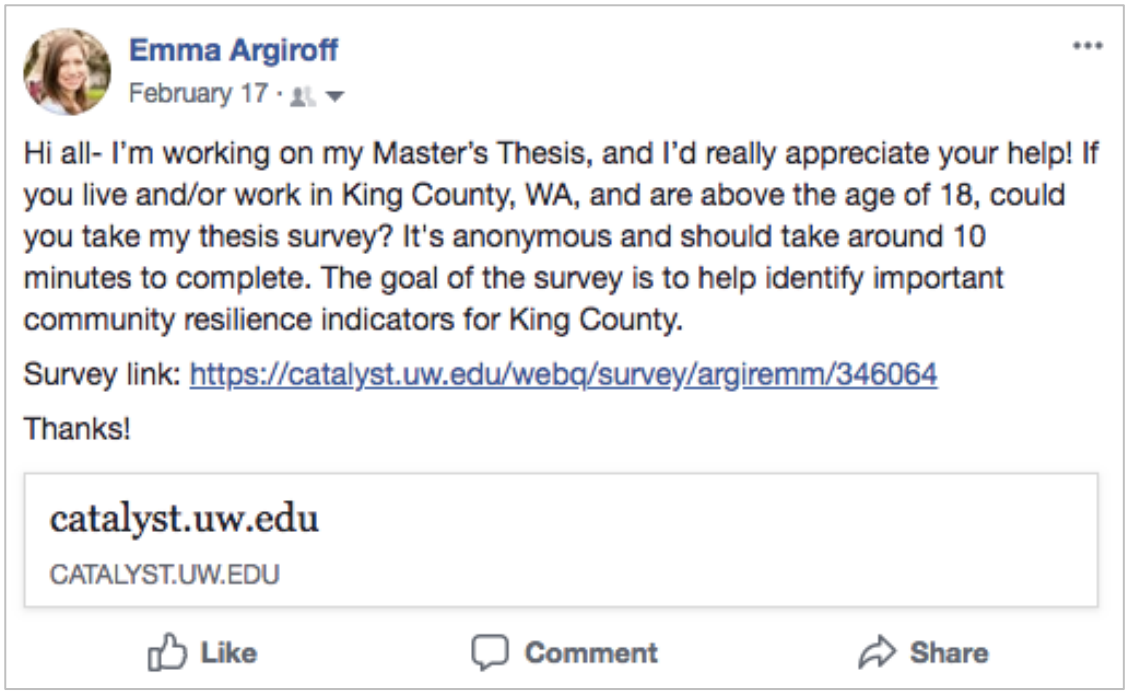


Figure 5: Facebook post asking friends to respond to and share my survey

Survey Design

The survey was designed in three sections that each focused on a different research question. The first section concerned resilience dimensions, the second indicators, and the third respondent demographics. Before my survey was distributed, I conducted a pilot study with

peers and family members who provided feedback on the content and organization of my survey. This feedback helped to inform the design of my survey.

Section 1: Are all dimensions of resilience perceived as equally important in King County?

In the first section, respondents were asked to rank the social and community, economic, infrastructural, institutional, and environmental dimensions of resilience on a Likert scale of "not important" to "extremely important in measuring community resilience in King County"; this question also included a 'don't know' response (Figure 6). This data was used to inform the research question: *Are all dimensions of community resilience perceived as equally important in King County?* The following information was provided to describe each dimension of resilience:

- Social and Community (concerns the level of trust and cooperation among social networks within a community, as well as the ability of these networks to address community problems)
- Economy (concerns the wealth and resources of a given area, and the income disparity between residents of the area; also concerns resource management)
- Infrastructure (concerns the physical framework that supports community functions, including utilities, transportation, and communication systems, and the built environment)
- Institutions (concerns the ability of organized services to plan for and mitigate stresses, such as climate change, and shocks, such as earthquakes)
- Environment (concerns the natural framework that supports communities, including diverse factors such as open space and environmental equity)

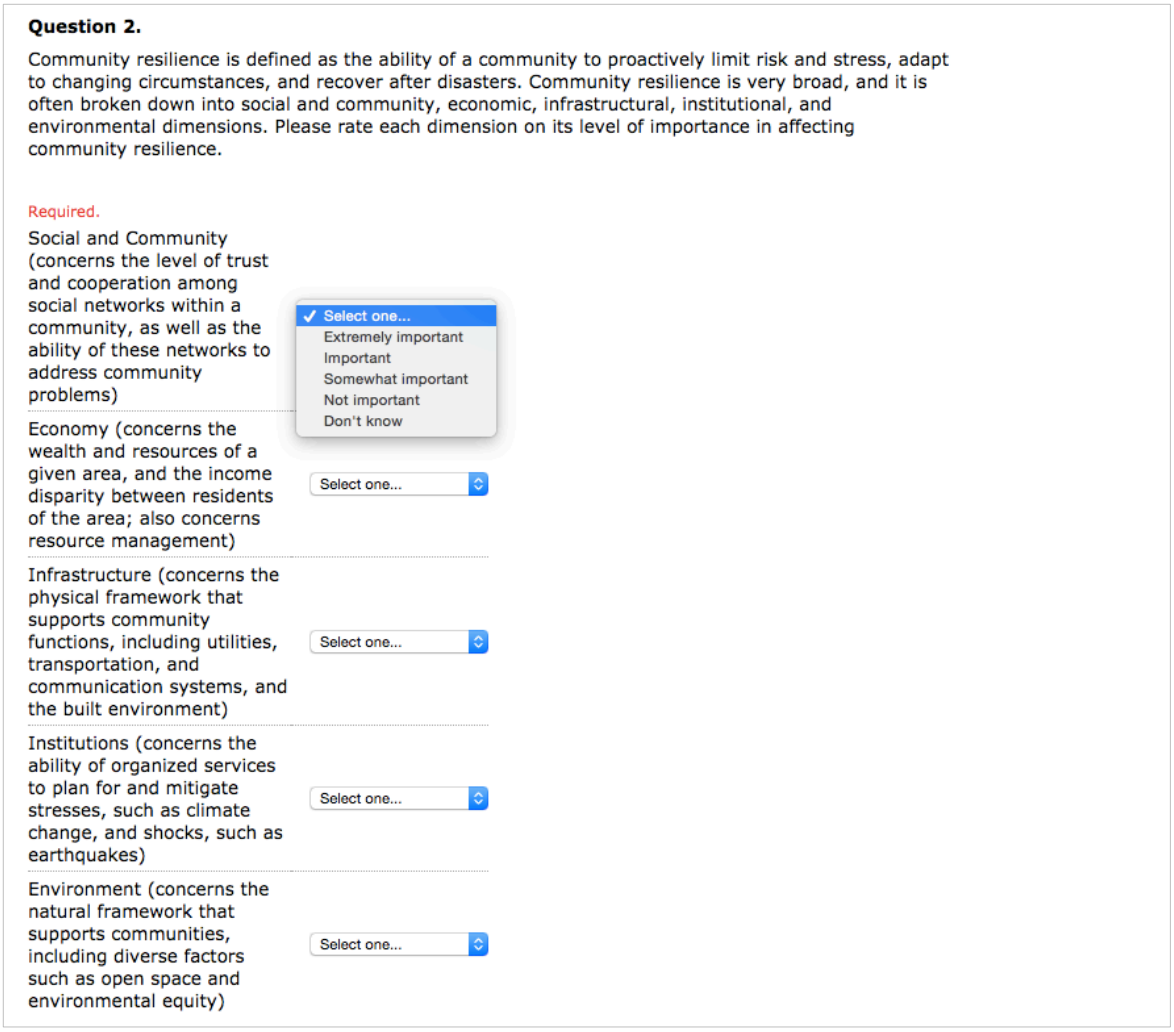
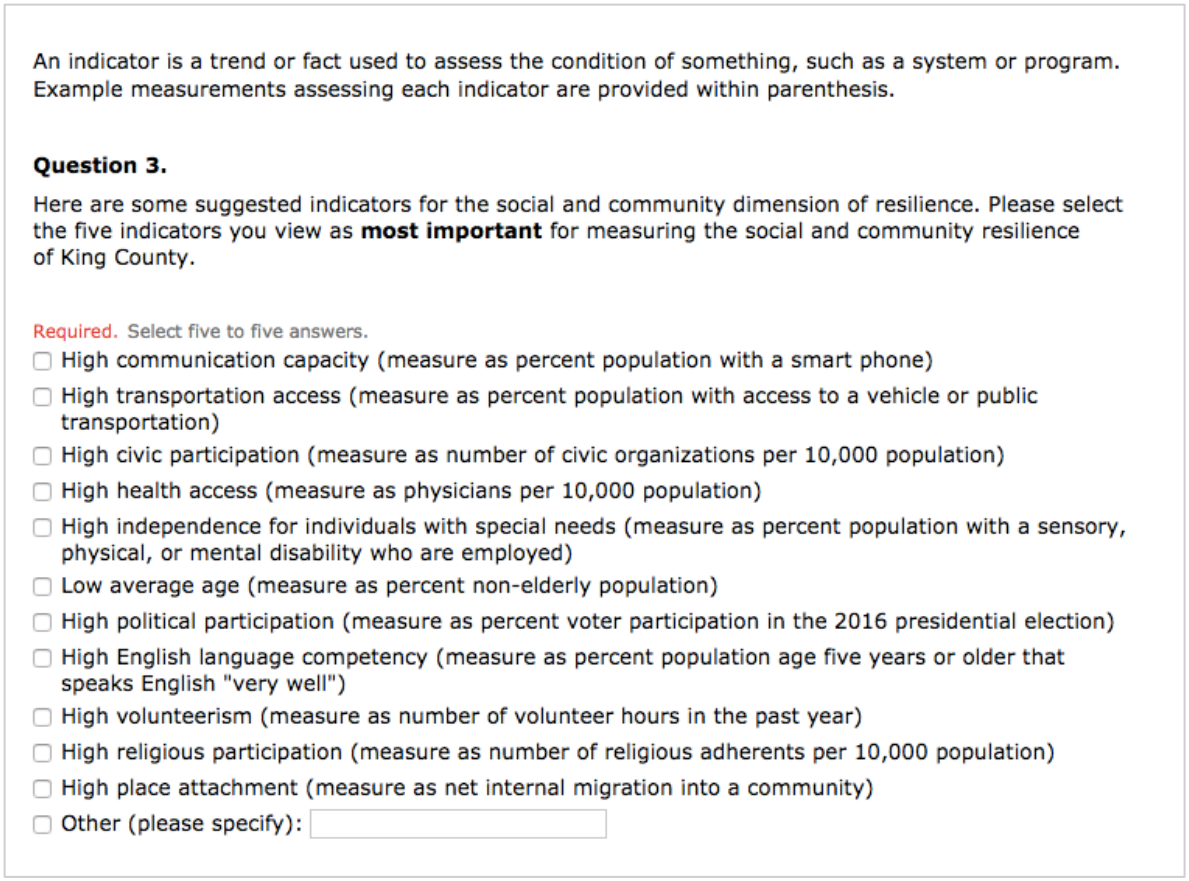


Figure 6: A preview of the resilience dimensions question

Section 2: What are the most valued community resilience indicators in King County?

In the second section, respondents were asked to choose the five most important indicators out of a list of indicators associated with each dimension (Figure 7). I also provided an definition of 'indicator' and explained that example measures were provided within parenthesis. I received feedback from respondents who piloted my survey to include a qualifier in front of each indicator to clarify the direction the indicator would need to move in order to positively affect community resilience. This qualifier helped to maintain consistency throughout the survey.



An indicator is a trend or fact used to assess the condition of something, such as a system or program. Example measurements assessing each indicator are provided within parenthesis.

Question 3.

Here are some suggested indicators for the social and community dimension of resilience. Please select the five indicators you view as **most important** for measuring the social and community resilience of King County.

Required. Select five to five answers.

- ☐ High communication capacity (measure as percent population with a smart phone)
- ☐ High transportation access (measure as percent population with access to a vehicle or public transportation)
- ☐ High civic participation (measure as number of civic organizations per 10,000 population)
- ☐ High health access (measure as physicians per 10,000 population)
- ☐ High independence for individuals with special needs (measure as percent population with a sensory, physical, or mental disability who are employed)
- ☐ Low average age (measure as percent non-elderly population)
- ☐ High political participation (measure as percent voter participation in the 2016 presidential election)
- ☐ High English language competency (measure as percent population age five years or older that speaks English "very well")
- ☐ High volunteerism (measure as number of volunteer hours in the past year)
- ☐ High religious participation (measure as number of religious adherents per 10,000 population)
- ☐ High place attachment (measure as net internal migration into a community)
- ☐ Other (please specify):

Figure 7: The social and community indicators question

The method of selecting the most important indicators required respondents to decisively select the indicators they perceived as most important. If respondents were to rate each indicator on a Likert scale, as they did with the dimensions, they would have been able to rank all indicators at the same level of importance, resulting in less-nuanced data to inform the research question: *What are the most valued community resilience indicators in King County?* One limitation of this method is that responses do not display the range of perceived importance; for example, one respondent may feel that the top five indicators chosen were very important, while the unselected indicators are slightly less important, while another respondent may feel that the chosen indicators are somewhat important, while the unselected indicators are not important at all. A write-in option was included for each indicator question

to give respondents an opportunity to provide additional suggestions of indicators that were not listed in the survey.

Section 3: How are resilience perceptions in King County influenced by race, gender, and professional sector?

The demographic section inquired about respondent's profession (public, private, academic, student, other), race and ethnicity, age, gender, and educational background. Responses to this section provided data to support my third research question: *How do perceptions of indicators and dimensions differ across groups defined by the demographic factors of profession, race, and gender?* Respondents were not required to answer the questions concerning race and ethnicity, age, gender, educational background, or city of residence in case they did not feel comfortable with providing the information. However, respondents were required to answer whether the lived or worked in King County, as this question was important in ensuring that respondents were qualified to take the survey (Figure 8).

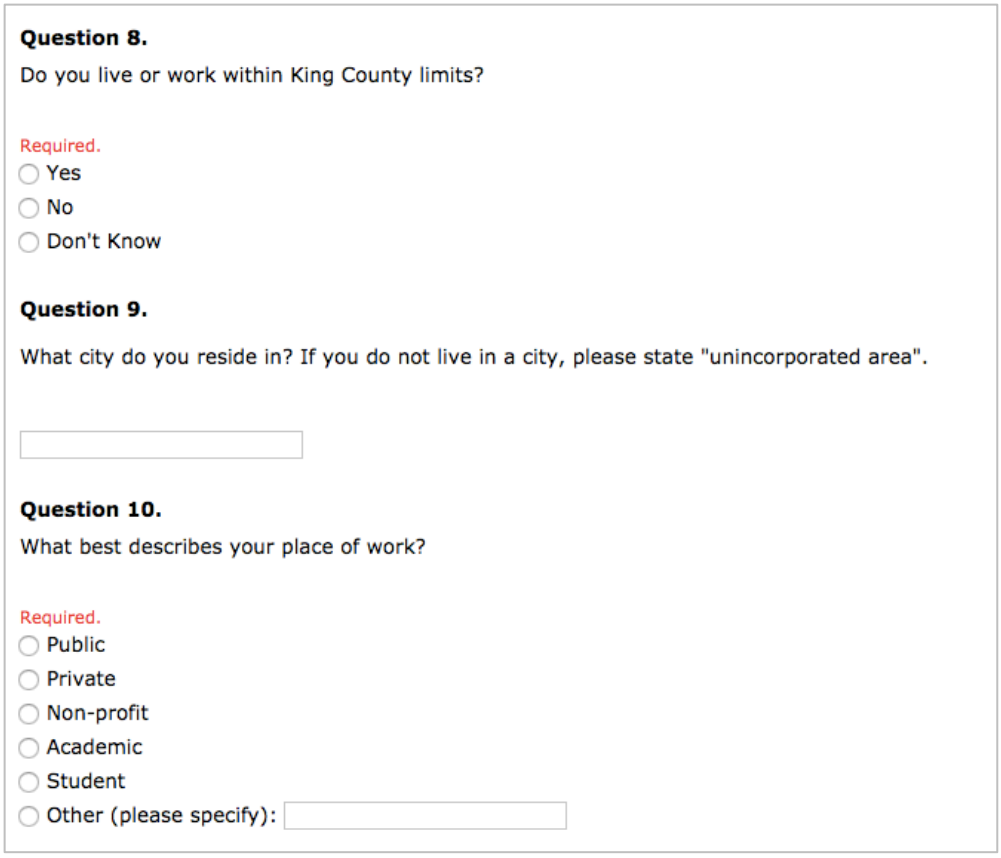


Figure 8: Preview of three demographic questions

Data Analysis

Results from the survey were stored in Catalyst WebQ, a University of Washington online survey tool. This tool facilitated data analysis by providing the percentage and frequency of response for each answer choice, as well as summary statistics, including the mean, median, mode, standard deviation, and minimum and maximum values for each question.

Section 1: Are all community resilience dimensions perceived as equally important in King County?

In the first section, the mean response statistic was used to analyze the average perceptions of importance of resilience dimensions, with 1 being 'extremely important', 2 as 'important', 3 as 'somewhat important, 4 being 'not important at all', and 5 as 'don't know'. Responses of 'Don't know' were removed from this analysis.

Table 3: Assigned values and mean scores.

Value	Mean = M
Most Valued	$M \leq 1.75$
Highly Valued	$1.75 < M \leq 2.5$
Somewhat Valued	$2.5 < M \leq 3.25$
Least Valued	$3.25 < M \leq 4$

Section 2: What are the most valued community resilience indicators in King County?

Identifying the most highly valued indicators was relatively simple. WebQ calculated the percentage of respondents who chose each listed indicator. This analysis was formalized using a system that broke down frequency of response into categories based on selection rate, where indicators with highest percent response (selected by 75% to 100% of respondents) were designated as high-valued indicators in King County, and those with the lowest percent response (selected by fewer than 25% of respondents) were designated as low-valued indicators. The middle ranges were divided between 'highly valued' and 'somewhat valued' indicators (Table 4).

Table 4: depicts the value assigned to each response rate, where the highest value indicators were selected between 75% and 100% of the time, and the lowest value less than 25% of the time.

Value	Selection Rate = SR
Most valued	$75 \leq SR \leq 100\%$
Highly valued	$50 \leq SR < 75\%$
Somewhat valued	$25 \leq SR < 50\%$
Least valued	$0 \leq SR < 25\%$

The total number of write-in responses was summarized and designated as an 'other' indicator for this analysis.

Section 3: How are resilience perceptions in King County influenced by race, gender, and professional sector?

Survey results were recorded into Microsoft Excel with corresponding columns of demographic information. The first demographic analysis focused on profession (public, private, non-profit, and student), the second on race (white or non-white), and the third on gender (male and non-male). I identified the top five indicators per dimension for each group and put these indicators in a new list in Excel. Indicators were not recorded twice if they were in the same group. Then, I categorized each indicator based on percent response, where most valued indicators had between a 75% and 100% selection rate, highly value had equal to or greater than 50% selection rate and less than 75%, and so forth (see Table 4).

For dimensions and indicators, a color-coded table was used to display the percent response across each category, where 'most valued' indicators or dimensions were coded with green, 'highly valued' with light yellow, 'somewhat valued' with orange, and 'least valued' with red. This color-coded format was used to simplify the complexity of the analysis, which involved comparing group perceptions of multiple dimensions and indicators. For the dimensional analysis, value categories were based on mean score (Table 5). Responses of 'Don't know' were

removed from this analysis. For the indicator analysis, value categories were based on selection rate (Table 6).

Table 5: The value category and associated color assigned to dimensions according to mean score

Value	Mean = M	Color
Most valued	$M \leq 1.75$	
Highly valued	$1.75 < M \leq 2.5$	
Somewhat valued	$2.5 < M \leq 3.25$	
Least valued	$3.25 < M \leq 4$	

Table 6: The value category and associated color assigned to indicators based on selection rate

Value	Selection Rate = x	Color
Most valued	$75 \leq x \leq 100\%$	
Highly valued	$50 \leq x < 75\%$	
Somewhat valued	$25 \leq x < 50\%$	
Least valued	$0 \leq x < 25\%$	

4. Findings and Discussion

The methods described in Chapter Three address the following research questions:

1. Are all community resilience dimensions equally important?
2. What are important community resilience indicators for King County?
3. How do perceptions of community resilience indicators differ across groups defined by profession, race, and gender?

Results

To answer these questions, a survey was distributed to those who live and/or work in King County. The survey was open from February 9th – March 16th and received 49 responses. The following statements summarize the demographic distribution of the survey population:

- Ethnicity: 35 respondents were Caucasian, 11 Asian, and two mixed-race; no respondents were of Hispanic, Latino, or Spanish-speaking background.
- Gender: 30 respondents were female, 18 were male, and 1 selected 'other'
- Profession: 14 respondents worked for the public sector, 16 for the private sector, six for the non-profit sector, eight were students, and five respondents chose 'other'.
- City of Residence: 34 respondents resided in Seattle, four in Redmond, two in Sammamish, two in Kirkland, and one from each of the following cities: Bellevue, Bremerton, Burien, Everett, Newcastle, and Shoreline. One respondent did not specify city of residence.

- Age: 29 respondents were between 25 and 34 years old, seven were between 45 and 54 years, six were between 18 and 24 years, four between 35 and 44 years, two were between 55-64 years, and one respondent was over the age of 65.
- Highest level of education completed: 27 respondents had completed their Bachelor's Degree, 19 had received a Master's Degree, two respondents were high school graduates, and one respondent had achieved a Doctorate Degree.

Are all community resilience dimensions perceived as equally important in King County?

For the first sub-research question, it was hypothesized that all five dimensions of resilience would not be equally important to respondents. The results support this hypothesis; the infrastructural and social and community dimensions were most valued by respondents, and the institutional, economic, and environmental dimensions were highly valued (Table 7).

Table 7: Mean score for each resilience dimension and the value assigned to each score. See Table 3 for details on how value categories align with mean scores.

Dimension	Mean Score	Value
Infrastructure	1.59	Most Valued
Social and Community	1.69	Most Valued
Economy	1.88	Highly Valued
Institutions	1.92	Highly Valued
Environment	2.17	Highly Valued

The environmental dimension may have a lower score because the connection between community resilience and the environment is not as direct as the other dimensions, especially in urban environments. Additionally, environmental change often takes place over a longer period of time compared to other dimensions, which may make it harder for people to understand its impacts. For example, climate change impacts may be less noticeable than

transportation challenges, which residents face daily. Infrastructural resilience and social and community dimensions are frequently discussed as being important components of resilience, which may have contributed to their high rating.

What are the most valued community resilience indicators for King County?

For the second research question, I hypothesized that the indicators derived from Seattle's Draft Resilience Strategy, including racial equity, homelessness, housing affordability, seismic retrofitting, and transportation infrastructure, would be the most valued resilience indicators among King County respondents, as these indicators measure important challenges facing the County. This hypothesis was not supported by the analysis, as most of these indicators fell into the 'highly valued' category where selection rate was between 50% and 75%, but not the most valued category, where selection rate was between 75% and 100%. Transportation access was the only indicator derived from the Resilience Strategy that fall into the 'most valued' category (Table 8).

Table 8: Distribution of response rate for each indicator into different categories defined by selection rate (SR).

Dimension	Most valued ($75 \leq SR \leq 100\%$)	Highly valued ($50 \leq SR < 75\%$)	Somewhat valued ($25 \leq SR < 50\%$)	Least valued ($0 \leq SR < 25\%$
Social and Community	High transportation access High civic participation	High political participation High communication capacity High health access	High independence for individuals with special needs High volunteerism High place attachment	Low Average Age High Religious Participation High English language competency
Economic	*None in highest quartile*	High occupational diversity High employment High educational equity Low poverty High racial equity High housing affordability Low homelessness	High diversity in business size High creativity and innovation	High housing capital High median income
Infrastructural	High drinking water reliability High medical care capacity	High transit connectivity High access/ evacuation potential High rates of seismic retrofitting	Sturdy housing condition High sheltering capacity High internet access High accessibility	High density High dam safety

Dimension	Most valued (75 ≤ SR ≤ 100%)	Highly valued (50 ≤ SR < 75%)	Somewhat valued (25 ≤ SR < 50%)	Least valued (0 ≤ SR < 25%
Institutional	High emergency preparedness	Disaster resistant building codes High emergency response Strong hazard mitigation planning High plan integration	High mitigation investment High health insurance coverage High earthquake insurance coverage High jurisdictional coordination	High flood insurance coverage
Environmental	High water quality	High air quality High renewable energy use	High forest conservation Low carbon emissions High environmental equity High natural flood protection High water conservation Low sea level rise	High soil quality

Social and Community Indicators

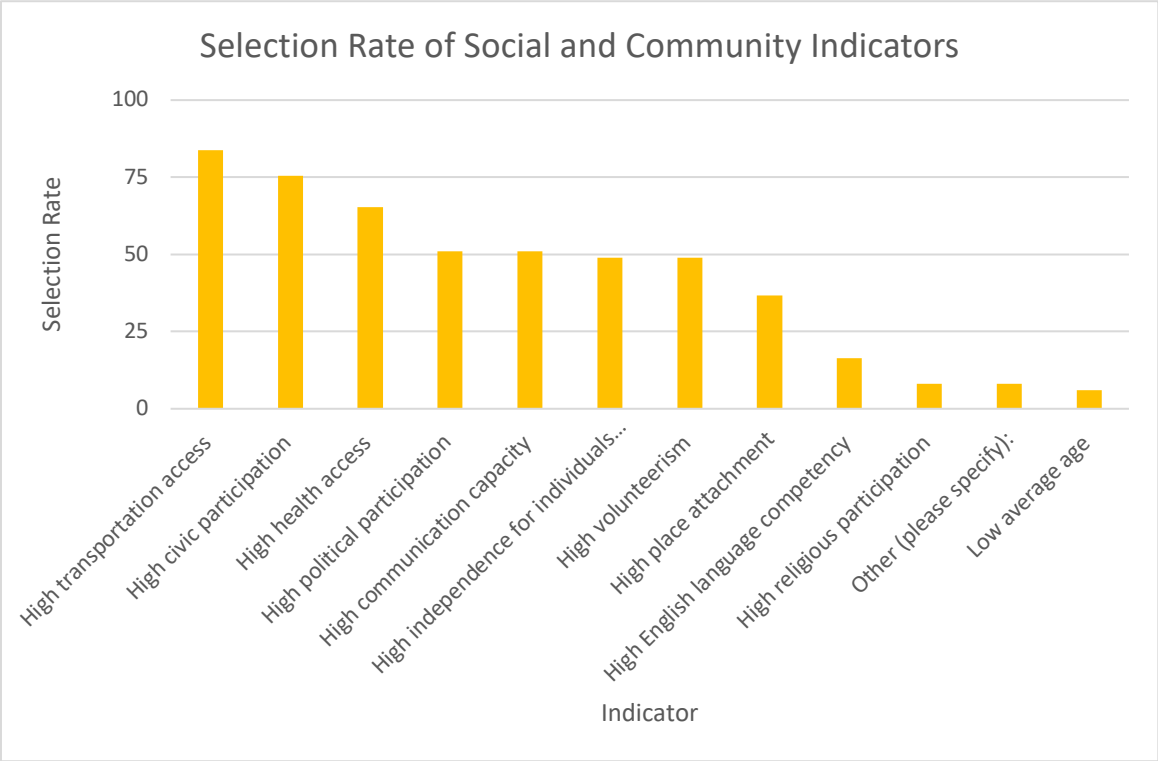


Figure 9: Distribution of selection rates for social and community indicators

High transportation access and high civic participation were the only two indicators in the most valued indicator category for the social and community dimension, where selection rates were between 75% and 100%. Demographic indicators, such as age and language spoken, were least valued, with a selection rate lower than 25%. Demographic indicators are referenced in multiple academic papers as important resilience indicators. According to Cutter, Burton, and Emrich (2010), "linking demographic attributes to social capacity suggests that communities with fewer elderly, disabled residents, and non-native English-speaking residents likely exhibit greater resilience than communities without these characteristics." This implies that increasing homogeneity has a positive effect on resilience. While theoretically these indicators may make certain resilience aspects easier, such as mass communication to an all English-speaking

population, there is no ethical or practical program that would seek to limit diversity with the goal of increasing resilience.

Two respondents suggested adding low average commute time to the list of indicators, and one recommended measuring high level or positive neighborhood interactions. Another respondent stressed the importance of measuring political participation in mid-term or local elections, rather than presidential elections, which was the example measure provided on the survey.

Economic Indicators

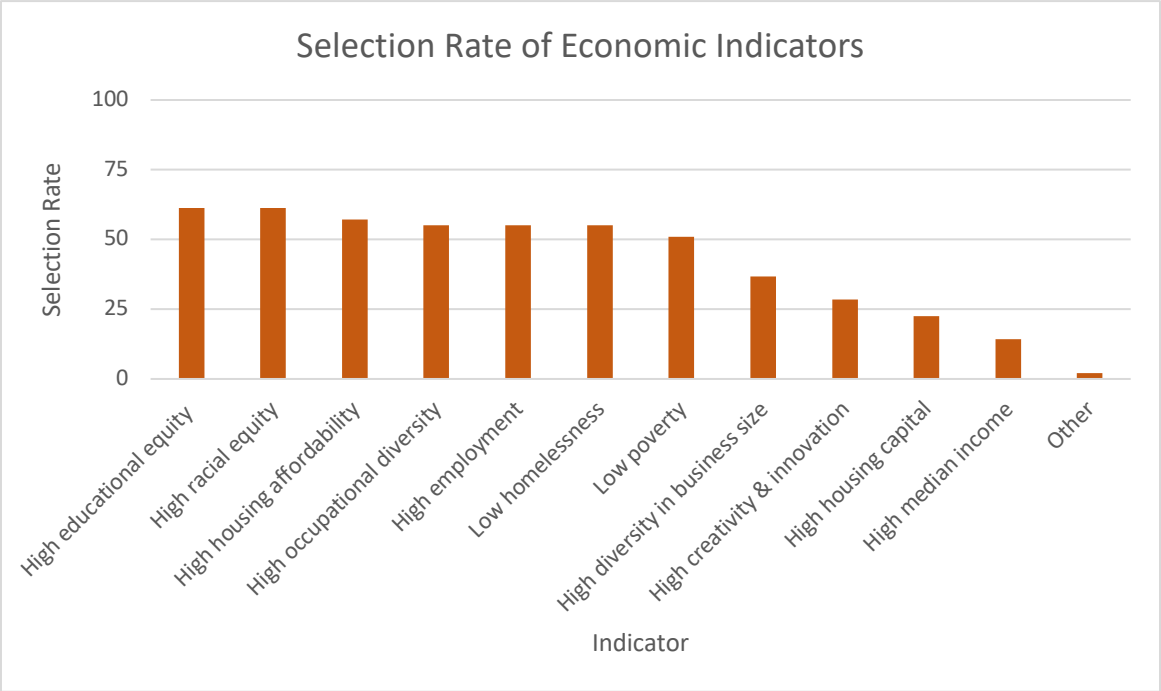


Figure 10: Distribution of selection rates for economic indicators

The distribution of responses for economic indicators was relatively even compared to the distribution for other dimensions; seven out of twelve indicators ranked in the 'highly valued' category, with educational and racial equity as the highest-ranking indicators. High median income was in the 'least valued category', possibly because this indicator does not assess the

distribution of wealth, which is an important equity implication. Respondents are most likely aware of the persistent inequities that affect disadvantaged groups in King County, particularly by race (King County Office of Equity and Social Justice, 2016). The Equity and Social Justice Initiative is a county-wide effort to address the root causes of these inequities, such as institutionalized racism, and the resulting socio-economic conditions (King County Office of Equity and Social Justice, 2016). These challenges make clear the connection between equity and resilience to those who live and/or work in the county.

Housing affordability is also a popular indicator. According to King County, 290,100 households were cost-burdened in 2017, which means that these households spend more than 30% of their annual income on housing (King County Affordability Task Force, 2017). Respondents are likely concerned about King County's affordability crisis and view this indicator as important in assessing resilience. However, housing capital, particularly homeownership, was least valued by respondents. In an area suffering a housing affordability crisis, homeownership is less of an important resilience focus. The ability of residents to rent is particularly important, as renting provides lower-income individuals an option for housing.

High occupational diversity was also frequently selected. King County is an economically booming area, and much of this growth is driven by the technology sector. Occupational diversity ensures redundancy in economic activity, and decreases the risk and impact of economic recessions. High creativity and innovation, and diversity in business size had lower perceived importance even though these indicators relate to occupational diversity. One respondent suggested adding municipal and state fiscal policies to the list.

Infrastructural Indicators

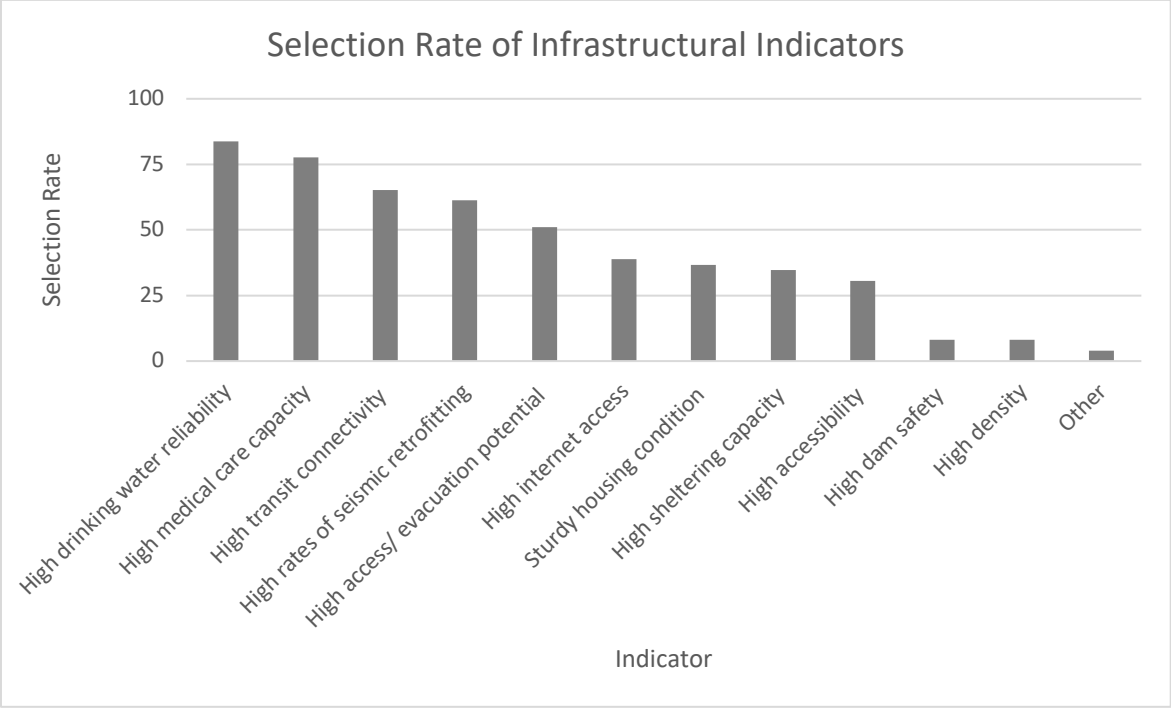


Figure 11: Distribution of selection rates for infrastructural indicators

For infrastructural indicators, drinking water reliability and medical care capacity had the highest selection rate and were most valued by respondents. Transit connectivity, seismic retrofitting, and access and evacuation potential were highly valued. Surprisingly, the seismic retrofitting indicator was the fourth-most frequently chosen. One possible explanation is that drinking water reliability, transit connectivity, and medical care capacity indicators concern pervasive challenges that respondents face in their daily lives. While there is a high risk of earthquakes in western Washington, residents do not experience seismic activity frequently and it may be perceived as a less imminent challenge.

Internet access, housing condition, sheltering capacity, and accessibility ranked in the 'somewhat valued' category. High density and dam safety were the least chosen indicators,

with less than a 25% selection rate. One respondent suggested adding high utility and transportation infrastructure safety to the indicators list.

Institutional Indicators

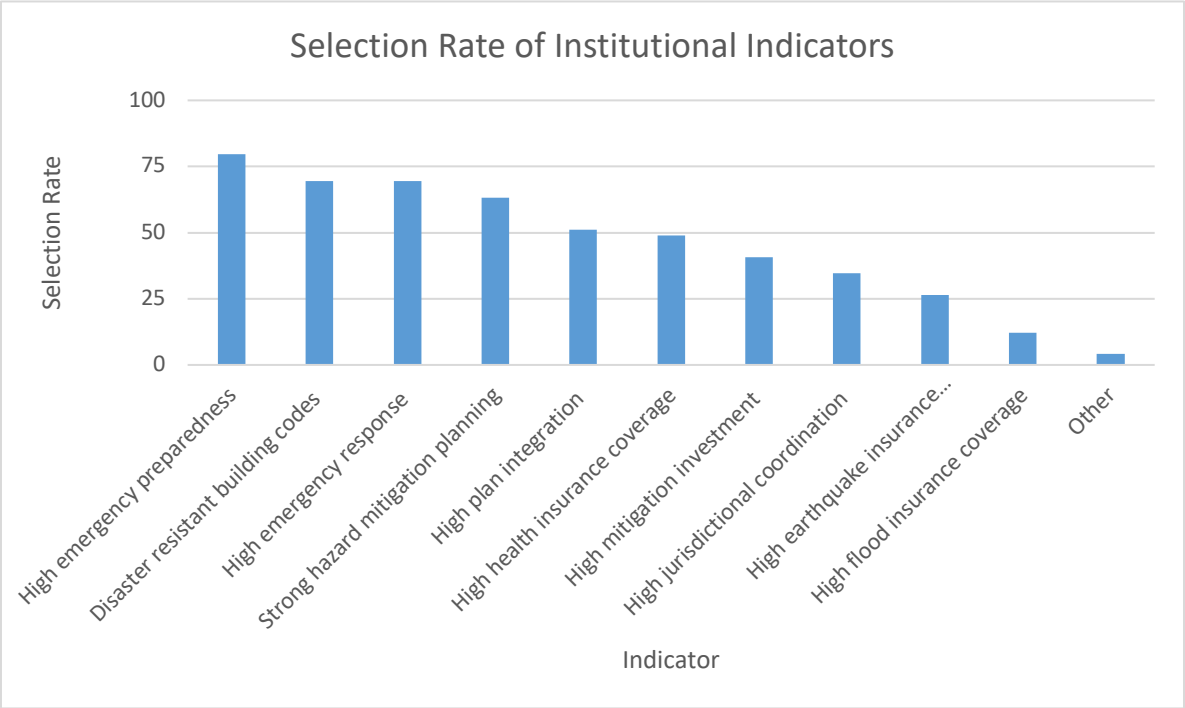


Figure 12: Distribution of selection rates for institutional indicators

Emergency preparedness was the most valued indicator, suggesting that respondents value institutional proactivity. Highly valued indicators include emergency response, disaster-resistant building codes, hazard mitigation planning, and plan integration. Flood and earthquake insurance ranked least important and were much less popular than health insurance. Many Americans do not know that their homeowner's insurance does not cover flood or earthquake damage or they may choose to take the risk and not purchase additional insurance (Federal Emergency Management Agency, 2017). One respondent suggested adding high public assistance capacity to the list, and deemphazising private insurance in assessing resilience.

Environmental Indicators

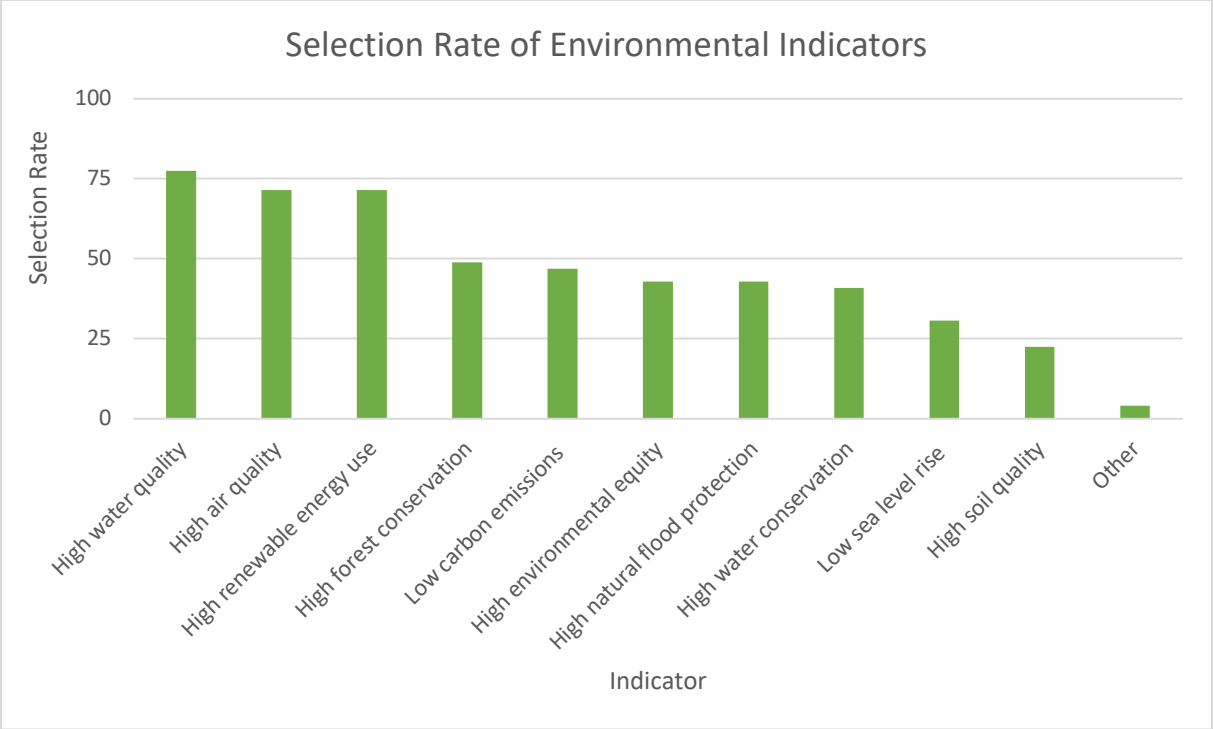


Figure 13: Distribution of selection rates for environmental indicators

Water quality, air quality, and renewable energy use were the three most frequently chosen indicators in the environmental dimension. Water quality was the only indicator in the 'most valued' category. This could be because high water and air quality are fundamentally important to human health and well-being, and renewable energy use is one of the most important methods to mitigate carbon emissions. Surprisingly, low carbon emissions and environmental equity indicators were ranked in the 'somewhat valued' category. Sea level rise and soil quality were the lowest ranking indicators.

How do community resilience perceptions differ across professional sectors?

Organizations are guided by missions, visions, and goals that change depending on the industry. These professional influences may affect values and perceptions pertaining to community

resilience. To test this question, respondents were separated into four professional categories: Non-profit, Public, Private, and Student. As stated previously, 14 respondents were from the public sector, 16 from the private sector, six from the non-profit sector, and eight were students. Retired and unemployed respondents, which made up the remaining five respondents, were not included in this analysis. Professional sectors are large categories that capture a range of professions. For example, the private sector may include respondents who work for corporations and small businesses, and are therefore likely to perceive resilience differently. However, due to time and resource constraints, professional sectors were used for this analysis.

As a reminder, Table 9 depicts the color-coding system used for dimensional analysis, and Table 10 indicator analysis.

Table 9: Value and color assigned to dimensions based on mean score

Value	Mean = M	Color
Most valued	$1.75 \leq M$	
Highly valued	$1.75 < M \leq 2.5$	
Somewhat valued	$2.5 < M \leq 3.25$	
Least valued	$3.25 < M \leq 4$	

Table 10: Value and color assigned to indicators based on selection rate

Value	Selection Rate = x	Color
Most valued	$75 \leq x \leq 100\%$	
Highly valued	$50 \leq x < 75\%$	
Somewhat valued	$25 \leq x < 50\%$	
Least valued	$0 \leq x < 25\%$	

Dimensional Analysis

Table 11: Perceived importance of dimensions by professional sectors

Resilience Dimension	**Professional Sector**			
	Non Profit	Public	Private	Student
Social & Community				
Economic				
Infrastructure				
Institutions				
Environment				

All resilience dimensions were valued as either 'most important' or 'highly important' across all professional sectors. However, the environmental dimension was valued slightly less than other dimensions. Social and infrastructural dimensions were 'most valued' across all professional sectors. Slight deviations occurred with the institutional and economic dimensions; non-profit sector respondents valued these dimensions slightly more than all other sectors.

Indicator Analysis

Table 12: Perceived importance of social and community indicators by professional sectors

Social & Community Indicators	**Professional Sector (Top Five Selection)**			
	Non-Profit	Public	Private	Student
High transportation access				
High civic participation				
High political participation				
High communication capacity				
High independence for special needs				
High health access				
High volunteerism				
High place attachment				

There was strong agreement across sectors that transportation access and civic participation indicators were highly important in assessing resilience. The non-profit sector valued independence for individuals with special needs and political participation more than those who worked in other sectors. Students valued volunteerism more than other professions. There was little agreement over the importance of high place attachment; students valued this indicator as most important while public sector respondents valued this indicator as least important.

Table 13: Perceived importance of economic indicators by professional sectors

Economic Indicators	Professional Sector (Top Five Selection)			
	Non-Profit	Public	Private	Student
High educational equity				
High racial equity				
High housing affordability				
High occupational diversity				
Low poverty				
High diversity in business size				
High employment				
Low homelessness				

The majority of the top five economic indicators were 'highly-valued' with a selection rate equal to or above 50% and less than 75%. The greatest range in value occurred with the housing affordability and diversity in business size indicators. The private sector valued housing affordability less than other sectors, especially the non-profit sector which perceived affordability as most important.

Table 14: Perceived importance of infrastructural indicators by professional sectors

Infrastructural Indicators	Professional Sector (Top Five Selection)			
	Non-Profit	Public	Private	Student
High drinking water reliability				
High medical care capacity				
High internet access				
Sturdy housing condition				
High sheltering capacity				
High accessibility				
High transit connectivity				
High rates of seismic retrofitting				
High access/ evacuation potential				

There was strong agreement across sectors that drinking water reliability and medical care capacity were highly important indicators. High internet access, housing condition, and accessibility were valued more in the non-profit sector, possibly because these indicators represent challenges faced by many non-profit clients. The seismic retrofitting indicator was valued as most important by students and least important by the non-profit sector respondents.

Table 15: Perceived importance of institutional indicators by professional sectors

Institutional Indicators	**Professional Sector (Top Five Selection)**			
	Non-Profit	Public	Private	Student
High emergency preparedness				
High emergency response				
Strong hazard mitigation planning				
High plan integration				
High health insurance coverage				
Disaster resistant building codes				
High mitigation investment				

Emergency preparedness and response indicators were valued highly by respondents across all sectors. Students valued high mitigation investment much more than respondents from other sectors. Students and non-profits valued high plan integration as most important, while public and private sectors perceived this indicator as somewhat important. Some variation occurred with the hazard mitigation planning indicator; private sector respondents valued hazard mitigation planning as most important, while the public sector valued it as somewhat important.

Table 16: Perceived importance of environmental indicators by professional sectors

Environmental Indicators	Professional Sector (Top Five Selection)			
	Non-Profit	Public	Private	Student
High water quality				
High air quality				
High renewable energy use				
High forest conservation				
Low carbon emissions				
High environmental equity				
High water conservation				
High natural flood protection				
Low sea level rise				

There was consistent agreement that high water quality and high renewable energy use are highly important indicators for assessing resilience in King County. There was less agreement among sectors about the importance of high water conservation. Sea level rise was less important than other indicators, with only students valuing it with high importance. Students also valued natural flood protection much more than other sectors.

How do community resilience perceptions differ across racial groups?

This group analysis was performed because race influences access to and demand for resources, which likely impacts resilience needs. Respondents were separated into two racial categories: White and Non-white, which included 11 Asian and two Mixed-race respondents. One respondent's race was not specified and was therefore not included in this analysis. The racial distribution of the study sample was 35 Caucasian, 11 Asian, and two mixed-race respondents; no respondents were of Hispanic, Latino, or Spanish-speaking background. Because no respondents represented underserved populations, particularly from black, Native

American, and Hispanic populations, this analysis is rather limited in understanding the resilience perceptions of these communities. However, these methods could be applied to data from a more representative survey to better understand resilience perceptions of underserved communities.

The same tabular, color-coding system used in the professional group analysis was used to depict the dimension and indicator values in both racial categories, where 'most valued indicators' were coded with green, 'highly valued' with light yellow, 'somewhat valued' with orange, and 'least valued' with red. Table 5 depicts the analysis for dimensions, and Table 6 depicts analysis for indicators.

Resilience Dimensions

Table 17: Perceived importance of dimensions by race

Resilience Dimension	**Race**	
	White	Non-White
Social and Community		
Economic		
Infrastructure		
Institutions		
Environment		

The infrastructural dimension is valued as most important dimension by white and non-white respondents. Both groups value economic, institutional, an environmental dimensions as highly important. Non-white respondents valued the social and community dimension slightly less than non-white respondents.

Resilience Indicators

Table 18: Perceived importance of social and community indicators by race

Social & Community Indicators	**Race (Top Five Selection)**	
	White	Non-White
High transportation access		
High civic participation		
High health access		
High political participation		
High communication capacity		
High independence for individuals with special needs		
High volunteerism		

White and non-white respondents both valued transportation access as most important and health access as highly important. White respondents valued political participation, communication capacity, independence for individuals with special needs, and volunteerism slightly more than non-white respondents. Non-white respondents valued civic participation as most important, and white respondents as highly important.

Table 19: Perceived importance of economic indicators by race

Economic Indicators	**Race (Top Five Selection)**	
	White	Non-White
High educational equity		
High racial equity		
High housing affordability		
High occupational diversity		
Low homelessness		
High employment		
Low poverty		

High educational equity was highly valued among white and non-white respondents. Although non-white respondents valued educational equity slightly more than white respondents, racial equity was less valued among non-white respondents.

Table 20: Perceived importance of infrastructural indicators by race

Infrastructural Indicators	**Race (Top Five Selection)**	
	White	Non-White
High drinking water reliability		
High medical care capacity		
High transit connectivity		
High rates of seismic retrofitting		
High access/ evacuation potential		
High internet access		

Drinking water reliability, medical care capacity and transit connectivity were most or highly valued by white and non-white respondents. Seismic retrofitting was also valued highly, but neither group designated it as most important. Non-white respondents valued access and evacuation potential much more than white respondents. High internet access was only somewhat valued by both groups.

Table 21: Perceived importance of to institutional indicators by race

Institutional Indicators	**Race (Top Five Selection)**	
	White	Non-White
High emergency preparedness		
Disaster resistant building codes		
High emergency response		
Strong hazard mitigation planning		
High health insurance coverage		
High plan integration		

There was little variation between the perceptions of both groups. Emergency preparedness was most valued among white and non-white respondents. Emergency response was also 'most valued' by non-white respondents, and 'highly valued' by white respondents. Health insurance coverage and plan integration were slightly less valued.

Table 22: Perceived importance of environmental indicators by race

Environmental Indicators	Race (Top Five Selection)	
	White	Non-White
High water quality		
High air quality		
High renewable energy use		
High forest conservation		
High environmental equity		
Low carbon emissions		
High natural flood protection		
High water conservation		

In general, there was agreement of the importance of each environmental indicator. Both groups placed the highest value on water quality and carbon emissions indicators. High air quality was valued slightly more by non-white respondents, but still valued highly across both racial groups. Less value was placed on natural flood protection, high water conservation, and high environmental equity by both white and non-white respondents.

How do community resilience perceptions differ across gender groups?

Gender, like race, can also influence access to and demand for resources, therefore impact resilience values. In this analysis, respondents were separated into two gender categories: male and non-male, which included female and other respondents. The gender distribution of respondents was 61% female, 37% male, 2% other. The same tabular, color-coding system used in the professional group analysis was used to depict the value for each indicator where 'most valued indicators' were coded with green, 'highly valued' with light yellow, and so forth. Table 5 depicts dimensional analysis, and Table 6 indicator analysis.

Resilience Dimensions

Table 23: Perceived importance of resilience dimensions by gender

Resilience Dimension	**Gender**	
	Male	Non-Male
Social and Community		
Economic		
Infrastructure		
Institutions		
Environment		

With the exception of the environmental dimension, all dimensions were 'highly' or 'most valued' by respondents. Both gender groups perceived the infrastructural dimension as most important. Non-male groups valued the environmental dimension more than male respondents, who somewhat valued this dimension.

Resilience Indicators

Table 24: Perceived importance social and community indicators by gender

Social and Community Indicators	**Gender (Top Five Selection)**	
	Male	Non-Male
High transportation access		
High civic participation		
High health access		
High communication capacity		
High volunteerism		
High political participation		
High independence for individuals with special needs		

Transportation access, civic participation, and health access were most or highly valued across genders. High volunteerism and communication capacity were also highly valued by

male and non-male respondents. Non-male respondents valued political participation more than male respondents. Male respondents valued independence for individuals with special needs as least important, and non-male respondents valued it as highly important.

Table 25: Perceived importance of economic indicators by gender

Economic Indicators	**Gender (Top Five Selection)**	
	Male	Non-Male
High educational equity		
High racial equity		
High housing affordability		
High occupational diversity		
High employment		
Low homelessness		
Low poverty		
High housing capital		

None of the economic indicators were valued as 'most important' by either gender group. Male respondents somewhat valued housing capital, while non-male respondents placed the least value on this indicator. Racial equity, homelessness, and housing affordability were valued slightly more by non-male respondents than male respondents.

Table 26: Perceived importance of infrastructural indicators by gender

Infrastructural Indicators	Gender (Top Five Selection)	
	Male	Non-Male
High drinking water reliability		
High medical care capacity		
High transit connectivity		
High rates of seismic retrofitting		
High access/ evacuation potential		
High internet access		
Sturdy housing condition		

Both gender groups valued drinking water reliability as most important. Male and non-male respondents somewhat valued internet access and housing conditions. Male respondents placed a slightly higher value on medical care capacity, and access/ evacuation potential than non-male groups.

Table 27: Perceived importance of institutional indicators by gender

Institutional Indicators	Gender (Top Five Selection)	
	Male	Non-Male
High emergency preparedness		
Disaster resistant building codes		
High emergency response		
Strong hazard mitigation planning		
High mitigation investment		
High plan integration		

Most institutional indicators were highly valued by both male and non-male respondents. Non-male respondents valued emergency preparedness as 'most important' and

males as ‘highly important’. Male respondents valued mitigation investment more, and plan integration less than non-male respondents.

Table 28: Perceived importance of top-five environmental indicators by gender

Environmental Indicators	**Gender (Top Five Selection)**	
	Male	Non-Male
High water quality		
High air quality		
High renewable energy use		
Low carbon emissions		
High water conservation		
Low sea level rise		
High environmental equity		

Both groups valued water quality, air quality, and renewable energy use as ‘highly’ or ‘most important’. Carbon emissions, water conservation, and environmental equity were valued slightly lower value by both groups. Sea level rise perceived as least important by non-male respondents.

5. Conclusions

King County faces a variety of challenges, including rising income inequality, population growth, climate change impacts, and major earthquakes. In order to effectively bolster community resilience, local governments and communities must agree on the framework to define and simplify resilience into components as well as methods to measure these components. In order to develop programs that are representative of community needs, they must also understand community perceptions of resilience especially for underserved populations that face barriers to resources.

However, resilience is a broad and complex concept that is perceived differently by individuals and communities depending on demographic and situational factors. Resilience frameworks described in academic literature and government publications often simplify resilience into social and community, economic, infrastructural, institutional, and environmental dimensions. There is little discussion on whether resilience dimensions are perceived as equally important in building resilience, and whether their perceived importance changes based on location or other context factors. Additionally, the community resilience literature does not consistently define important indicators for measuring resilience, as indicators change depending on location, scale, and community values.

This study seeks to address these gaps by asking the following research questions:

1. Are all community resilience dimensions perceived as equally important?
2. What are valued community resilience indicators for King County?

3. How do perceptions of community resilience indicators differ across groups defined by profession, race, and gender?

Review and Discussion of the Findings

These research questions were informed by an anonymous, cross-sectional survey instrument distributed to people who live and/or work in King County. There were a total or 49 respondents who took the survey. Results for each research question are summarized in the subsequent sections.

Are all community resilience indicators perceived as equally important in King County?

Survey respondents rated the five most common resilience dimensions using a Likert scale of 1 being 'most important' and 4 being 'least important'. The mean response score for each dimension determined whether a given dimension was 'most valued' with a score less than or equal to 1.75, 'highly valued' with a score greater than 1.75 and less than or equal to 2.5 'somewhat valued' with a score greater than 2.5 and less than or equal to 3.25, or 'least valued' with a score greater than 3.25 and less than or equal to 4. According to the survey results, the infrastructural, and social and community dimensions were most valued by respondents, with mean scores of 1.59 and 1.69 respectively. The economic, institutional, and environmental dimensions were 'highly valued' with mean scores of 1.88, 1.92, and 2.17 respectively.

These findings support the hypothesis that all five resilience dimensions are not equally important to respondents. According to the findings, all five resilience dimensions are perceived as 'most important' or 'highly important' to community members, supporting the multi-dimensional nature of community resilience. Dimensions are interrelated and improving one

dimension of resilience can often impact another; for example, improving economic conditions of low-income communities can empower communities to be more politically and civically active, thus increasing the social and community resilience dimension. According to these findings, effective community resilience programs should seek to build resilience in many dimensions simultaneously using multi-pronged approaches involving many actors, such as government agencies and community organizations.

What are the most valued community resilience indicators in King County?

Survey respondents were asked to choose their top-five most important indicators for each dimension. The 'most valued' indicators for all dimensions had a selection rate between 75% and 100%; these indicators included transportation access, civic participation, drinking water reliability, medical care capacity, emergency preparedness, and water quality. Transportation access is the only indicator derived from Seattle's Draft Resilience Strategy that was in the 'most valued' category. Therefore, the results do not support the hypothesis that all indicators derived from the Seattle Resilience Strategy, including housing affordability, homelessness, racial equity, transportation infrastructure quality (access and connectivity), and seismic retrofitting would be 'most valued' by respondents. However, all of these indicators, except transportation access, were 'highly valued' with a selection rate equal to or greater than 50% and less than 75%. The least important indicators, with a selection rate equal to or greater than 0% and less than 25%, included demographic indicators (e.g. average age and English language capacity), housing capital (e.g. percent homeownership), median income, density, dam safety, flood insurance coverage and soil quality.

The findings support that indicators concerning fundamental, frequent, and relevant challenges, such as transportation access, drinking water reliability and quality, and medical care capacity, tend to be perceived as most important by King County residents. Indicators derived from the Seattle Resilience Strategy tend to be perceived as 'highly important' by residents, as Seattle faces similar challenges as King County, especially around racial equity, housing affordability, and seismic retrofitting. King County residents do not value indicators that measure demographic characteristics, such as language spoken, as these demographic indicators imply that decreasing diversity will increase resilience. While theoretically these indicators may make certain resilience aspects easier, such as mass communication to an all English-speaking population, limiting diversity is seen as unethical and detrimental to other aspects of resilience, and would not be supported by the local government or community.

How do community resilience perceptions in King County differ across racial, gender and professional sectors?

Survey respondents were asked to provide demographic information, which was used to analyze differences in perceptions among racial, gender, and professional groups. This analysis suggests that perceptions of the resilience dimensions and the top-five most valued indicators differ slightly depending on racial, gender, and demographic factors. However, it is difficult to make any specific claims about the differences in perceptions, considering the lack of diversity in survey response and small sample size.

Generally, these findings suggest that demographic factors, specifically, profession, race, and gender, may influence resilience values. Demographic factors impact community resilience perceptions because they influence personal values and access and demand for resources.

Knowledge of resilience values of different groups will provide insights into the needs and concerns of different groups. This knowledge is necessary to inform equity-focused resilience efforts that address gaps in resources experienced by underserved populations, a crucial step in building community resilience.

Limitations of Indicators and Measures

Although indicators can be a useful tool for assessing trends or progress, there are limitations to using indicators. Not everything that can be measured should be measured, and some important resilience-building aspects may be difficult to measure. For example, the majority of respondents perceived emergency preparedness as important, but this does not necessarily equate to preparedness action. Motivation to engage in preparedness actions is much harder to measure than perceived importance of preparedness.

Indicators and measures are open to interpretation. Respondents were provided with example measures to help better understand each indicator. However, there are many more measures that can be used for assessing each indicator concept. For example, the political participation indicator was paired with the example measure of 'percent voter participation in the 2016 presidential election' on my survey. However, another measure for political participation could be the 'percent population who participated in the latest local election', which slightly changes the interpretation of the indicator. After deciding on important indicators, communities will have to decide exactly what they will measure, altering the meaning of the indicator to individuals.

Recommendations for Further Research

There is still much to learn about the broad concept of community resilience. This study focuses on understanding resilience perceptions in King County. However, resilience values are likely to change depending on factors such as time, location, scale of the study area, cultural values. Studies have already been conducted to assess and compare regional resilience in the United States. Cutter, Ash, and Emrich (2014) applied a common set of resilience variables to counties across the United States to find that Midwestern and Great Plains counties have the highest resilience. Further research is needed to understand regional differences in values and perceptions pertaining to community resilience.

Further examination of how resilience perceptions differ depending on demographic factors is also required. Although this study explored the effects of profession, race, and gender on resilience values in King County, the lack of diverse response limited this analysis, particularly for race and gender. Additionally, compounding variables may have impacted the responses. To illustrate, if the majority of non-white respondents worked for the private sector, then non-white responses may reflect their professional experience rather than their racial, cultural, or ethnic background. In order to understand how demographic factors influence resilience values, a much higher sample size is required across all demographic groups in question. A more diverse response can be achieved if a research team works with community liaisons, translators and interpreters to engage respondents in a variety of ways. This research is essential to understanding the needs and priorities of different groups, especially populations experiencing inequities based on demographic factors such as race, gender, age, sexuality, immigration status, and disabilities.

Finally, more research is needed to investigate how governments and communities can effectively work together to build resilience to stresses and shocks. Although I identified valued dimensions and indicators through this study, I did not look at whether they could be influenced by policy, and if so, how. These strategies should be monitored to ensure long-term effectiveness, and analyze patterns of success and weaknesses in their approaches. This ever-evolving body of research will help practitioners make decisions and clarify the broad and complex concept of resilience.

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Appendix A – IRB Approval Form

UNIVERSITY of WASHINGTON
HUMAN SUBJECTS DIVISION

NOT HUMAN SUBJECTS

February 2, 2018

Dear Emma Argiroff:

On 2/2/2018 the University of Washington Human Subjects Division reviewed the following application:

Type of Review:	Initial Study
Title of Study:	A Preliminary Survey to Identify Important Community Resilience Indicators for King County
Investigator:	Emma Argiroff
IRB ID:	STUDY00004161
Funding:	None
IND, IDE, or HDE:	None

The Human Subjects Division determined that the proposed activity does not involve human subjects, as defined by federal and state regulations. Therefore, review and approval by the University of Washington IRB is not required.

This determination applies only to the activities described in this application. **Depending on the nature of your study, you may need to obtain other approvals or permissions to conduct your research. For example, you might need to apply for access to data (e.g., to obtain UW student data). Or, you might need to obtain permission from facilities managers to approach possible subjects or conduct research procedures in the facilities (e.g., Seattle School District; the Harborview Emergency Department).**

If you need to make changes in the future that may affect this determination or are not sure, contact us to see if you need to submit a new application.

We wish you great success.

Sincerely,

Jennifer McCauley
IRB Administrator, Committee D
206-543-0884
jmccaule@uw.edu

Appendix B – Community Resilience Survey

Print view of 'Community Resilience Indicators Survey'

Print this page

Question 1.
I am currently enrolled in the Master of Urban Planning Program at the University of Washington, and I am in the process of writing my Master's Thesis. This survey will inform my research, the purpose of which is to identify important community resilience indicators for King County. My thesis will be publicly available; however, all responses to this survey will be anonymous.

This survey should take approximately 10 minutes to complete. In order to participate in this survey you must be 18 years of age or older. Please indicate your willingness to participate by answering the question below.

CONFIRMATION OF CONSENT:

I agree to voluntarily participate in this study, and that I am at least 18 years of age. I grant permission for the data generated by this survey to be used by the researcher. I understand that the survey is anonymous, and I can withdraw from it at any point without penalty or consequences.

- ○ Yes
- ○ No - please exit this survey

Question 2.
Community resilience is defined as the ability of a community to proactively limit risk and stress, adapt to changing circumstances, and recover after disasters. Community resilience is very broad, and it is often broken down into social and community, economic, infrastructural, institutional, and environmental dimensions. Please rate each dimension on its level of importance in affecting community resilience.

Rows

Social and Community (concerns the level of trust and cooperation among social networks within a community, as well as the ability of these networks to address community problems)

Economy (concerns the wealth and resources of a given area, and the income disparity between residents of the area; also concerns resource management)

Infrastructure (concerns the physical framework that supports community functions, including utilities, transportation, and communication systems, and the built environment)

Institutions (concerns the ability of organized services to plan for and mitigate stresses, such as climate change, and shocks, such as earthquakes)

Environment (concerns the natural framework that supports communities, including diverse factors such as open space and environmental equity)

- ○ Extremely important
- ○ Important
- ○ Somewhat important
- ○ Not important
- ○ Don't know

An indicator is a trend or fact used to assess the condition of something, such as a system or program. Example measurements assessing each indicator are provided within parenthesis.

Question 3.
Here are some suggested indicators for the social and community dimension of resilience. Please select the five indicators you view as **most important** for measuring the social and community resilience of King County.

- ☐ High civic participation (measure as number of civic organizations per 10,000 population)
- ☐ High independence for individuals with special needs (measure as percent population with a sensory, physical, or mental disability who are employed)
- ☐ High volunteerism (measure as number of volunteer hours in the past year)
- ☐ Low average age (measure as percent non-elderly population)
- ☐ High political participation (measure as percent voter participation in the 2016 presidential

election)

- ☐ High religious participation (measure as number of religious adherents per 10,000 population)
- ☐ High English language competency (measure as percent population age five years or older that speaks English "very well")
- ☐ High transportation access (measure as percent population with access to a vehicle or public transportation)
- ☐ High place attachment (measure as net internal migration into a community)
- ☐ High communication capacity (measure as percent population with a smart phone)
- ☐ High health access (measure as physicians per 10,000 population)
- ☐ Other (please specify):

Question 4.
Here are some suggested indicators for the economic dimension of community resilience. Please select the five indicators you view as **most important** for measuring the economic resilience of King County.

- ☐ High occupational diversity (measure as percent population employed in non-dominant industries)
- ☐ High employment (measure as employment-to-population ratio)
- ☐ High educational equity (measure as ratio of percent population with college education to percent population with no high school diploma)
- ☐ High housing capital (measure as percent homeownership)
- ☐ Low poverty (measure as percent population living above the poverty line)
- ☐ High racial equity (measure as equal pay for equal work across racial groups)
- ☐ High median income (measure as median household income)
- ☐ High housing affordability (measure as percent of households in which housing costs, including utilities, are less than 30% of monthly income)
- ☐ High creativity & innovation (measure as percent employed in creative class occupation, such as design, engineering, art, or architecture)
- ☐ High diversity in business size (measure as ratio of small to large businesses)
- ☐ Low homelessness (measure as percent of individuals experiencing homelessness whose days of homelessness are reduced in the past year)
- ☐ Other (please specify):

Question 5.
Here are some suggested indicators for the infrastructural dimension of community resilience. Please select the five indicators you view as **most important** for measuring the infrastructural resilience of King County.

- ☐ Sturdy housing condition (measure as percent housing units that are not mobile homes)
- ☐ High access/ evacuation potential (measure as principal arterial miles per square mile)
- ☐ High sheltering capacity (measure as hotels/motels per 10,000 people)
- ☐ High internet access (measure as percent population with access to Internet services)
- ☐ High rates of seismic retrofitting (measure as number of high priority structures, such as buildings or bridges, that were seismically retrofitted in past year)
- ☐ High medical care capacity (measure as percent population within one mile of a hospital)
- ☐ High dam safety (measure as percent of high hazard potential dams with an updated Emergency Action Plan)
- ☐ High density (measure as housing density of single-family homes)
- ☐ High transit connectivity (measure as percentage of public transportation passenger terminals with intermodal connectivity)
- ☐ High accessibility (measure as percentage of intersections with curb ramps in compliance with ADA requirements)
- ☐ High drinking water reliability (measure as the quantity of water in rivers and lakes during the summer season)
- ☐ Other (please specify):

Question 6.
Here are some suggested indicators for the institutional dimension of community resilience. Please select the five indicators you view as **most important** for measuring the institutional resilience of King County.

- ☐ Strong hazard mitigation planning (measure as percent population covered by a hazard mitigation plan)
- ☐ Disaster resistant building codes (measure as percentage of communities that are subject to one or more seismic, hurricane, or flood hazards that have adopted responsive building codes)
- ☐ High emergency response (measure as average first responder response time)
- ☐ High jurisdictional coordination (measure as number of government and special units per 10,000 population)
- ☐ High flood insurance coverage (measure as percent population in StormReady Communities)
- ☐ High plan integration (measure as the alignment of goals and policies of community plans with hazard mitigation plans)
- ☐ High earthquake insurance coverage (measure as percent population covered by earthquake insurance in earthquake-prone areas)
- ☐ High health insurance coverage (measure as percent population covered by a health insurance plan)
- ☐ High emergency preparedness (measure as percent population that has participated in preparedness skills training)
- ☐ High mitigation investment (measure as ten year average per capita spending for mitigation)
- ☐ Other (please specify):

Question 7.
Here are some suggested indicators for the environmental dimension of community resilience. Please select the five indicators you view as **most important** for measuring the environmental resilience of King County.

- ☐ High soil quality (measure as number of earthworms per square foot)
- ☐ High environmental equity (measure as percentage of neighborhoods within 1/2 mile of a park or recreation field)
- ☐ High air quality (measure as Air Quality Index)
- ☐ High water quality (measure as percent water bodies not impaired according to EPA standards)
- ☐ High natural flood protection (measure as percent land in wetlands)
- ☐ High water conservation (measure as per capita water use for all domestic uses)
- ☐ High renewable energy use (measure as percent of energy that comes from renewable sources)
- ☐ Low sea level rise (measure as mm/year)
- ☐ High forest conservation (measure as percent increase in tree cover canopy since 2000)
- ☐ Low carbon emissions (measure as metric tons per capita)
- ☐ Other (please specify):

Question 8.
Do you live or work within King County limits?

- ○ Yes
- ○ No
- ○ Don't Know

Question 9.
What city do you reside in? If you do not live in a city, please state "unincorporated area".

Question 10.
What best describes your place of work?

- ○ Public
- ○ Private
- ○ Non-profit
- ○ Academic
- ○ Student

- Other (please specify):

Question 11.
What is the highest degree or level of school you have completed? *If currently enrolled, highest degree received.*

- Some high school, no diploma
- High school graduate, diploma or the equivalent (e.g. GED)
- Associate degree
- Bachelor's degree
- Master's degree
- Professional degree
- Doctorate degree
- Other (please specify):

Question 12.
What is your gender?

- Male
- Female
- Other

Question 13.
What is your age?

- 18-24
- 25-34
- 35-44
- 45-54
- 55-64
- 65-74
- 74 or older

Question 14.
What is your race?

- Black/ African American
- White/ Caucasian
- American Indian or Alaskan Native
- Asian
- Native Hawaiian or Pacific Islander
- Some other race or combination of races:

Question 15.
Are you of a Hispanic, Latino, or Spanish-speaking background?

- Yes
- No
- Don't Know