

Assessing Local Governments' Sustainability Strategies

by

Hyunjung Ji

A Dissertation Presented in Partial Fulfillment
of the Requirements for the Degree
Doctor of Philosophy

Approved May 2016 by the
Graduate Supervisory Committee:

Nicole Darnall, Chair
Elizabeth Corley
Richard C. Feiock
Spiro Maroulis

ARIZONA STATE UNIVERSITY

August 2016

ABSTRACT

A sustainability strategy is a distinctive pattern in an organization's sustainability programs that are designed to encourage individuals and organizations to behave in more sustainable ways. Local governments worldwide have increasingly pursued sustainability strategies to improve their community health and environment by adopting sustainability programs that span a variety of environmental issues and use a diverse set of policy instruments. Despite increasing prevalence of sustainability efforts at the local level, as yet, there has been little understanding of variation in their sustainability strategies and its relationship with environmental performance outcomes. Prior research has mainly focused on the number of programs that local governments adopt and assumed that local governments with more sustainability programs are more likely to improve the environment than local governments with fewer programs. However, local governments' sustainability strategies require more nuanced understanding about variations in their sustainability programs, in particular across their program design in that a sustainability strategy relates to both quantity and design aspects of programs.

I address these research gaps in three essays that explore the research question of (1) how design features of sustainability programs vary across US local governments, (2) which factors influence variations in program design, (3) how these factors are related to environmental quality outcomes in communities. By assessing US local governments' sustainability programs, I found that even for local governments that adopt a same number of sustainability programs, they design their programs differently, especially across the breadth of environmental issues that local governments address in their sustainability programs and the breadth of policy instrument that are used in their

programs. Findings suggest that pressures from external stakeholders and variations in local governments' organizational capacities are related to local governments' decisions to pursue different types of sustainability strategies. Finally, I find that local governments that design their programs more comprehensively are likely to have greater environmental performance outcomes in their community. My dissertation expands existing research in a significant way by focusing on the importance of program design and its link with improved environmental performance, thereby providing important implications for distinguishing among local governments' sustainability strategies.

ACKNOWLEDGMENTS

I thank all of my dissertation committee members – Professors Nicole Darnall, Elizabeth Corley, Richard Feiock, and Spiro Maroulis – for their constructive comments and continued supports for my dissertation work and academic career. In particular, I am sincerely grateful to my advisor, Professor Nicole Darnall, for her thoughtful and enthusiastic mentorship throughout my journey to Ph.D. It is my great fortune to have Professor Nicole Darnall as my academic advisor. I am also indebted to the member of my committee in that they have kept me on track, shared their ideas, and encouraged me to be a more thoughtful scholar. Without their support, this dissertation could not have been completed.

I am very grateful to my life mentor, Master Monk Doseong, who has provided me with great support and wisdom and enlightened me throughout my life. I also give my best regard to my mother, Chon Ok Park, who has always inspired, strengthened, and guided me. She has shared all the painful and joyful moments of my life with me. I send my deepest gratitude and sincere love to my parent. My sister, Minjeong Ji, and her family, Jongtae Lee, Jangwon Lee, and Seunghyun Lee, have always shared such great strength and joy with me. I sincerely appreciate their support and patience during my Ph.D.

Finally, I send my best regards to all my friends in and outside of the School of Public Affairs. I appreciate them providing intellectual stimulation and scholarly inspirations, and it is my great pleasure to have you all during my Ph.D journey.

TABLE OF CONTENTS

	Page
LIST OF TABLES.....	viii
LIST OF FIGURES	ix
CHAPTER	
1 INTRODUCTION.....	1
2 ALL ARE NOT CREATED EQUAL: ASSESSING THE DESIGN	
FEATURES OF LOCAL SUSTAINABILITY PROGRAMS	5
Sustainability Strategy And the Design of Local Governments’	
Sustainability Programs	7
Exploitative and Explorative Sustainability Strategies.....	8
Breadth of Environmental Issues.....	11
Breadth of Policy Instruments	13
Comparative Analysis of US Local Sustainability Program Design.....	16
Data.....	16
Measuring Breadth of Environmental Issues	17
Measuring Breadth of Policy Instruments.....	22
Empirical Analysis.....	30
Results	32
Discussion	36
Conclusion.....	39
3 WHY DO LOCAL GOVERNMENTS PURSUE DIFFERENT TYPES OF	
SUSTAINABILITY STRATEGIES?	42

CHAPTER	Page
Introduction	42
A Typology of Local Sustainability Strategies	45
Stakeholder Pressures and Local Sustainability.....	49
Internal Organizational Capacity and Local Sustainability	52
External Stakeholder Pressures, Internal Organizational Capacity, and Local Sustainability Strategies.....	54
Methodology	57
Data	57
Measures	58
Dependent Variable	58
Explanatory Variables	61
Control Variables	64
Empirical Model	65
Results	68
Discussion and Conclusion.....	74
 4 HOW DO DIFFERENT TYPES OF LOCAL GOVERNMENTS’ SUSTAINABILITY PROGRAMS RELATE TO THEIR ENVIRONMENTAL OUTCOME?	 77
Introduction	77
Local governments’ Sustainability Programs	79
Environmental Performance of Local Governments’ Sustainability Programs.....	 81

CHAPTER	Page
Empirical Analysis	84
Data.....	84
Measures.....	86
Dependent Variable	86
Explanatory Variables	90
Control Variables	95
Empirical Model	101
Results	105
Environmental Performance of Local Governments' Sustainability Programs.....	105
Local Governments' Sustainability Programs as Endogenous Variables ..	110
Local Governments' Sustainability Program Adoption	112
Discussion	115
5 DISCUSSION AND IMPLICATIONS.....	120
REFERENCES	123

LIST OF TABLES

Table	Page
2.1. Four Exemplary Cases of The Breadth of Environmental Issue: Number of Sustainability Programs Across 14 Environmental Issues	21
2.2. Four Exemplary Cases of The Breadth of Policy Instruments: Number of Sustainability Programs Across 12 Policy Instruments	29
2.3. T-test Results on Average Number of Sustainability Programs Across Environmental Issues Between Low-and High-Entropy Local Governments	34
2.4. T-test Results on Average Number of Sustainability Programs Across Policy Instrument Types Between Low-and High-entropy Local Governments ...	36
3.1. Descriptive Statistics for Attributes of Local Sustainability Strategies.....	61
3.2. Descriptive Statistics and Correlations	67
3.3. Multinomial Logistic Regressions Predicting Each Type of Local Sustainability Strategy.....	70
3.4. OLS Regressions Predicting the Breadth of Environmental Issues and Number of Programs	73
4.1. A Typology of Policy Instruments	94
4.2. Descriptive Statistics and Correlations	100
4.3. Spatial Autoregressive Estimation Results: Basic Models	107
4.4. Spatial Autoregressive Estimation Results: Nested Models.....	109
4.5. Predicting Counties' Sustainability Program Implementation	113
4.6. Two Stage Spatial Autoregressive Estimation Results	114

LIST OF FIGURES

Figure	Page
3.1. Three Types of Sustainability Strategies	60
4.1. Ozone Quality in 2003 (Left) and 2013 (Right)	88
4.2. Ozone Quality Change Between 2003 and 2013	89

Chapter 1

INTRODUCTION

Many scholars have underscored the role of local governments in addressing contemporary environmental issues (John, 1994; Portney, 2003; Stewart & Wiener, 1992) and their voluntary sustainability strategies can be effective at addressing them (Portney, 2003). Local governments' sustainability strategy is a distinctive pattern in their sustainability programs (Sharma, 2000) that usually include a set of incentive-oriented and information-based tools designed to encourage individuals and organizations to behave in more sustainable ways (Borck & Coglianesi, 2009). Accordingly, local governments have increasingly adopted a wide array of sustainability programs that span a variety of environmental issues (Berry & Portney, 2013; Daley, Sharp, & Bae, 2013; Svara, 2011).

However, these programs differ significantly in their design features. For instance, local governments have given uneven consideration of the environmental issues that they address in their sustainability programs (Portney, 2003; Svara, 2011). In other instances, some local governments have chosen to adopt sustainability programs that heavily depend on a few types of policy instruments. As such, variations exist in the scope of environmental issues and their use of policy instruments to address these issues (Daley et al., 2013; Portney, 2003; Svara, 2011). These design variations may affect their environmental performance outcomes (Darnall & Kim, 2012; Stewart & Wiener, 1992) in that more comprehensive programs may have greater potential for improving environmental conditions (Berry & Portney, 2013; Daley et al., 2013; Darnall & Kim, 2012). The potential has prompted multiple scholars to advocate that local governments

design their sustainability programs in a comprehensive way (Gunningham & Sinclair, 1999).

Despite increasing scholarly attention, there are at least three gaps in the previous literature examining local governments' sustainability programs. First, as yet, I do not have a good understanding of how local governments' sustainability programs are designed, especially across a large number of local governments. Prior research assessing local governments' sustainability programs has assumed that local governments with more sustainability programs are more likely to improve the environment than local governments with fewer programs (Berry & Portney, 2013; Owen & Videras, 2008; Portney, 2003; Swann, 2016). However, local governments with the same number of sustainability programs may design their programs very differently (Dupuis & Biesbroek, 2013). Understanding these variations therefore provide richer explanation about local governments' sustainability strategy and may offer more a more accurate way to estimate their environmental performance outcomes.

A second research gap is that prior research has not identified the factors that influence local governments to design their sustainability strategies differently. Rather, scholars have typically regarded these decisions monolithically (Bae & Feiock, 2013)—either local governments adopt a particular sustainability program or not (Sharp, Daley, & Lynch, 2010). In other instances, they have assessed how many sustainability programs that local governments adopt (Hawkins, Krause, Feiock, & Curley, 2016; Krause, 2011; Portney, 2003; Swann, 2016) as part of their overall sustainability strategy. However, varying degrees of stakeholder pressures and organizational capacities are likely to relate to whether or not a local government chooses to adopt a large number of

sustainability programs. They are also likely to influence whether or not these programs address a narrow or a broad range of environmental issues.

A third gap relates to the fact that scholarship has not examined the important question about whether or not local governments' sustainability programs improve environmental outcomes. I also do not know how different types of sustainability strategies relate to environmental performance outcomes. However, knowledge of these relationships is needed to assist local governments with improving the environmental conditions of their communities.

I will address each of these questions in three essays. In the first essay, I consider how local governments' different postures toward implementing sustainability programs, in particular exploitative/exploratory postures, lead to variations in two critical design features that are closely related to environmental performance outcomes: (1) the breadth of environmental issues and (2) the breadth of policy instrument types. I address variations in these design features of local governments' sustainability programs by empirically assessing 70 local governments' sustainability programs, the largest comparative study to date.

In the second essay, I explore how variations in stakeholders' pressures and internal organizational capacities are related to different types of local governments' sustainability strategies. Drawing on strategic management framework assessing organizations' environmental strategy, I develop a framework that characterizes four types of sustainability strategies (reactive, middle group and proactive) based on the number of sustainability programs they implement and the breadth of environmental

issues that they address in sustainability programs. I then empirically assess this framework by examining 1,146 US local governments' sustainability strategies.

In the third essay, I examine how the design of 102 U.S. county governments' sustainability programs are related with improved environmental conditions in their locality between 2003 and 2013. After controlling for the spillover effects of ozone quality among neighboring counties, I show that greater environmental performance outcomes were associated with local governments' sustainability programs that are designed more comprehensively.

In sum, the results of this research expand existing research in a significant way, and broaden the discussion about local governments' sustainability strategies by assessing their design features, determinants, and environmental performance outcomes. Knowledge of these different dimensions is essential for understanding why some local governments' sustainability strategies are more efficacious than others.

Chapter 2

ALL ARE NOT CREATED EQUAL: ASSESSING THE DESIGN FEATURES OF LOCAL SUSTAINABILITY PROGRAMS

Since the 1992 Rio Earth Summit, many local governments have developed a suite of sustainability programs designed to induce individuals and organizations to collectively improve communities' health and environment (Ayre and Callway, 2005). These programs target a variety of areas, from recycling to utility usage and land development (Feiock and Coutts, 2013), and have the potential to lead to sweeping shifts in social norms for environmental protection (Engel, 2006). However, as their prevalence has increased, so too have questions about program outcomes (Posner and Weisbach, 2010; Wiener, 2007).

Skepticism exists because some local governments appear to be designing their sustainability programs in a way that does not ensure improved environmental performance (Kosloff, Trexler, and Nelson, 2004; Posner and Weisbach, 2010; Wiener, 2007). For example, anecdotal evidence indicates that some local sustainability programs may require only modest changes in environmental behavior (Kosloff, Trexler, and Nelson, 2004). Others may require changes that are restricted to a local government's internal operations rather than extending their focus to the broader community (Bae and Feiock, 2013; Daley et al., 2013). Still others may lack long term investments that improve environmental and social conditions (Camagni, Capello, and Nijkamp, 1998; Posner and Weisbach, 2010). These more constrained sustainability programs tend to be low risk in nature in that they emphasize activities with predictable (but modest) environmental outcomes.

Prior research assessing the design of local governments' sustainability programs has assumed that local governments with more sustainability programs are more likely to improve the environment than local governments with fewer programs (Berry and Portney, 2013; de la Cruz, 2009; Owen and Videras, 2008; Portney, 2003; Swann, 2015). However, local governments with the same number of sustainability programs may design their programs very differently (Dupuis and Briesbroek, 2013), with some taking a more exploratory strategy while others take a more exploitative strategy (March, 1991). Consequently, the environmental outcomes of these sustainability programs may differ significantly. As yet, researchers lack a good understanding of how local governments' sustainability programs are designed, especially across a large number of local governments.

I address these issues by empirically assessing the designs of 70 local governments' sustainability programs in the United States (U.S.), the largest comparative study to date. My research question is how local governments' sustainability strategies lead to variations in two critical design features that are closely related to environmental performance outcomes: (1) the breadth of environmental issues and (2) the breadth of policy instrument types. Findings offer evidence that, although local governments might adopt the same number of sustainability programs, these programs are designed very differently. Some local governments design their sustainability programs more narrowly by focusing on a more limited number of environmental issues (e.g., recycling and internal government energy use) and constraining their policy instrument types (e.g., provision of services and infrastructure upgrade). However, other local governments design their sustainability programs more broadly by focusing on more environmental

issues and incorporating more diverse types of policy instruments to address them. The findings emphasize the importance of sustainability strategies and its connection with varying program design (Koski, 2007; Kosloff et al., 2004; Krause, 2011). Variations in the design features reflect local governments' exploratory/exploitative postures toward sustainability outcomes in that local governments that design their sustainability programs more broadly tend to focus on more innovative types of environmental issues and policy instruments. These design differences may affect local governments' ability to improve the natural environment (Koski, 2007). My findings imply an underlying exploration/innovation proposition faced by local authorities such that local governments that design their sustainability programs in a more experimental manner incur higher uncertainty associated with their program benefits in short term. However, the potential rewards associated with innovative environmental performance outcomes are also likely to be greater than sustainability programs that are designed more restrictively.

Sustainability strategy and the design of local governments' sustainability programs

Organizations' social license to operate depends on the community in which they are imbedded (Al-Saleh and Mahroum, 2014; Porter and Kramer, 2006, 2010). Addressing pressures that arise from within the community enhances their long-term viability (Meyer and Rowan, 1977). In response to increasing stakeholder pressures about environmental concerns, some organizations adopt sustainability programs (Bulkeley and Betsill, 2013; Engel, 2006). However, implementing these programs comes with high uncertainty in predicting the effects of their sustainability programs because the cost of implementation is immediate and tangible, whereas program benefits are often uncertain and intangible

(Engel and Orbach, 2008; Frame, 2008). Organizations have pursued different strategies to cope with the uncertainties (March, 1991; Walker, Rahman, and Cave, 2001) that confront them during designing their sustainability programs,¹ with some organizations pursuing an exploitative strategy and others pursuing an exploratory strategy (Li, Vanhaverbeke and Schoenmakers, 2007; March, 1991; Moynihan, 2008).

Exploratory and Exploitative Sustainability Strategies

Exploratory strategies emphasize creating new opportunities of organizational innovation by exploring a variety of alternative (March, 1991; Li, Vanhaverbeke and Schoenmakers, 2008; Moynihan, 2008). Given the focus on developing innovative practices, the exploratory strategy focuses on experiment, variation seeking, and new alternatives, thereby pursuing fundamental and innovative changes (March, 1991). Related to designing sustainability programs, some local governments seek to be recognized as sustainability leaders (Ayre and Callway, 2005, 2005) by making significant strides in improving their environmental quality (Portney, 2003). The competitive factor causes local governments to design their sustainability programs in a way that creates significant environmental improvements through innovative change (Hart and Millstein, 2003; Porter and Kramer, 2010). In taking this strategic approach, local governments not only focus on their internal operation processes, but also extend their sustainability programs to address the wellbeing of their overall community (Daley et al., 2013; Porter and Kramer, 2011). This broader focus tends to promote social and

¹ Program design is the process by which public managers choose from among a variety of possible options in order to address a particular problem (Schneider & Sidney, 2009).

environmental improvements to the broader society while also enhancing the organization's reputation within its community and peer networks (Porter and Kramer, 2006). Consequently, sustainability programs that are borne from an exploratory strategy tend to pursue long-term benefits (as opposed to short-term wins) (Hart and Millstein, 2003; Porter and Kramer, 2006, 2011) that may include improvements to human health and well-being, social vitality, and resource efficiency (Fiorino, 2010). However, because of their more experimental approach, organizations that pursue an exploratory strategy also tend to incur greater uncertainty in developing their sustainability programs (Hart and Millstein, 2003; Porter and Kramer, 2006) in that their program benefits are often less certain, less immediate, and more diffuse (Li et al., 2008; March, 1991; Moynihan, 2008).

Exploitative strategies are developed, not because of competitive factors, but in an effort to reduce uncertainty (March, 1991) associated with generating program benefits (March, 1991; Li et al., 2008). Given its focus on reliability of program benefits (March, 1991), organizations that pursue an exploitative strategy tend to focus on a limited range of alternative rather than seeking a variety of options (March, 1991; Li et al., 2008). The essence of exploitative strategy is refinement and extension of existing competences and practices, thereby ensuring positive, proximate, and predictable program benefits (March, 1991). Related to designing sustainability programs, local governments that pursue an exploitative strategy are more likely to design programs that address peripheral environmental issues (Hart and Millstein, 2003; Maak, 2008) with predictable, but modest, outcomes (Posner and Weisbach, 2010; Wiener, 2007) rather than focusing on complex sustainability concerns that require fundamental changes and extensive

implementation efforts (Porter and Kramer, 2006). Their programs are likely to be limited to improving the organization's internal operating processes (Bae and Feiock, 2013; Daley et al., 2013) because they are practically feasible and show immediate benefits (Yanarella and Levine, 2008). This narrower approach tends to emphasize short-term environmental improvements (Posner and Weisbach, 2010) that focus on enhancing an organization's internal efficiencies (Dupuis and Briesbroek, 2013; Porter and Kramer, 2010) through activities such as improved resource use (Yanarella and Levine, 2008). Because of each of these factors, sustainability programs borne from an exploitative strategy are designed to accrue more short-term, certain benefits and are less focused on the long-term (Michaels, 2008).

Despite the important distinctions among organizations' sustainability strategies, there has been very little knowledge about the design features of local governments' sustainability programs. Prior research has assumed that local governments with a greater number of sustainability programs are more likely to improve the environment, yet local governments with the same number of sustainability programs may design their programs differently, with some taking a more exploratory strategy and others taking a more exploitative strategy (March, 1991). Understanding these important design distinctions is critical for understanding whether local governments' sustainability programs are more likely to improve environmental outcomes (Carley and Miller, 2012; Koski, 2007; Krause, 2011).

I suggest that two design variations are particularly salient to local governments' pursuit of an exploitative versus exploratory sustainability strategy as they are related to policy ends and means respectively (Howlett, 2009): the breadth of environmental issues

that the programs address (Lafferty and Hovden, 2003; Stead and Meijers, 2009; Stewart and Wiener, 1992; Underdal, 1980) and the breadth of policy instruments that the programs use individually or jointly to achieve their sustainability objectives (Simons et al., 1999; Sovacool, 2009; Stewart and Wiener, 1992). Both concepts are discussed in the following sections.

Breadth of Environmental Issues

Breadth of environmental issues is defined as all possible sources that affect environmental quality (Stewart and Wiener, 1992). As part of its overall sustainability strategy, a local government must assess which environmental issues it will address, which requires an understanding of the pollutants and sources of pollution within their jurisdictions (Lafferty and Hovden, 2003; Stewart and Wiener, 1992)². While local governments are motivated to address environmental issues to achieve broad societal benefits, addressing some environmental issues present more certain economic benefits to local governments (Bae and Feiock, 2013; Daley et al., 2013). For instance, addressing environmental issues of recycling and resource efficiency within internal government facilities provide more certain economic benefits (e.g., operation cost savings) (Daley et al., 2013; Yanarella and Levine, 2008), whereas addressing environmental issues of air, water, and alternative energy present relatively less certain economic benefits (Bae and Feiock, 2013; Sharp et al., 2011). Addressing the environmental issues associated with high level of economic benefits often present more predictable, immediate, and tangible

² For instance, a local government may identify carbon emissions as an environmental pollutant within its jurisdiction. Sources of that carbon may include energy usage within government facilities, businesses and residential homes, and automobiles.

payoffs to local governments (Yanarella and Levine, 2008), thereby increasing reliability of sustainability program benefits.

Local governments that pursue an exploratory strategy are likely to address a greater breadth of environmental issues ranged from those presenting high level of economic benefits to those presenting low level of economic benefits. Because of their more experimental focus, these governments tend to address complex environmental issues that require fundamental changes in both their organizational operations (Yanarella and Levine, 2008; Daley et al., 2013) and community engagement (Bae and Feiock, 2013). They explore a variety of environmental issues by adopting a holistic approach, integrating all their related environmental issues, and establishing multiple pathways to address them (Lafeerty and Hovden, 2003; Stead and Meijers, 2009; Underdal, 1980). Although some environmental issues do not generate tangible and certain economic benefits immediately, by addressing a greater breadth of environmental issues, local governments can achieve greater (and more long-term) environmental improvements while also enhancing social wellbeing and economic growth in long-term (Florida, 2003).

By contrast, local governments that pursue an exploitative strategy are more likely to design their sustainability programs around the environmental issues that are more likely to provide high level of economic benefits. In determining which environmental issues to emphasize, these governments focus on environmental issues affecting their internal operations (Bae and Feiock, 2013; Daley et al., 2013) or environmental issues that are less complex (such as energy consumption related to lighting) and do not lead to fundamental changes in their organizational operations. Consistent with pursuing an exploitative strategy, addressing these issues is more practically feasible and less

expensive to implement (Yanarella and Levine, 2008), but still offer short-term economic benefits (Moffet, Bregha and Middelkoop, 2004). Therefore, as they seek for greater certainty in predicting program benefits (Daley et al., 2013; Yanarella and Levine, 2008), the breadth of environmental issues that they address become narrower and to be restricted to the environmental issues with high level of economic benefits.

Proposition 1. *Local governments that design sustainability strategies around a narrower breadth of environmental issues emphasize environmental impacts with more certain economic benefits than local governments that design sustainability strategies around a broader breadth of environmental issues.*

Breadth of Policy Instruments

Policy instruments are identifiable methods that influence individuals or organizations to behave in responsible ways in order to improve a social outcome (Schneider and Ingram, 1993). The breadth of a local government's policy instruments is defined as the diversity of policy approaches used to address a particular social concern (Sovacool, 2009; Stern, 2000). For last decades, environmental policy instruments have been increasingly diversified as they have evolved (Gunningham and Sinclair, 1999) from the first generation of direct government intervention (e.g., regulations, direct provision of services/infrastructure) (Jordan, Wurzel, and Zito, 2005) to the second generation of market-oriented instruments to the third generation of social controls (Long, 1997)³. The

³ In the 1970s, the first generation of command and control regulation had focused on the "one-size-fits-all" prescriptive approach (Gaines & Katz, 2002, p. 843). While it improved the quality of our air and water and land (Hirsch, 2010; Stewart & Wiener, 1992; Woods & Potoski, 2010), it failed to encourage the development of pollution prevention efforts by industry and individuals (Fiorino, 2004) as there is no reward for going further, and hence no incentive to prevent potential issues that are not yet covered by current regulation (Fiorino, 2004; Hirsch, 2010). In the mid 1980s, the market-oriented environmental policy emerged as the second generation of environmental policy in order to address these critics on the unidirectional government intervention (Fiorino, 1999; Hatch, 2005; Stewart, 1992). Environmental policy

newer the environmental policy instruments, the less intervening to business and individual citizens (Gunningham and Sinclair, 1999; Jordan et al., 2005). While each policy instrument has its own strengths and weakness (Gunningham and Sinclair, 1998, 1999), the first generation of policy instruments often have well proven policy effects, fix problems quickly, and therefore present high level of assurance that the objective will be achieved (Long, 1997), whereas the newer generation of policy instruments are more flexible, experimental and innovative (Jordan et al., 2005). Local sustainability programs utilize a variety of policy instruments to influence individuals' and organizations' behaviors (Daley et al., 2013; Krause, 2011), and the first generation of policy instruments has remained a main tool of choice for governments due to the high level of certainty (Long, 1997) .

Local governments that pursue an exploratory strategy are likely to use a broader spectrum of policy instruments ranged from the first generation to the third generation. Given the emphasis on experimentation with new alternatives (March, 1991), they not only depend on the traditional policy instruments, but also seek for novel policy instruments that may work through more indirect policy mechanisms of economic and social control (Jacobsen, Kotchen, and Clendenning, 2013; McKenzie-Mohr, 2000). For

of the second generation includes pollution fees, tradable permit system, and various market incentives (Stewart, 1992). The market-oriented policy instruments give polluting entities the incentive to ask whether there might be a better way to improve environmental quality other than producing environmental pollution (Crawford-Brown & Crawford-Brown, 2011). Therefore, this generation of environmental policy gives private industries market incentives and flexibility to devise environmental programs that fit to their businesses. Finally, by the 1990s, U.S. policy makers have begun to search the third generation of environmental policy (Fiorino, 1999; Long, 1997). In search of more effective prevention strategy, government, industry and civil society have begun to experiment with more governance-oriented approach (Jordan et al., 2005), including voluntary initiatives, such as green procurement, third party certification and education programs (Kerr et al., 1998). The third generation of environmental policy instrument focuses on changing public attitudes and transforming economic structure that indirectly encourage business and individuals to behave more sustainable ways (Long, 1997).

instance, in order to encourage individuals and organizations to engage in pro-environmental behaviors (e.g., energy savings, vehicle use reduction, recycling), local governments pursuing an exploratory strategy not only use policy instruments that directly induce their behavior change by providing legal, physical and administrative assistances (e.g., legal limits, infrastructure and public services), but also utilize the policy instruments that indirectly influence them by changing prices of the behaviors (e.g., tax incentives, charges) and socially constructed norms toward the behavior (e.g., education, voluntary agreement). By using multiple set of policy instruments, the sustainability programs that born from this exploratory strategy are more likely to shape (or constrain) individual behaviors or perceptions over time (Dietz and Stern, 2002; McKenzie-Mohr, 2000) as well as encourage immediate behavior changes (Kollmuss and Agyeman, 2002). Despite the more experimental trials, this more integrative approach tends to encourage individuals and organizations to sustain their behavior changes for a long time (Yanarella and Levine, 2008), thereby inducing more fundamental (and innovative) as well as long-term improvements in environmental and social conditions.

By contrast, local governments that pursue an exploitative strategy may tend to design their sustainability program around the first generation of environmental policy instruments. Compared to other types of policy instruments, the first generation of policy instruments ensure greater certainty of policy effects even if it is modest (Long, 1997) because of their longer history of implementation. Instead of adopting a variety set of policy instruments, an exploitative strategy tends to emphasize a few selected alternatives for policy instruments that have greater certainty related to program benefits (Matland ,1995), and can ensure the delivery of short-term benefits (Yanarella and

Levine, 2008), even if small. Therefore, as they seek for greater certainty in predicting effects of policy instruments, the breadth of policy instruments that they utilize to achieve the policy goal become narrower and to be restricted to the more traditional policy instruments.

Proposition 2. *Local governments that design sustainability strategies around a narrower breadth of policy instruments emphasize environmental impacts with more traditional policy instruments than local governments that design sustainability strategies around a broader breadth of environmental issues.*

Comparative Analysis of US Local Sustainability Program design

Data

To assess the design of local sustainability programs, I rely on the data from the 2010 International City/County Management Association (ICMA)'s Local Government Sustainability Policies and Programs survey. The survey was developed with the input of ICMA's Center for Sustainable Communities and other research institutes (ICMA, 2010) and asked local governments' sustainability managers about their jurisdiction's sustainability programs. In the summer of 2010, the survey was mailed to sustainability managers of total 8,569 local governments including county and municipal governments. Local governments that did not respond to the first survey received a follow-up reminder. Total 2,176 (25.39%) local governments – 1,874 municipalities and 302 counties – responded (Svara, 2011). Sustainability managers were provided with a list of 119 sustainability programs, and for each of the 119 programs, respondents were asked to indicate which actions their local government had taken. Respondents reported 'Yes' (1) or 'No' (0) for presence of each sustainability program.

ICMA data provides at least three merits to the research examining US local governments' sustainability effort. First, it includes the most comprehensive array of sustainability programs currently in use at the local level (Svara, 2011). While previous literature examined US local governments' sustainability programs by relying on other survey data (Berry and Portney, 2013; Bae and Feiock, 2013; Daley et al., 2013; Hawkins et al., 2015), they are either limited to a certain environmental area (e.g., energy) (Bae and Feiock, 2013; Daley et al., 2013) or include a less comprehensive list of sustainability programs (Hawkins et al., 2015; Portney, 2003). Second, it includes the largest number of local governments across entire United States. Despite the relatively low response rate, the data still includes 2,176 observations, the largest set of local government to my knowledge, including all types of local governments, such as counties, cities, and townships. Finally, ICMA is one of the most influential associations for US local governments (Svara, 2011), which makes local governments to respond in a more reliable manner.

Measuring Breadth of Environmental Issues

To measure the breadth of local governments' environmental issues addressed in their sustainability programs, the ICMA survey divided 119 sustainability programs along eight environmental impacts: air, water, recycling, energy conservation, buildings, land use, transportation, and social inclusion⁴.

⁴ For more details about the structure of the survey, a summary of the survey questionnaire is available at <file:///C:/Users/Hyunjung/Downloads/ICMA%202010%20Sustainability%20Survey%20Summary.pdf>.

The eight aggregate environmental issues were disaggregated based on their specific goals and target populations. For example, energy conservation programs were disaggregated based on their pollution source as sustainability programs that address more pollution sources have greater breadth (Daley et al., 2013). This step led to the generation of five types of energy items: energy in government, energy in residential homes, energy in business, energy in outdoor lights/vehicles, and alternative energy generation. Similarly, the aggregate category of transportation was disaggregated into three types of transportation items based on their pollution source: public transportation, reduced commute trips (e.g., telework, compressed work week), and alternative modes of vehicles (e.g., walk, bike). After disaggregation, I identified 14 environmental issues: air, water, recycling, energy in government, energy in residential homes, energy in business, energy in outdoor lights/vehicles, alternative energy generation, public transportation, reduced commute trips, alternative modes of vehicles, green building/construction, sustainable land use, and social inclusion.

I then categorized these environmental issues according to the potential of providing economic benefits to local governments: low, medium, and high level of economic benefits. First of all, recycling, energy in government, and energy in outdoor lights/vehicles (e.g., street lights, traffic signals) could be categorized into the high level of economic benefit because they are related to reducing government operation cost savings (Daley et al., 2013; Yanarella and Levine, 2008). On the other hand, environmental issues of air, water, alternative energy, and social inclusion could be categorized into the low level of economic benefit because they often create high level of spill-over effects, which make their economic effects more uncertain and diffuse (Sharp

et al., 2011; Yanarella and Levine, 2008). Finally, environmental issues related to energy in residential homes and business, transportation, and land use may fall into the grey area where economic benefits are somewhat expected, but less tangible and immediate than these issues of recycling and energy saving in government. Therefore, I categorized the remaining environmental issues into the medium level of economic benefit category.

Each local government's breadth of environmental issues was measured by the extent to which their sustainability programs were broadly distributed across these 14 environmental issues. In finalizing the measure for breadth of environmental issues, I utilized Shannon's H entropy score (Jacquemin & Berry, 1979). Shannon's H entropy score is one of the most widely used measures for breadth or diversity of items because it is sensitive to high levels of scope and therefore leads to wider variation than other types of breadth measures (e.g. Herphindal HirschmanIndex) (Halpin & Thomas, 2012).

Shannon's H entropy score takes the following form:

$$E_E = \sum_{j=1}^m P_j * \ln(1/P_j)$$

where P_j is a proportion of sustainability programs addressing j th environmental issue in total adopted sustainable programs, *the logarithm of $1/P_j$* is a weight of each proportion and m is the number of total available environmental issues, which is in this case 14.

Local governments whose sustainability programs address a greater breadth of environmental issues therefore receive a higher the entropy score (E_E).

As a complementary measure, I also multiplied the number of each local governments' sustainability programs with its entropy score. This second measure accounted for the

quantity of local governments' sustainability programs in addition to the distribution of environmental issues that they address (Halpin & Thomas, 2012).

$$\text{Number} * E_E = \sum_{i=1}^n \text{Sustainability programs}_i * \sum_{j=1}^n P_j * \ln\left(\frac{1}{P_j}\right)$$

Table 2.1 offers examples of four selected local governments to illustrate measures for the breadth of environmental issues. Each of the local governments in the first two columns, City of Cozad in NE and Village of Skaneateles in NY, implemented 10 sustainability programs. However, the breadth of environmental issues addressed in City of Cozad's sustainability programs is more constrained than Village of Skaneateles's, as evidenced by City of Cozad's entropy score of 0.77, compared to Village of Skaneateles's entropy score of 1.79. The differences in entropy scores reflect the fact that Village of Skaneateles' sustainability programs are more evenly distributed across the 14 environmental issues, whereas City of Cozad's sustainability programs are more heavily concentrated one environmental issue (energy saving in governments). In considering my second measure of breadth of environmental issues, which accounts for the quantity of local governments' sustainability programs in addition to the distribution of environmental issues that they address, Village of Skaneateles's score is 17.89, compared to City of Cozad's score of 7.72. From the variation in the breadth of environmental issues between City of Cozad's and Village of Skaneateles's sustainability programs, I can infer that these local governments may pursue different sustainability strategies in determining environmental issues to address in their sustainability programs. City of Cozad's sustainability programs are more likely to concentrate to environmental issues

that present high level of economic benefits, whereas Village of Skaneateles's sustainability programs that are designed more broadly across all environmental issues.

City of Arlington in WA and City of Mercer Island in WA illustrate a similar pattern but for cities that implemented a large number (i.e., 38) of sustainability programs. City of Arlington's sustainability programs are designed less broadly across environmental issues compared to City of Mercer Island's programs. City of Arlington's sustainability programs are constrained to a smaller number of environmental issues, in particular those with high level of economic benefits, whereas City of Mercer Island has a broader focus, which is reflected in their entropy scores (2.79 and 3.53, respectively). Similar differences are seen when the number of each city's sustainability programs is multiplied by its entropy score. City of Arlington's score is 106.36 and City of Mercer Island score is 134.05, which may reflect a more certain economic benefit-focused approach associated with City of Arlington's sustainability programs.

Table 2.1

Four exemplary cases of the breadth of environmental issue: Number of sustainability programs across 14 environmental issues

Environmental Issues		Cozad , NE	Skaneateles , NY	Arlington , WA	Mercer Island, WA
Low level of economic benefits	Total (n=31)	2	4	9	12
	Air quality(n=8)	--	1	1	4
	Water saving and quality(n=6)	--	1	5	4
	Alternative energy (n=9)	--	1	--	0
	Social Inclusion (n=8)	2	1	3	4
	Total (n=63)	0	3	14	13

Medium level of economic benefits	Energy use in Residents(n=13)	--	1	1	2
	Energy use in Business(n=12)	--	--	--	--
	Public transportation improvements(n=5)	--	--	1	2
	Reduced commute trips (n=6)	--	--	4	4
	Alternative modes of transportation (n=7)	--	1	4	--
	Green building and construction (n=7)	--	--	2	2
	Density and Sustainable development(n=13)	--	1	2	3
High level of economic benefits	Total (n=25)	8	3	15	13
	Energy use in Governments(n=6)	--	1	6	4
	Energy use in Outdoor light/vehicles(n=9)	7	1	2	3
	Recycling(n=10)	1	1	7	6
# of sustainability programs (n=119)		10	10	38	38
Breadth of environmental issues (EE)		0.77	1.79	2.79	2.3.53
Number * EE		7.72	17.89	106.36	134.05

Note: Average score of the breadth of environmental issues of 2,176 local governments is 1.77, and its standard deviation is 0.54. US local governments implement 17.94 sustainability programs on average, and standard deviation is 12.41, which is ranged from the minimum, 0, to the maximum 76.

Measuring Breadth of Policy Instruments

To measure the breadth of local governments' policy instruments used in their sustainability programs, I identified all the available types of policy instruments comprising the 119 programs in the 2010 ICMA survey. As the ICMA survey did not categorize the 119 sustainability programs according to policy instrument types, I established a typology of policy instruments drawing on prior research categorizing policy instrument types in the local sustainability program context (Bengston, Fletcher, and Nelson, 2004; Cubbage, Harou, and Sills, 2007; Kaufmann-Hayoz et al., 2001; Dietz, Ostrom, and Stern, 2003; Li & Geiser, 2005). In categorizing policy instrument types,

previous studies have commonly focused on the mechanism through which a policy instrument influences individual or organizational behaviors (Kaufmann-Hayoz et al., 2001; Dietz and Stern, 2002; Li and Geiser, 2005). Based on the policy mechanism criteria, I identified 12 types of policy instruments: voluntary agreement, provision of service, establishment of new infrastructure, infrastructure upgrade, tax benefits, direct financial payment, reduced fees, other incentives, charges, limit, education, and green procurement. Although these policy instruments are not completely mutually exclusive (Kaufmann-Hayoz et al., 2001), each policy instrument can be considered a distinctive type because each one depends on a different mechanism to influence behaviors. Moreover, these policy instruments could be categorized into different generations of environmental policy instruments (Jordan et al., 2005; Long, 1997). Definitions and the mechanisms of each policy instrument type by different generations are discussed below.

First of all, limits, direct provision of service and infrastructure could be categorized as the first generation of environmental policy instrument (Long, 1997) in that they are heavily depend on government's unidirectional intervention (Jordan et al., 2005).

Limits or requirements mandate some forms of behaviors or specific outcomes of actions by way of strong commitment to legal orders (Kaufmann-Hayoz et al., 2001). Examples from the ICMA list include land use requirements in urban planning, zoning codes to restrict certain development, and limits on impervious surfaces on private property.

Provision of service refers to providing practices, procedures, or actions that enable individuals or organizations to achieve the desired outcomes (Kaufmann-Hayoz et al., 2001). Local governments often transform and/or establish public services that assist or

promote certain environmentally sustainable behaviors (Kaufmann-Hayoz et al., 2001). Examples from the ICMA list include e-waste collection services, commuter rail systems, energy audit services, and the provision of alternative work options to public employees (e.g., compressed workweek, telework).

Infrastructure is “man-made, mobile or immobile physical objects that shape the actor’s scope of opportunities for action” (Kaufmann-Hayoz et al., 2001, p.39). Related to sustainability programs, local governments create physical conditions that enable or promote sustainable behaviors among individuals or organizations by establishing new infrastructures (Dietz and Stern, 2002). Examples drawn from the ICMA list include establishing bike lanes or sidewalks, installing charging station for electric vehicles, and installing new outdoor light fixtures. Local governments could also improve physical conditions by upgrading infrastructures (Dietz & Stern, 2002). Examples of the infrastructure upgrade from the ICMA list include retrofitting streetlights or traffic signals, upgrading facilities’ water or sewer systems, and widening sidewalks.

Second, tax benefits, direct financial payments, reduced fees, other incentives,⁵ and charges are variants of economic instruments (Bengston, Fletcher, and Nelson, 2004; Kaufmann-Hayoz et al., 2001), all of which could be categorized into the second generation of environmental policy instruments (Jordan et al., 2005; Long, 1997).

⁵ Other incentives are not drawn from a theoretical typology, but a category for the empirical measures. From the ICMA list of sustainability programs, 10 sustainability programs are described as incentives, but do not include details about specific types of incentives. Examples include density incentives, incentives for other than density for LEED-certified commercials, incentives for other than density for LEED-certified single-family residential facilities, incentives for water conservation, incentives for public employees for taking mass transit to work, carpool, walk, or bike, incentives for sustainable development, and financial support/incentives for affordable housing.

Tax benefits are tax deductions or exemptions for certain activities or services (Cubbage, Harou, and Sills, 2007). Related to sustainability programs, tax benefits encourage pro-environmental behaviors by reducing the cost of the behaviors at the margin (Braun, 2007), such as tax credits for residents or businesses who conduct energy audits or weatherization for their houses or buildings (ICMA). Direct financial payment refers to the direct provision of financial subsidies to individuals and organizations (Cubbage, Harou, and Sills, 2007), and it also provides individuals and organizations with economic incentives to engage in pro-environmental behaviors (Cubbage, Harou, and Sills, 2007; Sussman, 2007). Examples from the ICMA list include direct grants, direct loans for home audits, and the provision of funding for preschool education. Reducing fees encourages individual behaviors by reducing the costs of the pro-environmental behaviors through discounted prices or fees associated with the behaviors other than tax incentives (Bengston et al., 2004; Dietz & Stern, 2002). The ICMA examples include the purchase of development rights to preserve open spaces, or reducing fees for environmentally friendly development. Charges are prices imposed for utilizing public services or the privilege of engaging in certain activities (Kaufmann-Hayoz et al., 2001). They focus on discouraging individual or organizational behaviors by raising the costs of polluting behaviors (Bengston et al., 2004; Dietz & Stern, 2002). Examples from the ICMA list include water price structures to encourage conservation, charges based on the amount of waste discarded, or charging market rates for public employee parking to discourage commuting.

Finally, voluntary agreements, education, and green procurement are characterized as less intervening policy instruments (Jordan et al., 2005) in that they influence institutional

norms, public attitudes, and market drivers as policy mechanisms. Therefore, they could be categorized into the third generation of environmental policy instrument (Long, 1997).

Voluntary agreements are legally non-binding commitments made by organizations to achieve certain objectives or take certain measures (Dietz & Stern, 2002; Kaufmann-Hayoz et al., 2001). Voluntary agreements provide local governments and community members with strategic orientation toward the declared sustainability goal that they should achieve through their collective efforts (Kemp, 2000). Examples from the ICMA list are agreements on energy efficiency rates, greenhouse gas emission targets, and consumption goals or standards to achieve.

Education is an information-based instrument that influences individuals' beliefs, knowledge, and beliefs in social norms (Dietz & Stern, 2002; Kaufmann-Hayoz et al., 2001; Schultz, 2002) by informing, educating, or communicating (Kaufmann-Hayoz et al., 2001, p.48). Examples from the ICMA list include education programs dealing with energy conservation and reports published on a community's quality of life indicators.

Green procurement refers to public organizations' purchasing of products and services (Li and Geiser, 2005). Local governments incorporate sustainability criteria in their purchasing decisions, which is called sustainable procurement (Li and Geiser, 2005; Stevens, 2010). By purchasing environmentally friendly products or services (e.g., office supplies made from recycled materials, energy-efficient appliances or equipment, and electricity generated from renewable energy sources) (Stevens, 2010), local governments not only increase resource efficiency from an organization's internal operations and public service deliveries, but also drive the force for markets toward environmentally friendly products and services (Li and Geiser, 2005). Examples from the ICMA list

include green product purchasing programs, the purchase of fuel-efficient vehicles, and restrictions on the purchase of bottled water by governments.

By relying on the definitions and descriptions of the policy instrument types, I identified a policy instrument type for each of the 119 sustainability programs. Eight sustainability programs were excluded from measuring the breadth of policy instruments because they were not described sufficiently for us to determine their policy instrument types. I thus categorized 111 (of 119) sustainability programs into the 12 types of policy instruments.

Each local government's breadth of policy instruments was measured by the extent to which their sustainability programs were broadly distributed across these 12 types of policy instrument. I utilized Shannon's H entropy score (Jacquemin & Berry, 1979) to measure the breadth of policy instruments. The measure takes the following form:

$$E_P = \sum_{k=1}^l P_k * \ln(1/P_k)$$

where P_k is a proportion of sustainability programs addressing k th type of policy instrument in total adopted sustainable programs, *the logarithm of $1/P_k$* is a weight of each proportion and l is the number of total available policy instrument types, which is in this case 12. Local governments whose sustainability programs address a greater breadth of policy instruments therefore receive a higher the entropy score (E_P).

As a second measure, I also used multiplied the number of each local governments' sustainability programs with its entropy score. This measure accounted for the quantity of local governments' sustainability programs in addition to the distribution of policy instruments that they use (Halpin & Thomas, 2012).

$$\text{Number} * E_P = \sum_{i=1}^n \text{Sustainability programs}_i * \sum_{k=1}^l P_k * \ln\left(\frac{1}{P_k}\right)$$

Similar to Table 3.1, Table 3.2 provides examples of four selected local governments to illustrate the measures for the breadth of policy instruments. Each of the local governments in the first two columns, City of Cozad in NE and City of Colorado in TX, implemented 10 sustainability programs. However, the breadth of policy instruments used by City of Cozad's sustainability programs is more restricted than City of Colorado's, as evidenced by City of Cozad's entropy score of 0.96, compared to City of Colorado's entropy score of 1.97. The differences in entropy scores reflect the fact that City of Colorado's sustainability programs are more evenly distributed across the 12 policy instruments, whereas City of Cozad's sustainability programs are more heavily concentrated on one policy instrument (i.e., provision of services). In considering the second measure of the breadth of policy instruments, which accounts for the quantity of local governments' sustainability programs in addition to the distribution of policy instruments that they use, City of Colorado's score is 19.74, compared to City of Cozad's score of 9.57. From the difference in the breadth of policy instruments between City of Cozad's and City of Colorado's sustainability programs, I can infer that these local governments may pursue different sustainability strategies in selecting policy instruments to use in their sustainability programs. City of Cozad's sustainability programs are more likely to concentrate to the first generation of policy instruments, whereas City of Colorado's programs are more broadly distributed across all types of policy instruments.

City of Redding in CA and City of Long Beach in CA illustrate a similar pattern, but for cities that implemented a large number (i.e., 38) of sustainability programs. City of

Redding's sustainability programs are designed less broadly across policy instruments compared to City of Long Beach's programs. City of Redding's sustainability programs are constrained to a smaller number of policy instruments, whereas City of Long Beach has a broader focus, as evidence by their entropy scores: 1.65 and 2.68, respectively. Similar differences are seen when the number of each city's sustainability programs is multiplied by its entropy score. City of Redding's score is 62.82, and City of Long Beach's score is 102.01, which may reflect a more traditional policy instrument-focused approach associated with City of Redding's sustainability programs.

Table 2.2

Four exemplary cases of the breadth of policy instruments: Number of sustainability programs across 12 policy instruments

Policy Instrument Types		Cozad, NE	Colorado, TX	Redding, CA	Long Beach, CA
3rd generation of environmental policy instruments	Total (n=19)	0	1	4	12
	Voluntary agreement (n=8)	--	1	--	3
	Education (n=2)	--	--	2	2
	Green procurement (n=9)	--	--	2	7
2nd generation of environmental policy instruments	Total (n=49)	1	5	9	6
	Tax benefits (n=11)	--	--	--	--
	Direct payment (n=21)	--	2	6	--
	Reducing fees (n=4)	--	1	--	1
	Other incentive(n=10)	--	1	3	4
	Charges (n=3)	1	1	--	1
1st generation of environmental policy instruments	Total (n=43)	9	4	25	20
	Limit (n=9)	--	1	4	2
	Provision of service(n=18)	8	1	11	9
	Infrastructure Upgrade (n=10)	1	--	2	3
	Infrastructure Establish (n=6)	--	2	8	6
Number of sustainability programs (n=111)		10	10	38	38

Breadth of policy instrument (EP)	0.96	1.97	1.65	2.68
Number * EP	9.57	19.74	62.82	102.01

Note: Average score of the breadth of policy instruments of 2,176 local governments is 1.35, and its standard deviation is 0.45. US local governments implement 17.94 sustainability programs on average, and standard deviation is 12.41, which is ranged from the minimum, 0, to the maximum 76.

Empirical Analysis

To assess Propositions 1 and 2, I created two groups of local governments according to their entropy scores: those with exploitative and exploratory strategies. To create these two groups, I first limited local governments to those that have a similar number of sustainability programs because my research focused on how local governments design their programs differently despite a similar number of sustainability programs. I limited local governments to those with more than 26 sustainability programs (which is 75th percentile of the number of sustainability programs) or fewer than 30 sustainability programs (which is about 80th percentile of the number of sustainability programs).

I focused on local governments adopting a large set of sustainability programs. First, they are leading actors in adopting more sustainability programs than others. By categorizing these local governments by the design features of their sustainability programs, I identify genuinely proactive local governments that adopt not only more sustainability programs, but also design them more comprehensively than other local governments. Second, local governments with a large set of sustainability programs may have greater flexibility in designing their programs across various environmental issues and policy instrument types than those that have only a few or a modest number of sustainability programs. Given the greater flexibility, I may be able to identify local governments that adopt a large number of sustainability programs while failing to design

them with sufficient policy designs that relate to substantial improvements in environmental performance. As I limited local governments to those between the 75th and 80th percentile in terms of their number of sustainability programs, 140 local governments were selected to create local governments with the exploitative and exploratory strategies.

To test proposition 1, I categorized the selected local governments into exploitative and exploratory strategy categories based on their entropy score for breadth of environmental issues (E_E). If the E_E was in the bottom 25% (lower than 25th percentile), the local governments were categorized in the exploitative sustainability strategy group; these local governments' sustainability programs address a narrower array of environmental issues than other local governments' programs despite a similar number of programs. Meanwhile, local governments with the exploratory sustainability strategy were in the top 25% (greater than 75th percentile) for E_E .

To test proposition 2, I created another set of exploitative and exploratory strategy categories for local governments based on the entropy score of the breadth of policy instruments (E_P). When E_P was in the bottom 25% (lower than 25th percentile), the local government was categorized in the exploitative sustainability strategy group; these local governments' sustainability programs use a narrower set of policy instruments than other local governments' programs despite a similar number of programs. Local governments whose E_P was in the top 25% (greater than 75th percentile) were categorized in the exploratory sustainability strategy group.

Using these two sets of local governments with low- and high-entropy scores⁶, I then conducted *t*-tests to compare how the similar number of sustainability programs were designed across environmental issues and policy instrument types between these two groups of local governments.

Results

Table 2.3 presents average number of sustainability programs across 14 environmental issues among the low-and high-entropy score (E_E) groups, which represent local governments with the exploitative and exploratory strategy respectively.

The results of the *t*-test indicated that total number of sustainability programs between the low-and high- entropy groups are statistically similar, 27.34 and 27.53 respectively. However, variations exist in the breadth of environmental issues that they address, as evidenced by the statistical difference ($p < 0.01$) in their entropy score for the breadth of environmental issues: 1.80 and 2.17 respectively. Variations also exist in the complementary measure of the breadth of environmental issues (49.32 and 59.62 respectively; $p < 0.01$), which accounts for the quantity of local governments' sustainability programs in addition to the breadth of environmental issues.

Even though these two groups of local governments implement a similar number of sustainability programs, I find that they tend to focus on different environmental issues. More specifically, the local governments with the low- entropy score group have more sustainability programs that address the environmental issues that are associated with

⁶ List of the selected 70 local governments that were included in this study could be provided based upon requests.

high economic benefits ($p < 0.01$), such as recycling, energy use in the government, and energy use in outdoor light/vehicles compared to those with the high- entropy score.

By contrast, the local governments with the high- entropy score have more programs that accrue medium and low level of economic benefits to local governments ($p < 0.01$), such as air quality, water quality, alternative energy source development compared to those with the low- entropy score.

Focusing on the breadth of policy instruments, table 2.4 presents the average number of sustainability programs across 12 policy instrument types between the low-and high-entropy groups for the breadth of policy instruments (E_p), which represent the exploitative and exploratory sustainability strategy respectively.

Similarly, I conduct a *t*-test for the total number of sustainability programs across low-and high- risk sustainability strategy groups and find that they are statistically similar, 27.23 and 27.51 respectively. However, variations exist ($p < 0.01$) in the breadth of policy instruments in their entropy score for the breadth of policy instruments: 1.34 and 1.73 respectively. Variations also emerge in the complementary measure of the breadth of policy instruments ($p < 0.01$), which is the number of sustainability programs multiplied by the entropy score for breadth of policy instruments (39.60 and 47.82 respectively).

Despite having a similar number of sustainability programs, these local governments show different patterns in designing their sustainability programs across policy instrument types. More specifically, the local governments with the low- entropy scores are likely to have more sustainability programs that use the first generation of

environmental policy instruments ($p < 0.01$), such as limits, provision of services and infrastructure upgrade as compared to those with the high- entropy scores.

By contrast, the local governments with the high- entropy scores have more sustainability programs that use the second and third generation of environmental policy instruments ($p < 0.01 - p < 0.10$), such as voluntary agreement, education, and green procurement as compared to those with the low- entropy scores.

Table 2.3

T-test results on average number of sustainability programs across environmental issues between Low-and High-entropy local governments

Environmental Issues		Low-entropy group (obs=35)		High-entropy group (obs=35)		P-value
Low level of economic benefits	Total (n=31)	6.56	(0.49)	8.21	(0.30)	0.00
	Air quality(n=8)	1.19	(1.53)	1.53	(0.95)	0.28
	Water saving and quality(n=6)	1.78	(1.58)	2.19	(1.06)	0.23
	Alternative energy (n=9)	0.28	(0.58)	0.66	(0.83)	0.04
	Social Inclusion (n=8)	2.75	(2.29)	2.53	(1.14)	0.62
Medium level of economic benefits	Total (n=63)	7.00	(0.41)	8.65	(0.38)	0.00
	Energy use in Residents(n=13)	0.47	(0.67)	1.09	(1.17)	0.01
	Energy use in Business(n=12)	0.09	(0.53)	0.22	(0.66)	0.40
	Public transportation improvements(n=5)	0.47	(0.72)	1.25	(0.84)	0.00
	Reduced commute trips (n=6)	0.75	(0.98)	0.63	(0.79)	0.57
	Alternative modes of transportation (n=7)	3.00	(1.61)	3.16	(1.22)	0.66
	Green building and construction (n=7)	0.63	(0.91)	1.19	(1.12)	0.03
	Density and Sustainable development(n=13)	2.16	(1.90)	2.44	(1.34)	0.49
High level of economic benefits	Total (n=25)	12.01	(0.45)	10.06	(0.25)	0.00
	Energy use in Governments(n=6)	3.75	(1.44)	3.09	(1.06)	0.04
	Energy use in Outdoor light/vehicles(n=9)	2.41	(1.46)	2.53	(1.07)	0.69

Recycling(n=10)	5.69	(1.62)	4.56	(1.46)	0.00
# of sustainability programs (n=119)	27.34	(1.10)	27.53	(1.05)	0.48
Breadth of environmental issues (EE)	1.80	(0.08)	2.17	(0.06)	0.00
Number * EE	49.32	(2.86)	59.62	(2.92)	0.00

Note: Standard deviations in parentheses.

Table 2.4

T-test results on average number of sustainability programs across policy instrument types between Low-and High-entropy local governments

Policy Instrument Types		Low-entropy group (obs=35)		High-entropy group(obs=35)		P-value
3rd generation of environmental policy instruments	Total (n=19)	2.37	(0.28)	5.37	(0.28)	0.00
	Voluntary agreement (n=8)	0.31	(0.76)	1.40	(1.46)	0.00
	Education (n=2)	0.40	(0.55)	1.09	(0.61)	0.00
	Green procurement (n=9)	1.66	(1.45)	2.89	(1.18)	0.00
2nd generation of environmental policy instruments	Total (n=49)	3.60	(0.49)	4.71	(0.32)	0.06
	Tax benefits (n=11)	0.20	(1.02)	0.17	(0.45)	0.88
	Direct payment (n=21)	1.34	(2.24)	0.80	(1.41)	0.22
	Reducing fees (n=4)	0.40	(0.85)	0.71	(1.02)	0.16
	Other incentive(n=10)	1.40	(1.03)	2.11	(1.18)	0.00
	Charges (n=3)	0.26	(0.51)	0.91	(0.56)	0.00
1st generation of environmental policy instruments	Total (n=43)	20.54	(0.44)	16.97	(0.30)	0.00
	Limit (n=9)	2.26	(1.54)	3.06	(1.19)	0.02
	Provision of service(n=18)	10.03	(2.04)	6.94	(1.55)	0.00
	Infrastructure Upgrade (n=10)	6.37	(1.31)	5.37	(1.70)	0.01
	Infrastructure Establish (n=6)	1.89	(1.05)	1.60	(1.06)	0.26
Number of sustainability programs (n=111)		27.23	(1.14)	27.51	(1.20)	0.31
Breadth of policy instrument (EP)		1.34	(0.08)	1.74	(0.07)	0.00
Number * EP		36.60	(2.50)	47.82	(2.77)	0.00

Note: Standard deviations in parentheses.

Discussion

Taken as a whole, the results indicate that even when local governments adopt a similar number of sustainability programs, they design their programs differently according to their sustainability strategies. In terms of the breadth of environmental issues, local governments that design their programs more narrowly are more likely to

focus on the issues with high level of economic benefits (e.g., recycling and internal energy saving). These programs require less effort because of their internal focus and quicker payoffs (Krause, 2011; Collins, Roper, and Lawrence, 2010; Yanarella and Levine, 2008), which emphasizes their exploitative strategy. However, local governments that design their sustainability programs more broadly are more likely to focus on the more complex environmental issues even though they are associated with low level of economic benefits (e.g., air, water, alternative energy, and social inclusion). Despite the less certain economic benefits, these air, water, alternative energy and social inclusion issues have been considered key elements for creating a vibrant community (Bulkeley and Betsill, 2005). While addressing these environmental issues usually leads to greater environmental improvements, such actions might incur high costs and uncertainty for local governments as they need to target broad community members (Daley et al., 2013), conduct large-scale investments (Bulkeley and Betsill, 2005), and make fundamental changes in their community as well as internal organizations. However, their broader focus on a variety of environmental issues may have more extensive and innovative impacts on a community's health and environmental quality, implying their exploratory sustainability strategy. Therefore, these findings provide evidence in support of Proposition 1, which states that local governments that design sustainability strategies around a narrower breadth of environmental issues emphasize environmental impacts with more certain economic benefits than local governments that design sustainability strategies around a broader breadth of environmental issues.

Related to the breadth of policy instruments, local governments that design their programs more narrowly are more likely to depend on the first generation of policy

instruments (e.g., provision of public services and infrastructure upgrades). These policy instruments are relatively more feasible options for local governments as they could easily implement them by modifying existing public services or infrastructures. Moreover, providing favorable services may ensure the delivery of short-term policy outcomes (Yanarella and Levine, 2008) because it encourages immediate behavior changes by individuals and organizations, but less likely to sustain in the absence of the favorable assistances, implying their exploitative sustainability strategy.

By contrast, local governments that design their sustainability programs more broadly are more likely to use a variety of policy instruments including the second and the third generation of policy instruments (e.g., voluntary agreements, education, and economic-incentives). These policy instruments have great potential to sustain pro-environmental behaviors by individuals and organizations because they address critical barriers that inhibit their behavior changes, such as a lack of money, knowledge, and social norms (Braun, 2007; Kollmuss and Agyeman, 2002). More specifically, voluntary agreements and educational offerings are likely to induce fundamental changes in individuals' and organizations' behaviors by increasing awareness of an overriding goal to achieve, distributing information and knowledge about environmental issues, and ultimately shifting a cultural or social norm within the community—all of which may contribute to widespread community engagement in the local environmental governance (Selman and Parker, 1997). Due to this policy potential, voluntary agreements and educational opportunities have increasingly gained popularity among practitioners as a new policy instrument of environmental policy (Dietz and Stern, 2002; Kemp, 2000). Similarly, the economic instruments could establish effective incentive systems for community

engagements in pro-environmental behaviors as they are designed to be sensitive to the needs of target groups (Braun, 2007). Despite the extensive impacts of these policy instruments on individuals and organizations, these policy instruments may incur higher costs and uncertainty for local governments to implement these policy instruments because they are more likely to require strong political commitments, widespread community engagement and modified institutional settings (e.g. tax systems) to ensure the behavior changes in a long-term basis (Braun, 2007; Wheeler, 2007). All of these factors imply their exploratory sustainability strategy. Taken as a group, these findings offer evidence to support Proposition 2, which states that local governments that design sustainability strategies around a narrower breadth of policy instruments emphasize environmental impacts with more traditional policy instruments than local governments that design sustainability strategies around a broader breadth of environmental issues.

Conclusion

Local governments worldwide have increasingly engaged in envisioning, designing, and implementing sustainability programs (Bae and Feiock, 2013; Berry and Portney, 2013; Daley et al., 2013; Portney, 2003; Sharp et al., 2011). However, the environmental performance of these sustainability programs hinges on their program design (Darnall and Kim, 2012).

My study offers several important contributions to research on sustainability management at the local level. First, while previous literature has suggested that adopting more sustainability programs may lead to stronger environmental outcomes (Berry and Portney, 2013; de la Cruz, 2009; Owen and Videras, 2008; Portney, 2003; Swann, 2015), I offer strong evidence that these programs are not designed equivalently. Local

governments that pursue an exploratory strategy when designing their sustainability programs address a broad array of environmental issues and use a broad spectrum of policy instruments to address them. With their broader focus, they tend to address more complex environmental issues associated with air, water, and social inclusion, all of which are more likely affect both community health and environmental quality than other type of environmental issues. They also tend to use a diverse set of policy instruments to encourage individuals' and organizations' behavior changes directly and indirectly. In contrast, local governments that pursue an exploitative strategy focus on a limited number of environmental issues (e.g., recycling and internal government energy use) and use a more restricted set of policy instrument types (e.g., provision of services and infrastructure upgrades) to ensure reliability of their programs benefits in short-term. These design differences exist even if the number of sustainability programs across both types of local governments is equivalent. Given the importance of program design and its link with improved sustainability performance (Darnall and Kim, 2012), findings have important implications for distinguishing among local governments' sustainability programs. That is, sustainability programs borne from a exploratory strategy may be more likely to produce more desirable policy outcomes in long-run. These differences might otherwise go unnoticed if I focused exclusively on the number of programs that they implement (Schaffrin, Sewerin, and Seubert, 2015).

My findings therefore suggest that local governments should take a more strategic and integrative approach when designing their sustainability programs (Yanarella and Levein, 2008). Without careful consideration of program design, local governments'

sustainability efforts may lack value and, at some point, lose critical stakeholder support or futility (Fiorino, 2010).

Finally, since my findings offer evidence of distinctions between design features in local sustainability programs, additional research would benefit from a more in depth analysis of why these features vary. While prior research suggests that variations are likely due to differences in stakeholder (Engel and Orbach, 2008) and competitive pressures (Hart and Millstein, 2003; Porter and Kramer, 2010), these issues have not been investigated empirically as they relate to the local governments' sustainability strategies, and especially the design features of their sustainability programs. Additionally, future research should explore how variations in local governments' sustainability strategies are related empirically with environmental outcomes over time. My research suggests that local governments that adopt sustainability programs that address a greater breadth of environmental issues and utilize a broader number of policy instruments to address them are more likely to improve environmental outcomes to a greater extent. However, these relationships have not yet been explored systematically. My hope is that this research offers a justification for doing so. Finally, my study characterizes sustainability strategies based on two design features (the breadth of environmental issues and the breadth of policy instruments). However, there might be other salient design features to consider, such as the stringency of environmental standards and monitoring/enforcement mechanisms. Examining these sorts of design features would offer a richer explanation about variations in local governments' sustainability programs. My hope is that my comparative analysis serves as a basis for undertaking future research in this area as there is still much to learn about how the design of local governments' sustainability strategies.

Chapter 3

WHY DO LOCAL GOVERNMENTS PURSUE DIFFERENT TYPES OF SUSTAINABILITY STRATEGIES?

Political resistance, high regulatory costs, and technical limitations have constrained national governments from enacting stringent regulations in response to global environmental problems (Potoski, 2015). In absence of national action, and in the face of increasing environmental risk, local governments worldwide have voluntarily implemented their own sustainability strategies to improve community health and environmental quality (Hawkins et al., 2016). These strategies are usually composed of a set of programs that utilize incentive-oriented tools to encourage individuals and firms to behave in more sustainable ways (Borck & Coglianese, 2009). They tend to target a variety of areas—from recycling to utility usage and land development—(Feiock & Coutts, 2013) and have the potential to create distinctive public benefits including improved environmental outcomes, quality of life, and community well-being (Daley et al., 2013; Florida, 2005).

Despite their promise, local government's sustainability strategies do not yield the same environmental performance outcomes because of variations in how they are designed. For instance, as part of their sustainability strategy, some local governments choose to design their programs across a broad array of environmental issues (Daley et al., 2013; Sharp et al., 2010) to create innovative pathways to sustainability (Ayre & Callway, 2005), thereby differentiating themselves (Segev, 1989) from other governments. In other cases, local governments focus on only certain types of environmental issues that are likely to generate short-term, tangible benefits to

governments (Kosloff, Trexler, & Nelson, 2004), thereby appealing to external stakeholder pressures for environmental protection (K. Engel, 2006). As such, local governments may assess their internal motivations and external pressures to make strategic decisions in designing their sustainability programs, which forms its sustainability strategy (Sharma, 2000). Local governments' pursuit of different sustainability strategies may subsequently affect how effective they are at improving the local environmental quality and enhancing the quality of life of community residents. However, as yet, scholars have known little about the different types of sustainability strategies that local governments pursue, and the factors that influence local governments to adopt one sustainability strategy over another.

Prior literature assessing the factors that influence local governments' sustainability decisions has typically regarded their decisions monolithically (Bae & Feiock, 2013)—either local governments adopt a program or not (Sharp et al., 2010) or how many programs to implement (Hawkins et al., 2016; Krause, 2011; Portney, 2003; Swann, 2016). In this paper, I suggest that differing stakeholder interests and organizational capacity are likely to influence local public managers to pursue certain types of sustainability strategies and therefore their strategic decisions about whether or not a local government chooses to address a narrow or a broad range of environmental issues. However, as yet, previous literature has not considered how different these factors are related to local government's pursuit of different types of sustainability strategies that lead to variations in their sustainability designs.

In this paper, I explore how variations in stakeholders' pressures and internal organizational capacities relate with different types of local governments' sustainability

strategies. Drawing on previous literature on organizations' voluntary environmental strategy (Aragón-Correa, 1998; Basu & Palazzo, 2008; Buysse & Verbeke, 2003; Porter & Kramer, 2006; Sharma & Vredenburg, 1998), I characterizes local governments' sustainability strategies (reactive, middle group, and proactive) based on a design aspect of their sustainability programs, in particular the breadth of environmental issues that they address in sustainability programs. I empirically assess this framework using data from the International City/County Management Association (ICMA)'s Local Sustainability Program Survey, the U.S. Census, and the National Charitable Center Statistics (NCCS) to analyze the sustainability strategies of 1,146 US local governments. Findings indicate that external pressures from heavy industry stakeholders and weaker organizational capacities are associated with local governments that pursue a reactive sustainability strategy (designing sustainability programs across a narrow array of environmental issues). By contrast, external pressures from new economy stakeholders and stronger organizational capacities are associated with local governments that pursue a proactive sustainability strategy (designing sustainability programs across a broad array of environmental issues).

These findings extend existing local government literature by developing a more comprehensive framework of local governments' sustainability strategies. By virtue of their more comprehensive design, a proactive strategy may be more likely to lead to more improved environmental outcomes. If so, knowledge of these relationships provides local government managers and policymakers with important information about the factors needed to achieve the full potential of their sustainability strategies.

A TYPOLOGY OF LOCAL SUSTAINABILITY STRATEGIES

Local public managers chose among a variety of strategies when implementing their sustainability programs, with the goal of improving environmental conditions within their community (Daley et al., 2013). Previous literature examining the implementation of local governments' sustainability programs has mainly focused on their number only (Berry & Portney, 2013; Portney, 2003; Swann, 2016). They usually considered local governments that implement more sustainability programs as being more serious about sustainability issues (Portney, 2003) and more likely to improve the environmental conditions within their community than local governments that implement only a few or a modest number of programs (Portney, 2003; Svava, 2011).

However, even for local governments that implement a similar number of sustainability programs, variations are likely to exist in the breadth of environmental issues that they address (Sharp et al., 2010). In other words, some local governments may address a broad array of environmental issues across, say, 10 sustainability programs whereas others address only a few environmental issues across the same number of programs. The local governments that address a broad array of environmental issues tend to more holistically integrate all their related environmental issues into their sustainability programs, and establish multiple pathways to address them (Lafferty & Hovden, 2003). Such an holistic approach requires local governments to coordinate their programs not only across multiple departments within a government (Krause, Feiock, & Hawkins, 2016; Zeemering, 2009), but also across community members, the private and non-profit sectors (Sharp et al., 2010), which is more time intensive and costly than taking a less holistic approach. However, by addressing a greater breadth of environmental issues,

local governments can achieve greater (and more long-term) environmental improvements while also enhancing social wellbeing and economic growth (Florida, 2005).

Despite the importance of the design aspect of sustainability programs in examining local governments' sustainability strategy, yet researchers have very little understanding about how local governments' sustainability programs vary by the breadth of environmental concerns they address. Considering the design dimension extends the prior research on local governments' sustainability efforts and further offers a more comprehensive understanding about how local governments implement their sustainability programs and the potential they may have to improve environmental conditions within their community. I suggest that local governments' pursuit of different sustainability strategies is closely related to the breadth of environmental issues that these programs address. Drawing from prior literature examining organizations' strategic postures toward implementing voluntary environmental programs (Aragón-Correa, 1998; Basu & Palazzo, 2008; Buysse & Verbeke, 2003; Sharma & Vredenburg, 1998), I suggest local governments may pursue three types of sustainability strategies: reactive, middle group, and proactive strategies.

Local governments that pursue a *reactive strategy* design their sustainability programs across a narrow array of environmental issues (Basu & Palazzo, 2008; Porter & Kramer, 2006; Sharma & Vredenburg, 1998). Local governments that pursue this strategy do not perceive environmental protection as an essential part of their organizational mission (Sharma & Vredenburg, 1998) because they often lack understanding and concern about environmental problems (Basu & Palazzo, 2008). Instead of implementing

sustainability programs for substantial environmental performance outcomes, they tend to promote the sustainability programs that are practically feasible and often appeal to their stakeholders (Yanarella & Levine, 2008), while seeking for short-term environmental benefits (Daley et al., 2013; Yanarella & Levine, 2008). For instance, some local governments implement sustainability programs with emphasis on resource efficiency issues within their organization in an effort to reduce their internal costs (Bae & Feiock, 2013; Daley et al., 2013) rather than improving the environmental conditions in the broader community (Hawkins et al., 2016). Given a lack of a consistent sustainability strategy (Porter & Kramer, 2006; Sharma & Vredenburg, 1998), they are more likely to constrain their programs into recycling or energy saving issues in government buildings for which the short-term benefits are ensured (Bae & Feiock, 2013; Daley et al., 2013; Yanarella & Levine, 2008). By doing so, they could appeal to external pressures for environmental protection (Yanarella & Levine, 2008), while enjoying economic benefits that accrue to their organizations (Daley et al., 2013). The implementation of sustainability programs is therefore typically based on an ad hoc approach (Miles, Snow, Meyer, & Coleman, 1978) that address issues as they arise instead of approaching in a more calculated manner (Sharma & Vredenburg, 1998).

By contrast, a *proactive strategy* involves local governments that design their sustainability programs across a broad array of environmental issues. Local governments pursuing a proactive strategy are likely to be leading actors in the local sustainability movement (Ayre & Callway, 2005) and therefore focus on differentiating themselves (Miles et al., 1978) from other governments. To be a leading actor, these governments focus on more complex and fundamental environmental issues even if doing so comes

with higher costs and efforts (Sharma & Vredenburg, 1998). Moreover, proactive local governments tend to pursue long-term social and environmental benefits (as opposed to short-term wins) that may create competitive advantages to the external community as well as internal long-term efficiency goals (Slater & Mohr, 2006), such as improvements to human health and well-being, social vitality, and resource efficiency (Fiorino, 2010). Such efforts require a sustainability vision and the creation of innovative changes that are often followed by others (Aragón-Correa, 1998; Buysse & Verbeke, 2003; Sharma & Vredenburg, 1998).

Finally, local governments that pursue a *middle group strategy* implement sustainability programs in an effort to avoid being laggards (March, 1991) in local sustainability movement. Their primary interest is to maintain stability (March, 1991) and therefore tend to promote certain level of environmental performance outcomes from their sustainability programs, which makes them seemingly proactive. However, they are less likely to take high risk associated with creating fundamental and innovative changes (Kim & Darnall, 2015; Miles et al., 1978), and therefore their sustainability programs tend to be less comprehensive than those pursuing a proactive strategy. For instance, some local governments tend to balance between potential benefits and costs (Miles et al., 1978) associated with implementing sustainability programs and therefore analytically design their sustainability programs by distributing them across different environmental issues (Aragón-Correa, 1998), but still focusing on certain types of environmental issues that ensure tangible and immediate program benefits (Porter & Kramer, 2006). They also gradually tailor their sustainability programs to changing circumstances (Miles et al., 1978) in a way to reduce uncertainty related to sustainability

program benefits, while achieving incremental, modest changes (Slater & Mohr, 2006). For their interest in reliability of program performance outcomes from implementing sustainability programs, their sustainability efforts could be in between those pursuing a proactive strategy and those pursuing a reactive strategy.

Taken together, local governments implement a variety of sustainability strategies. I posit that their pursuit of one strategy over another is due to differences in stakeholder pressures on one hand (English, 2000 (English, 2000; Krause, 2011) and organizational capacities on the other (Bae & Feiock, 2013; Hood, 2007; Howlett, 2011; Steurer, 2011).

Stakeholder pressures and local sustainability

Stakeholders are defined as “any group or individual who can affect or is affected by the achievement of an organization’s objectives” (Freeman, 2010), p.46). They are the individuals who experience or anticipate experiencing actual or potential harms/benefits that result from an organization’s action or inaction (Donaldson & Preston, 1995). Related to an organization’s sustainability efforts, stakeholders with diverse and often conflicting interests are principal participants in sustainability programs (Daley et al., 2013; English, 2000). These interests create incentives for stakeholders to exert their political influence (K. H. Engel & Orbach, 2008) on local governments to behave in favor of their interests. Stakeholders with different interests and motivations (Daley et al., 2013; Hawkins et al., 2016) are therefore likely to be related to local governments’ pursuit of one sustainability strategy over another. I suggest that industry stakeholders and environmental NGOs are two stakeholder groups that are particularly salient to local governments’ sustainability strategies (Logan & Molotch, 2007; Vogel & Swanson, 1989).

Industry stakeholders are private sector firms that must adhere to current environmental regulations, and tend to emphasize economic growth as their most salient interest (Logan & Molotch, 2007). Industry stakeholders are also major sources of tax revenue, and are drivers of local economic growth (Logan & Molotch, 2007; Portney, 2003) and therefore exert significant influences on local governments' environmental decisions (Bae & Feiock, 2013; Daley & Garand, 2005; Portney, 2003).

Even though local governments' sustainability strategies do not impose the same economic burden on industry stakeholders as traditional environmental regulation (Borck & Coglianese, 2009), these approaches can constrain some firms' profits by increasing the cost of raw materials (Daley & Garand, 2005). In particular, *heavy polluting industry stakeholders* (Mani & Wheeler, 1998) often oppose local government's efforts to increase environmental protection. These stakeholders tend to generate environmental impacts across a variety of areas, from consuming significant quantities of raw materials (e.g. coal, lumber, water) to producing industrial waste (Daley & Garand, 2005). Industry stakeholders are therefore more likely to express concern about local governments' sustainability strategies that address a broad array of environmental issues (Fiorino, 1999). For example, industry stakeholders are often large landholders (Brody, 2003), and since much of the U.S.' critical habitats are located on or near private lands (Yaffee & Wondolleck, 2000), industry stakeholders and especially those in polluting industries are likely to affect environmental issues related to biodiversity, preservation of habitats, or management of natural resources (Brody, 2003; O'Connell & Noss, 1992). Moreover, heavy polluting industry stakeholders are less likely to be supportive of sustainability programs that promote citizen awareness and influence social norms in favor of

environmental protection, as both may increase external scrutiny about the legitimacy of their business operations (Luft Mobus, 2005).

Other industry stakeholders, and especially *new economy industry stakeholders*, are more likely to support environmental protection (Daley et al., 2013; Florida, 2005). New economy industry stakeholders consist of emerging science and technology businesses and particularly those associated with information and communications technologies (Hirsch, 2001; Krueger & Gibbs, 2007). The interests of new economy industry stakeholders differ from the heavy polluting industry stakeholders because the former generates relatively little pollution, and depends on recruiting and retaining workers who are creative, well-educated and mobile (Florida, 2005; Krueger & Gibbs, 2007). Such workers tend to seek communities that offer a better quality of life, including a cleaner environment (Krueger & Gibbs, 2007), and an urban setting that is more environmentally friendly (Florida, 2005). New economy industry stakeholders therefore tend to pressure their local governments to implement a large number of sustainability programs that improve the environmental quality of a broad scope of environmental concerns (Florida, 2005; Krueger & Gibbs, 2007).

In contrast to industry stakeholders, *environmental NGO* stakeholders are organized forms of civil society that operate without profit-seeking objectives and fill the public space between individual citizens and the state (Eikenberry & Kluver, 2004; Lane & Morrison, 2006). They are generally supportive of local governments' efforts to implement sustainability programs (Daley et al., 2013; Sharp et al., 2010) (Zeemering, 2009). Environmental NGOs assist local governments in responding to environmental issues, and educate citizens about the environmental risks in their communities (Lane &

Morrison, 2006). These entities often hold local governments responsible for creating broader public benefits (Young, 2000) associated with a cleaner environment (Daley et al., 2013) and monitor the effectiveness of government policies (Gan, Eskeland, & Kolshus, 2007). As a consequence, they are more likely to encourage local governments to adopt a large number of sustainability programs that address a wide array of environmental issues. Additionally, environmental NGOs work closely with individual citizens and seek to mobilize the broader public in favor of environmental protection (Buffardi, Pekkanen, & Smith, 2015).

Internal organizational capacity and local sustainability

While stakeholder pressures are likely to relate to local governments' sustainability strategies, so too are internal factors. Organizations are often internally motivated and driven by their own interests (Porter & Kramer, 2006), such as reputational benefits (Posner & Weisbach, 2010), internal operational efficiency (Daley et al., 2013), and community well-being (Fiorino, 2010). Their ability to pursue these interests often depends on organization-specific capacities (Barnett, Greve, & Park, 1994; Barney & Hansen, 1994). Two types of capacities that are particularly salient to local governments' decisions to implement one sustainability strategy over another: general administrative capacity and policy-specific capacity (Howlett, 2009a; Terman & Feiock, 2015).

Administrative capacity relates to the financing and staffing of an organization's administration (Collins & Gerber, 2008; Howlett, 2009a; Wang, Hawkins, Lebrede, & Berman, 2012). Since local governments' sustainability strategies are not financed by federal and state governments, managing organizational resources is essential for them to undertake these voluntary efforts (Wang et al., 2012). Local governments that possess the greater administrative capacity are more capable of allocating organizational resources

and facilitating managerial decisions towards implementing (Collins & Gerber, 2008) a more comprehensive sustainability strategy. For instance, implementing a greater number of sustainability programs often comes with a greater financial investment (Wang et al., 2012) and administrative cost (Krause et al., 2016), thereby requiring greater administrative capacity (Wang et al., 2012). Local governments with greater administrative capacities therefore are more capable of implementing a large set of sustainability programs (Feiock & Coutts, 2013) and achieving the organizational vision of sustainability.

By contrast, *policy-specific capacity* is related to government's ability to address substantive policy responsibilities, and requires access to expertise and information and professional staff (Howlett, 2009b). Greater information, knowledge, and technical assistance (Howlett, 2009b) allow local government to address contemporary environmental issues, which have become increasingly more complex (Potoski, 2015) as populations increase and technologies expand. For instance, policy-specific capacity allows local governments to invest in developing databases related to environmental issues within their community, identifying the most effective combination of policy instruments for their given circumstances (Sovacool, 2009), and developing integrative sustainability programs (Bulkeley, 2010; Daley et al., 2013). Local governments that have access to policy-specific capacity are therefore more likely to design a sustainability strategy that emphasizes a large number of substantive programs addressing a broad array of environmental issues.

External stakeholder pressures, internal organizational capacity, and local sustainability strategies

Taken together, in considering the extent to which the external stakeholders and internal organizational capacities influence local governments' sustainability efforts, I use a middle group strategy as a point of comparison.

Compared to local governments that pursue a middle group strategy, local governments that pursue a *reactive strategy* – by designing their programs across a narrow array of environmental issues – are related to greater external pressures from heavy polluting industry stakeholders who typically oppose the environmental protection, and weaker organizational capacity. Heavy polluting industry stakeholders are under significant pressure from state and federal regulators and community residents to reduce their environmental impacts. However, doing so can come at a significant cost, which is why they exert pressures by way of political activities that include lobbying and political campaigns during policy making process (Singleton, 2000). In order to overcome the political resistance from the heavy polluting industry stakeholders (Yanarella & Levine, 2008), and to address social preferences for improved environmental quality, local governments are more likely to constrain their sustainability programs into a few environmental issues, and especially those that involve fewer costs to industrial activities. By doing so, local governments can achieve some environmental objectives without political resistance from heavy polluting industry stakeholders (Yanarella & Levine, 2008). Even if heavy polluting industry stakeholders do not engage in active political protest, by virtue of their greater physical presence within their community, heavy polluting industry stakeholders may pressure local governments to focus on specific environmental issues that impose fewer costs them, rather pressuring local governments

to adopt sustainability strategies that lead to fundamental changes in environmental quality.

Related to internal organizational capacities, local governments that lack administrative capacities are more likely to have constrained budgets and staffs for undertaking large investment for initiating sustainability programs that are not their traditional public services (Wang et al., 2012). These organizations often emphasize organizational efficiency rather than broader interests in community in implementing sustainability programs (Daley et al., 2013; Yanarella & Levine, 2008). Moreover, with lack of policy specific capacities, local governments are less likely to have greater information and understanding about complex environmental issues, thereby resorting to the sustainability programs that are constrained to a narrow array of environmental issues and focus on serving to organizational benefits, such as energy savings in government (Daley et al., 2013; Yanarella & Levine, 2008). Therefore, under greater pressures from heavy polluting industry stakeholders coupled with lack of organizational capacity, local governments are more likely to pursue a reactive sustainability strategy by constraining their programs into a few environmental issues.

Hypothesis 1) Compared to local governments that pursue a middle group strategy, local governments with greater pressures from heavy polluting industry stakeholders and weaker organizational capacities are more likely to pursue a reactive sustainability strategy.

By contrast, compared to those pursuing a middle group strategy, local governments that pursue a proactive strategy have greater pressures from stakeholders who support their environmental efforts and greater organizational capacity. Pursuing a proactive strategy often requires greater organizational commitment (Sharma, 2000) due to greater political conflicts, administrative cost, and uncertain benefits associated with

implementing a large set of programs that are broad in scope. New economy industry and environmental NGOs promote a better quality of life in their community and therefore motivate local governments to undertake a more serious sustainability strategy by providing financial and technical assistance (Florida, 2005), increasing public awareness of environmental protection (Lane & Morrison, 2006), and engaging in political campaigns or lobbying (Daley et al., 2013). The presence of strong pressures from the supportive stakeholders legitimates local governments' fiscal and administrative investment for their sustainability programs (Wang et al., 2012) and further preempts political resistances from other stakeholders who oppose the environmental protection effort (Kim & Darnall, 2015).

In addition to the external pressures, greater policy-specific capacity enables local governments to develop, manage, and coordinate their complex issues in a way that spans multiple environmental issues (Hawkins et al., 2016), while greater administrative capacity allows local governments to finance and staff the well designed sustainability programs (Hawkins et al., 2016). More specifically, because of their policy-specific capacities, these governments have greater information, knowledge and understanding about complicated environmental issues (Howlett, 2009b), and therefore have the capacity to address a broader array of environmental issues than reactive local governments. Therefore, local governments that have greater pressures from new economy and environmental NGO stakeholders, in addition to stronger internal organizational capacities, are more likely to pursue a proactive sustainability strategy by designing their programs in a more comprehensive manner.

Hypothesis 2) Compared to local governments that pursue a middle group strategy, local governments with greater stakeholder pressures from new economy

industry and environmental NGO stakeholders, and organizational capacities, are more likely to adopt a proactive sustainability strategy.

Methodology

Data

To examine how stakeholders and organizational capacity relates to local governments' decisions to pursue different sustainability strategies, I rely on the data from the International City/County Management Association (ICMA)'s 2010 Local Government Sustainability Programs Survey. Developed by ICMA's Center for Sustainable Communities, with input from other research institutes (Svara, 2011), the survey questioned sustainability managers within U.S. local governments regarding the adoption of 119 different sustainability programs.

The survey was mailed to sustainability managers of total 8,569 local governments including county and municipal governments that had at least 2,500 populations. Local governments that did not respond to the first survey received a follow-up reminder. A total 2,176 (25.39%) local governments (1,874 municipalities and 302 counties) responded (Svara, 2011) to the survey.

These data were combined with data from the U.S. Census and the National Center for Charitable Statistics (NCCS) to form explanatory and control variables (discussed below). After the data merge, a total of 1,146 local governments remained in the sample. Among these local governments, I selected 312 local governments to form dependent variable, which categorizes local governments into four types of sustainability strategies. The process through which I selected 312 local governments is discussed in the following section.

Measures

Dependent variable

To measure the dependent variable, three sustainability strategies were developed: reactive, middle group, and proactive strategies. To create this categorical variable, I consider how broad environmental issues were addressed by local governments in their sustainability programs.

To assess the breadth of environmental issues, I relied on data from ICMA's survey, which provided sustainability managers with a list of 119 sustainability programs. For each of these programs, respondents were asked to indicate which actions their local government had taken. Respondents reported 'Yes' (1) or 'No' (0) for each sustainability program. To measure the breadth of local governments' environmental issues, the ICMA survey categorized the 119 sustainability programs into eight aggregate environmental impacts (air, water, recycling, energy conservation, buildings, land use, transportation, and social inclusion), which I disaggregated based on their specific goals and target populations. For example, energy conservation programs were disaggregated based on their pollution source as sustainability programs that address more pollution sources have greater breadth (Daley et al., 2013). This step led to the generation of five types of energy items (energy in government, energy in residential homes, energy in business, energy in outdoor lights/vehicles, and alternative energy generation) and three types of transportation (public transportation, reduced commute trips, and alternative modes of vehicles). After disaggregation, 14 environmental issues were considered: air, water, recycling, energy in government, energy in residential homes, energy in business, energy in outdoor lights/vehicles, alternative energy generation, public transportation, reduced

commute trips, alternative modes of vehicles, green building/construction, sustainable land use, and social inclusion.

In finalizing the measure for breadth of environmental issues, I utilized Shannon's H entropy score (Jacquemin & Berry, 1979). Shannon's H entropy score is one of the most widely used measures for breadth or diversity of items because it is sensitive to high levels of scope and therefore leads to wider variation than other types of breadth measures (e.g. Herphindal HirschmanIndex) (Halpin & Thomas III, 2012).

Shannon's H entropy score takes the following form:

$$E_E = \sum_{j=1}^m P_j * \ln(1/P_j)$$

where P_j is a proportion of sustainability programs addressing j th environmental issue in total adopted sustainable programs, *the logarithm of $1/P_j$* is a weight of each proportion and m is the number of total available environmental issues, which is in this case 14.

Local governments whose sustainability programs address a greater breadth of environmental issues therefore receive a higher the entropy score (E_E).

Local governments' sustainability strategies were characterized based on the breadth of environmental issues: reactive, middle group, or proactive. Since this dimension is delimited along a continuum, I focus on local governments that, on average, have greater variability in their sustainability strategies. In other words, I focus on the extreme groups of local governments with sustainability programs that are either extremely high or low in terms of the breadth of environmental issues, as shown in Figure 3.1. A low breadth of environmental issues was defined as local governments that were in the bottom 25% (lower than 25 percentile) with respect to their entropy score, whereas a high breadth of

environmental issues was defined as local governments that were in the top 25% (greater than 75 percentile) with respect to their entropy score. As a sensitivity check, I also created low and high groups by categorizing local governments that were one standard deviation away from the mean. I also varied the percentiles to 20%/80%, rather than 25%/75%. In both instances, the results are consistent, although I lose observations.

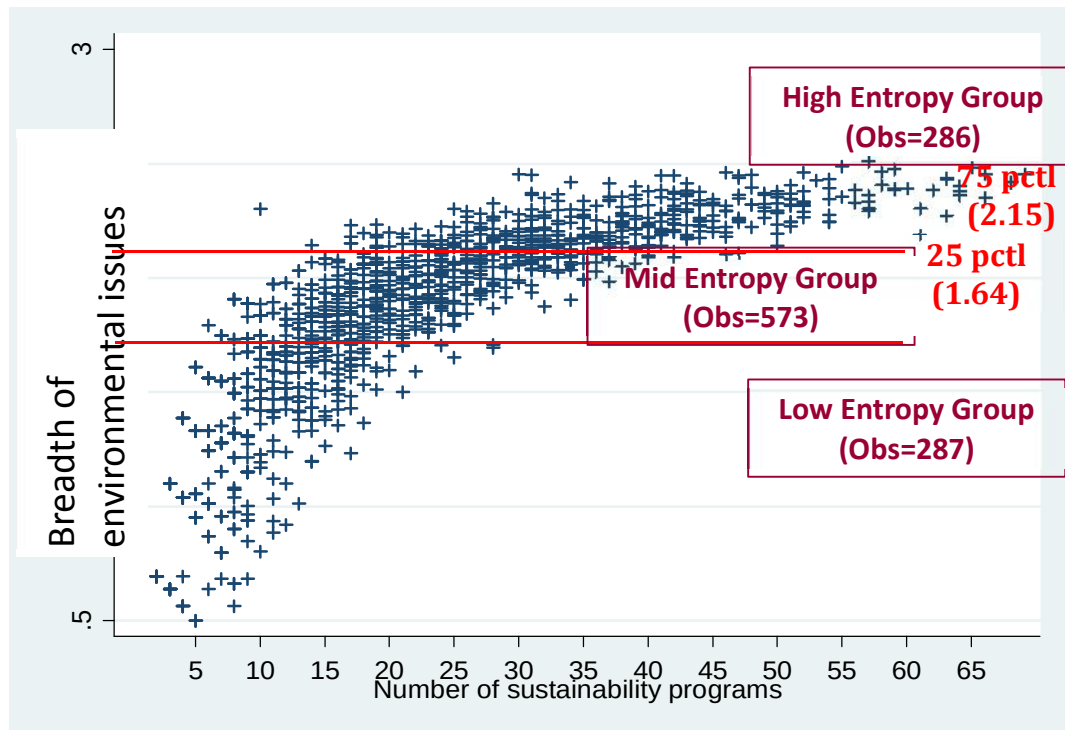


Figure 3.1

Three types of sustainability strategies

Local governments pursuing a *reactive sustainability strategy* were coded as having a low entropy score. A *proactive sustainability strategy* was coded as local governments having a high entropy score. Finally, local governments pursuing a *middle group strategy* were coded as local governments of which entropy scores are in the middle range. Table

3.1 shows the sample size and descriptive statistics for each category of my dependent variable.

Table 3.1

Descriptive statistics for attributes of local sustainability strategies

	Frequency (%)		Number of sustainability programs				Breadth of environmental issues			
			Mean	(S.D.)	Min	Max	Mean	(S.D.)	Min	Max
Reactive (Low-Entropy)	287	(25.04%)	8.63	(4.51)	1	22	1.15	(0.47)	0.00	1.63
Middle group (Mid-Entropy)	573	(50.00%)	20.96	(7.49)	6	50	1.92	(0.15)	1.64	2.15
Proactive (High-Entropy)	286	(24.96%)	40.24	(11.90)	10	76	2.27	(0.09)	2.15	2.51
Total	1146	(100.00%)	24.04	(20.76)	0	76	1.67	(0.77)	0.00	2.51

Explanatory Variables

Industry stakeholder pressures were measured by the number of employees since the employment size of an industrial sector often indicates the capacity of that industry to influence urban environmental politics (Bowen, 2002). I distinguished polluting industry stakeholders by using NAICS industry codes and 2007 Economic Census data to determine the total number of employees in each industry for each locality. Since manufacturing industries have been commonly employed as proxy for polluting industries (Bae & Feiock, 2013; Daley et al., 2013; Portney, 2003), I measured the heavy polluting industry stakeholder pressures by the total number of employees in the manufacturing industry within the locality divided by total population of the locality. Similarly, new economy industry stakeholders were measured by the total number of employees in information technology (IT) industry divided by total population.

I measured local environmental NGO stakeholder pressure (Daley et al., 2013) by relying on data from the National Center for Charitable Statistics (NCCS) to determine the number of environmental NGOs in a locality. Even though the size of each stakeholder group is not a perfect measure for each group's actual pressure on local governments, larger stakeholder groups often come with stronger power and capacity (Eesley & Lenox, 2006) and therefore are more likely to influence local governments in favor of their particular concerns.

Since greater fiscal capacity increases local governments' autonomy to finance their sustainability programs (Wang et al., 2012), local governments' general administrative capacity was measured by the degree to which local governments acquire revenues from their own sources such as taxes, public service fees and charges rather than intergovernmental aids (Ji, Ahn, & Chapman, 2015; Wang et al., 2012). These data were obtained from the US Census Bureau's 2006 Government Finance data that includes information about each local government's revenues and expenditures from different sources. I calculated fiscal independence by subtracting intergovernmental revenues from general revenues and then dividing the remaining revenue by general revenues of a locality.

General administrative capacity was also accounted by whether local government had professional leadership delivered by an appointed executive (Svara, 2011).⁷ An appointed executive is put into place by local council members and is relatively insulated from

⁷ Local governments have different types of leaders according to their government forms, either the appointed executive (e.g. the commission-administrator form for counties or the council-manager form for cities) or the elected executive (e.g. the commission-elected executive form for counties or the mayor-council form for cities) (Feiock, 2004; Nelson & Svara, 2011; Svara, 2010).

urban politics (Nelson & Svara, 2012; Sharp et al., 2010). As such, this individual possesses greater capacity to execute administrative tasks, from financing to staffing, compared to the elected executive who plays more political leadership. To measure professional leadership in local governments, I relied on an ICMA survey item that asked about whether the local government had a council-manager form for municipalities and council administrator form for counties (coded 1, otherwise 0).

Local governments' policy-specific capacities, was first measured by their membership with external networks (Bulkeley, 2010) since such membership often provides local governments with information, technical and financial assistance for their sustainability efforts (Bulkeley, 2010). I drew on survey data obtained from ICMA that asked whether local governments were members of the International Council for Local Environmental Initiatives (coded 1, otherwise 0), one of the most influential networks that assist local governments' sustainability initiatives, especially with responding to climate change (Betsill & Bulkeley, 2006; Bulkeley, 2010).

A second measure of local governments' policy-specific capacities related their number of public employees focused on environmental concerns. Compared to other public employees, these individuals have greater access to local knowledge and information about environmental issues and therefore have greater expertise in handling environmental problems (Daily & Huang, 2001). They often identify environmental issues within their locality (Baker, Peterson, Brown, & McAlpine, 2012; Sarkis, Gonzalez-Torre, & Adenso-Diaz, 2010) and have responsibility for resolving them. Data from the 2006 US Census Bureau Local Government Employment and Payroll were used to determine the number of local government employees working in areas of natural

resources, park and recreations, public welfare, health, solid waste management, and public utilities (cities only). This number was divided by the total population in the locality.

Control Variables

Local governments' choice of sustainability strategies is not accounted for solely by external political influences and internal organizational capacities. Since income and race are often associated with a community's interest in environmental concerns (Edwards & Darnall, 2010), I account for each locality's income and proportion of Caucasian residents using the 2007 American Community Survey from U.S. Census Bureau.

Political orientation of the state in which the local government is located can significantly influence local governments and their environmental priorities (Saha & Paterson, 2008) in that Democrats typically support a pro-environmental political agenda. As such, I rely on data from the U.S. Federal Election Commission to determine the average percentage of the popular vote for the Democratic party candidates in the 2004 and 2008 elections. Local governments that are located in the state for which average percentages in these both elections are greater than 50% were coded 1, otherwise 0.

Local governments located in different regions may face different geographical patterns and environmental problems (Svara, 2011; Zahran, Grover, Brody, & Vedlitz, 2008). To control for regional characteristics, using ICMA data, I include a set of dummy variables accounting for Western, North Central, North East, and Southern regions. Each dummy variable was coded 1 for each region, and 0 otherwise. The North East region is the reference group dummy.

Municipal governments differ from county governments in the types of public services they provide, revenue and expenditure structures, and the relationship with state governments (Ji et al., 2015), which may influence their sustainability programs. Using data from the ICMA survey, I control for the type of local government, municipal governments coded 1, county government coded 0.

Finally, the size of the locality may influence local governments' sustainability strategies because larger localities have more complicated environmental problems and often are more capable or resourceful when implementing their sustainability programs (Bae & Feiock, 2013). Using data from the US Census American Community Survey, this variable was measured by the locality's population divided by its geographical size (Bae & Feiock, 2013).

Table 3.2 reports descriptive statistics and correlations for the variables included in my analysis.

Empirical Model

To empirically examine my research hypotheses, I relied on multinomial logistic regression analysis. This technique is especially suitable for the purposes given my four category dependent variable. Multinomial logistic regression examines jointly all categories of the explanatory variable, and uses one of the categories as reference to allow for comparisons among responses observed in the dependent variable. A *middle group strategy* was a reference category. I report coefficients for each of the variables and marginal effects of variables that appear statistically significant for easier interpretability of my results. To examine the robustness of my empirical results, I also conducted Ordinary Least Square (OLS) regressions for the breadth of environmental

issues and number of sustainability programs. However, a primary interest of this paper is why some local governments choose to design their sustainability programs more or less broadly than others. Compared to the linear relationships from the OLS regression results, analyzing local governments' sustainability efforts by groups may provide more insightful information to differentiating local sustainability leaders or laggards from those doing moderately. For this reason, I placed greater emphasis on multinomial logit regression results.

Table 3.2

Descriptive Statistics and Correlations

	1)	2)	3)	4)	5)	6)	7)	8)	9)	10)	11)	12)	13)	14)	15)
1) Heavy polluting industries	1.00														
2) New economy industries	-0.11	1.00													
3) Num of NGOs	-0.18	0.11	1.00												
4) ICLEI Membership	-0.20	0.19	0.31	1.00											
5) Public employee capacity	-0.06	0.05	0.49	0.11	1.00										
6) Fiscal independence	-0.07	0.21	-0.07	0.09	-0.04	1.00									
7) Professional leadership	-0.14	0.07	0.04	0.10	-0.04	0.15	1.00								
8) Median income	-0.14	0.34	0.06	0.18	0.02	0.21	0.10	1.00							
9) White American race	0.23	0.05	-0.14	-0.18	-0.10	-0.10	-0.12	0.06	1.00						
10) Democrats	0.07	0.08	0.04	0.09	0.02	-0.11	0.08	0.17	0.15	1.00					
11) Western region	-0.28	0.08	0.09	0.21	-0.02	0.06	0.16	0.13	-0.24	0.20	1.00				
12) North central region	0.47	-0.02	-0.17	-0.17	-0.06	-0.10	-0.19	-0.03	0.44	0.20	-0.44	1.00			
13) Southern region	-0.18	-0.09	0.04	-0.05	0.02	0.08	0.08	-0.11	-0.29	-0.50	-0.41	-0.48	1.00		
14) Local government type	-0.01	0.05	-0.36	0.03	-0.06	0.35	-0.05	0.04	-0.07	0.00	0.05	0.06	-0.09	1.00	
15) Density	-0.09	0.20	0.10	0.21	0.34	0.17	0.02	0.15	-0.24	0.14	0.12	-0.05	-0.15	0.37	1
Mean	0.05	0.01	10.39	0.20	0.002	0.81	0.69	69558	0.70	0.69	0.31	0.31	0.28	0.78	2194
Standard deviation	0.03	0.01	19.47	0.40	0.002	0.17	0.46	29295	0.21	0.46	0.46	0.46	0.45	0.41	2181
Min	0.00	0.00	0.00	0.00	0.00	0.21	0.00	30731	0.03	0.00	0.00	0.00	0.00	0.00	2.40
Max	0.19	0.07	133	1.00	0.004	1.00	1.00	267332	0.99	1.00	1.00	1.00	1.00	1.00	17109

Note: Correlations > |.09| are statistically significant at $p < .05$

Results

The multinomial logistic regression results are reported in Table 3.3. The findings show that the regression model was statistically significant at $p < 0.001$, as noted by the log likelihood statistic. Additionally, the McFadden R-square for the model was 15.1%, indicating the model had reasonable good fit.

Our results indicate that compared to local governments that pursue a middle group strategy, external pressures from different stakeholder groups and internal organizational capacities were associated with local governments' pursuit of certain types of sustainability strategies. More specifically, greater pressures from heavy polluting industry stakeholders were associated with an increased probability that local governments pursue a reactive strategy over a middle group strategy ($p < 0.10$). By contrast, less pressures from new economy industry ($p < 0.05$) and environmental NGO stakeholders ($p < 0.05$) were associated with an increased probability that local governments pursue a reactive strategy over a middle group strategy. In addition, less public employees working for environmental issues (e.g. park and recreation, utilities, health, etc.) ($p < 0.01$) were also associated with an increased probability that local governments pursue a reactive sustainability strategy over a middle group strategy. These findings provide evidence in support of Hypothesis 1, stating that *compared to local governments that pursue a middle group strategy, local governments with greater stakeholder pressures from heavy polluting industry stakeholders and weaker organizational capacities are more likely to adopt a reactive sustainability strategy.*

By contrast, greater pressures from new economy industry stakeholders ($p < 0.10$) were associated with an increased probability that local governments pursue a proactive sustainability strategy over a middle group strategy. Moreover, local governments' both

policy specific capacities, a membership with the external network, ICLEI ($p < 0.01$) and more public employees ($p < 0.05$), were strongly associated with an increased probability that local governments pursue a proactive sustainability strategy over a middle group strategy. Stronger administrative capacities measured by higher fiscal independence in local governments ($p < 0.01$) and a professional leadership within the appointed executive government form ($p < 0.05$) were also strongly associated with their pursuit of a proactive strategy. These findings offer robust evidence for Hypothesis 2, which states that *compared to local governments that pursue a middle group strategy, local governments with greater stakeholder pressures from new economy industry and environmental NGO stakeholders, and greater organizational capacities, are more likely to adopt a proactive sustainability strategy*

Table 3.3

Multinomial logistic regressions predicting each type of local sustainability strategy

	Low-Entropy Group			Mid-Entropy	High-Entropy Group		
	RRR	(S.E.)	Marg. Effect (S.E.)	(Base)	RRR	(S.E.)	Marg. Effect (S.E.)
Stakeholder Type							
Heavy polluting industries	1.05*	(0.00)	0.001(.000)		1.00	(0.00)	
New economy industries	0.97**	(0.01)	-0.005(.002)		1.02*	(0.01)	0.020 (0.011)
Env't NGOs	0.96**	(0.02)	-0.006(.003)		1.01	(0.01)	
Organizational Capacity							
ICLEI membership	0.57	(0.25)			3.15***	(0.66)	1.146(0.211)
Public employee capacity	0.92***	(0.02)	-0.133(0.003)		1.02**	(0.01)	0.015(0.006)
Fiscal capacity	0.49	(0.26)			3.16***	(1.81)	1.149(0.574)
Professional leadership	0.78	(0.14)			1.59**	(0.32)	0.463(0.199)
Control Variables							
Household income	1.00	(0.00)			1.00**	(0.00)	-7.2e-06(2.8e-06)
White American race	1.01	(0.01)			1.00	(0.00)	
Democratic State	0.71	(0.15)			1.65**	(0.32)	0.497(0.196)
Western area	0.46**	(0.16)	-0.163 (0.048)		4.05***	(1.54)	1.398(0.380)
North Central area	0.47**	(0.15)	-0.131(0. 043)		1.84	(0.71)	
Southern area	0.70	(0.25)			2.31**	(0.94)	0.837(0.406)
Municipal government	0.36***	(0.11)	-0.143(0.042)		0.85	(0.24)	
Density	1.00	(0.00)			1.00	(0.00)	
Cons	4.42**	(3.26)			0.04***	(0.03)	
N	1,146						
Likelihood ratio chi2	358.67***	(0.00)					
R2 McFadden	0.151						

***p<0.01, **p<0.05, *p<0.10.

Related to control variables, local governments located in the Western or North Central regions (compared to those located in the North East region) ($p < 0.05$) and in the government type of municipality (compared to county governments) ($p < 0.01$) were less likely to pursue a reactive sustainability strategy over a middle group strategy. By contrast, local governments with higher level of median household income and Democratic political influences from the state were positively associated with probability of local governments pursuing a proactive strategy ($p < 0.05$). Moreover, local governments located in the Western ($p < 0.01$) or Southern regions ($p < 0.05$) were more likely to pursue a proactive sustainability strategy compared to local governments located in the North East region.

As an additional robustness check, I ran OLS regression on each dimension of sustainability strategies, the breadth of environmental issues and number of sustainability programs. The results are reported in Table 3.4.

F-statistics for all models were significant at $p < 0.01$, indicating that the null effect of the independent variables could be rejected. The significance of the coefficients indicates that the factors related with the breadth of environmental issues are similar to the results in the multinomial logit regression. The results indicate that while external pressure from the heavy polluting industry was negatively associated with the breadth of environmental issues, whereas external pressures from new economy industry and environmental NGOs were positively associated with the design feature. Related to organizational capacities, both policy specific and administrative capacities were positively associated with the greater breadth of environmental issues that local governments address in their sustainability programs. It is interesting to note that while the negative influence of the

heavy polluting industry was statistically significant for the breadth of environmental issues ($p < 0.05$), it has no more influence on the number of programs. Overall, these findings offer evidence additional about the robustness of the relationships. However, as discussed above, the OLS regression results provide little information about why some local governments show greater variability in the design feature of their sustainability programs than, on average, other governments as all the factors appear as significant to the design feature. For this reason, I put more emphasis on the multinomial logit regression results explaining why some local governments choose to design their sustainability programs in a way of either extremely high or low in terms of the breadth of environmental issues.

Table 3.4

OLS regressions predicting the Breadth of Environmental Issues and Number of Programs

	The breadth of environmental issues (OLS)		Number of programs (OLS)	
	<i>Coeff</i>	(S.E.)	<i>Coeff</i>	(S.E.)
<i>Stakeholder Type</i>				
Heavy polluting industries	-0.003**	(0.00)	-0.001	(0.00)
New economy				
Industries	0.018***	(0.00)	0.011***	(0.00)
Envnt NGOs	0.017***	(0.00)	0.009***	(0.00)
<i>Organizational Capacity</i>				
ICLEI membership	0.680***	(0.10)	0.328***	(0.05)
Public employee capacity	0.001***	(0.00)	0.000*	(0.00)
Fiscal capacity	0.468*	(0.26)	0.292*	(0.16)
Professional leadership	0.320***	(0.09)	0.222***	(0.05)
<i>Control Variables</i>				
Household income	0.000	(0.00)	0.000	(0.00)
White American race	-0.007***	(0.00)	-0.004***	(0.00)
Democratic State	0.446***	(0.09)	0.248***	(0.05)
Western area	0.828***	(0.19)	0.394***	(0.10)
North Central area	0.600**	(0.18)	0.240**	(0.09)
Southern area	0.675***	(0.19)	0.301***	(0.10)
Municipal government	0.131	(0.13)	0.037	(0.08)
Density	0.000	(0.00)	0.000	(0.00)
Cons	2.338***	(0.36)	2.131***	(0.21)
N	1146		1146	
F statistic or Wald chi2	20.22	(0.000)	32.97	(0.000)
Pseudo R2	0.241		0.240	

***p<0.01, **p<0.05, *p<0.10.

Discussion and conclusion

A significant number of local governments worldwide have developed strategies that incorporate sustainability principles into their urban management and policies (Fiorino, 2010). However, despite the increasing prevalence of these strategies, their design variations have not been considered, even though different types of sustainability strategies are likely to lead to different environmental performance outcomes (Sharma, 2000). This paper responds to these concerns and examines the factors associated with local governments' pursuit of different types of sustainability strategies. Findings suggest that local governments' pursuit of different types of sustainability strategy is associated with different pressures from external stakeholders and variations in internal organizational capacity. I offer at least two contributions to scholarship.

First, I offer important perspective on why local governments develop sustainability strategies. I suggest that local governments assess their external and internal settings to frame the decision of which type of sustainability strategy makes most sense for them: reactive, middle group, and proactive. Doing so takes a significant step beyond assessing local sustainability programs monolithically (Hawkins et al., 2016; Portney, 2003; Swann, 2016), and responds to growing concerns that more nuanced examinations are needed to understand variations in local governments' sustainability programs and how these variations affect environmental performance outcomes (Berry & Portney, 2013; Feiock & Coutts, 2013).

Second findings are relevant to public managers and policy makers. My findings imply that local governments tend to be reactive in implementing their sustainability programs when they are subject to greater external pressures in conjunction with weaker organizational capacities. More specifically, local governments tend to pursue a reactive

sustainability strategy when they are under greater pressure from heavy polluting industry stakeholders, along with less pressure from new economy industry and environmental NGO stakeholders and less public employees working who have information and knowledge about community's environmental issues. On the other hand, developing a proactive sustainability strategy is more likely to rely on organizational capacities in that their pursuit of the proactive sustainability strategy is strongly associated with all administrative and policy-specific capacities, while external pressures from new economy industry stakeholders were relatively weakly influential on their pursuit of a proactive strategy. These findings imply that to move toward sustainability, local governments may need to enhance local governments' internal capacity, in particular policy specific capacity, while also balancing stakeholders' interests (Bryson, Cunningham, & Lokkesmoe, 2002; Nutt & Backoff, 1993). One possible strategy may be establishing collaborative partnerships with organizations in other sectors, in particular new economy businesses and environmental NGOs, to enhance their resources and internal competencies, thereby creating knowledge and information (Lin & Darnall, 2015; Selsky & Parker, 2005) for designing and implementing sustainability programs. The collaborative partnerships may also benefit local governments by enabling them to more effectively respond to external pressures from various stakeholders and therefore improve the social legitimacy while addressing complex environmental issues that might not otherwise get addressed (Lin & Darnall, 2015; Selsky & Parker, 2005).

Despite these contributions, this study also has some limitations. First, this study characterizes sustainability strategies based on a design feature (the breadth of environmental issues). However, there might be other salient design features to consider,

such as the diversity of policy instruments, stringency of environmental standards, and monitoring/enforcement mechanisms. Examining these sorts of design features would offer a richer explanation about variations in local governments' sustainability programs. My hope is that the results of analysis serves as a basis for undertaking future research in this area as there is still much to learn about how the design of local governments' sustainability strategies.

Second, while I characterize local governments' sustainability strategies, I do not examine how each sustainability strategy relates to actual environmental performance outcomes. For instance, reactive and middle group strategies may lead to a similar environmental performance outcome even though middle group sustainability strategies have greater variation in their breadth of environmental issues. Moreover, middle group sustainability strategies may lead to similar environmental performance outcomes as proactive strategies. Prospective research could extend this study by examining how local governments that pursue different sustainability strategies relate to environmental performance outcomes. Doing so would take a much needed step toward understanding of local governments' sustainability strategies.

Chapter 4

HOW DO DIFFERENT TYPES OF LOCAL GOVERNMENTS' SUSTAINABILITY PROGRAMS RELATE TO THEIR ENVIRONMENTAL OUTCOME?

For decades, local governments worldwide have developed a suite of sustainability programs designed to induce individuals and organizations to collectively improve the environmental conditions within their jurisdictions (Betsill & Bulkeley, 2006; Lutsey & Sperling, 2008). However, as their prevalence has increased, so too have questions about their policy efficacy (Posner and Weisbach, 2010; (Posner & Weisbach, 2010; Wiener, 2007). Critics suggest that local governments face collective action problems in which they can enjoy the benefits of appearing to address environmental issues (Wiener, 2007) without necessarily investing the effort to improve the environment (Posner & Weisbach, 2010). These more symbolic sustainability strategies are often developed in reaction to external stakeholder pressures (K. Engel, 2006), and offer evidence that the decentralized collective approach to environmental protection lacks merit (Posner & Weisbach, 2010).

Despite these suggestions, as yet, there has been little empirical understanding of environmental impact of local governments' sustainability programs (Outka & Feiock, 2011; Sharp et al., 2010). Moreover, existing literature has not considered how program impact is related to the way in which these programs are constructed in that some local governments are more likely than others to design their programs in a more comprehensive manner by addressing a broad array of environmental issues (Sharp et al., 2010) using a diverse set of policy instruments (Bae & Feiock, 2013; Daley et al., 2013;

Hawkins et al., 2016; Swann, 2016). These variations are likely related to differences in programs' environmental performance outcomes (Darnall & Kim, 2012).

This paper addresses these issues by considering how the design of 102 county governments' individual sustainability programs relates to their improvement of local environmental outcomes. After controlling for the spillover effects related to the environmental quality of neighboring counties, my findings offer the evidence that, indeed, local governments' sustainability programs are related with improved environmental conditions. More specifically, local governments that design their sustainability programs more comprehensively are likely to improve their environmental quality to a greater extent than local governments whose programs are designed less comprehensively. These findings are significant because they represent one of the first empirical studies investigating the environmental impact of local governments' sustainability programs, and offer promise for the decentralized approach towards environmental protection. This issue is particularly important given the lack of strong national and international environmental regulatory regimes. While local governments are often regarded as being in an ideal position to change individual and organizational behavior (Ayre & Callway, 2005; Betsill & Bulkeley, 2006) because of their authority to address local concerns, and their ability to mobilize public support for local issues (UN, 1992), as yet, evidence of the efficacy of local governments' sustainability programs has been limited. My findings suggest that local governments appear to lead to desirable environmental outcomes through their sustainability programs, and especially those that are designed more comprehensively.

A second contribution of this research is that it expands the discussion of how program design relates to improved environmental performance outcomes, and is a much needed step towards pushing local sustainability movement forward. While local governments heavily depend on non-regulatory policy instruments in implementing sustainability programs (Fiorino, 1999), prior research has paid relatively little attention to how these programs are designed and how design is related to program efficacy (Daley et al., 2013). This research shows that more comprehensively designed programs are associated with the greater environmental performance outcomes. Findings on the relationship between the comprehensive design of sustainability programs and local air quality improvement will contribute to scholarship as well as practitioners as they will advance the policy debate toward a more productive discussion on how to design local sustainability programs for better environmental performance outcomes.

Local governments' sustainability programs

As environmental concerns have shifted from point source pollution generated from industrial activity to the non-point source pollution that is more diffuse and thus more difficult to resolve with typical regulations (Fiorino, 1999; Stewart & Wiener, 1992), local governments worldwide have voluntarily adopted a suite of decentralized sustainability programs (Daley et al., 2013; Feiock & Coutts, 2013). These programs usually include incentive- and information-based environmental programs that are designed to encourage more sustainable behavior from individuals and businesses (Mckenzie-Mohr, 2000). They are often more cost-effective than centralized regulatory policies because local governments can have greater flexibility to tailor their programs to the environmental preferences of their community (Stewart, 1993).

Despite their policy potential, many scholars have questioned the efficacy of local governments' sustainability programs (Posner & Weisbach, 2010; Wiener, 2007). These critics suggest that local governments tend to implement sustainability programs in reaction to external stakeholder pressures for environmental protection (K. Engel, 2006) rather than out of a genuine interest to improve environmental quality (Krause, 2011). In yielding to external stakeholder pressures, local governments develop ad-hoc programs (Krause, 2011; Posner & Weisbach, 2010), that seek to minimize the cost of doing business within their jurisdictions (Posner & Weisbach, 2010), rather than constructing a well-planned sustainability strategy. For these reasons, critics suggest that local governments' sustainability programs tend to be more symbolic than substantive (Wiener, 2007)

Other scholars point out that global environmental problems can be addressed by local governments (Krause, 2011; Lee & Koski, 2012)) by focusing on changing individual and organizational behavior (Betsill & Bulkeley, 2006; Feiock & Coutts, 2013). These supporters suggest that local-level engagement is key to long-term progress (Dietz, Gardner, Gilligan, Stern, & Vandenberg, 2009) because it can simultaneously improve environmental quality and facilitate economic and societal transformation (Outka & Feiock, 2011). Given local government's proximity to both businesses and citizens, it has a better understanding of local conditions and can design programs that are better suited to influence behavior that leads to long term environmental change (Dietz, Ostrom, & Stern, 2003; Kuh, 2008). However, the key leverage point to the success of these programs may be program design.

Environmental Performance of Local Governments' Sustainability Programs

Local public managers consider a variety of design features (Bae & Feiock, 2013; Daley et al., 2013) when implementing their sustainability programs. One important design feature is how comprehensively sustainability programs are designed (Daley et al., 2013; Krause, 2011; Portney, 2003; Swann, 2016), and policy researchers have suggested that sustainability programs that are design more comprehensively are likely to lead to greater policy outcomes (Darnall & Kim, 2012). However, despite recognition of the comprehensiveness as a salient design features for local sustainability programs, researchers know little about its implications in the context of sustainability program design. Rather, prior studies examining comprehensiveness of sustainability programs have typically focused on a summed count of programs (Berry & Portney, 2013; Hawkins et al., 2016; Krause, 2011; Portney, 2003; Svara, 2011). However, comprehensiveness of sustainability program has multiple dimensions, in particular across scope of policy issues and the mix of various policy instruments. For instance, some local governments may adopt sustainability programs that address a wide number of environmental issues from waste to land use, whereas others assign the same number of sustainability programs into a limited number of environmental issues. In other instances, local governments may adopt sustainability programs that utilize a limited number of policy instruments, whereas others may adopt the same number of sustainability programs, but utilize a broader selection of policy instruments. Considering variations in comprehensiveness of sustainability programs therefore may affect policy outcomes. However, prior studies have not considered these design issues.

This paper will add up new dimensions of comprehensive sustainability programs and discuss how these dimensions could be understood for designing sustainability programs in local governments. To be specific, I focus on three dimensions to define comprehensiveness of sustainability programs: number, breadth of policy domains and breadth of policy instrument types. Although each aspect commonly characterizes comprehensiveness of a local government's sustainability programs, each stresses somewhat different program aspects—namely, the quantity and the content aspects (Schaffrin, Sewerin, & Seubert, 2015) of their sustainability programs.

The number of sustainability programs is a density or quantity aspect (Schaffrin et al., 2015), reflecting the degree of organizational intervention or penetration (Knill, Schulze, & Tosun, 2012) in addressing sustainability issues. As the implementation of local government's sustainability programs is neither mandated nor financed by the federal or state governments, local governments decide how many programs to implement (Krause, 2011; Svara, 2011). Some local governments do not implement any actual sustainability programs (Krause, 2011), whereas others implement a large set of substantive programs (Wang et al., 2012). Implementing these programs requires investments of staff time related to internal coordination, engagement of critical stakeholders, and implementation. In other instances, these programs might require physical investments of resources related to infrastructure and public outreach (Wang et al., 2012). Because of these investments, local governments that adopt a large set of sustainability programs tend to be more serious about sustainability issues (Portney, 2003). These governments are therefore more likely to improve the environmental conditions within their community than local governments that implement only a few programs (Portney, 2003; Svara, 2011).

The breadth of environmental issues that local governments address in their sustainability programs represents content aspects (Schaffrin et al., 2015) of their sustainability programs. Comprehensive sustainability programs integrate a variety of environmental issues into their sustainability programs, and establish multiple pathways to address all the related environmental issues (Lafferty & Hovden, 2003). Such an integrated approach often requires not only inter-organizational coordination across multiple departments within a government (Krause et al., 2016), (Zeemering, 2009), but also inter-sectoral coordination across community members, the private and non-profit sectors (Sharp et al., 2010). While designing sustainability programs across a broader array of environmental issues is more time intensive and costly than taking a less comprehensive approach, local governments can achieve greater environmental performance outcomes by addressing a greater breadth of environmental issues.

The breadth of policy instrument is another dimension of sustainability programs' content (Howlett, 2009a). Policy instruments are identifiable methods of persuading individuals or organizations to behave in responsible ways in order to improve a social outcome (Schneider & Ingram, 1993). The breadth of policy instruments is the extent to which local governments use a diverse set of policy instruments to address a particular environmental concern (Sovacool, 2009; Stern, 2000). While some local governments tend to heavily depend on a few types of policy instruments, others consider the full range of policy instruments and adopt a mix of policy instruments to that work together to achieve desired policy outcomes (Gunningham & Sinclair, 1999). For instance, in order to encourage pro-environmental behaviors (e.g., energy savings, vehicle use reduction, recycling), some local governments incorporate drivers of behavior changes

into their program design (Kollmuss & Agyeman, 2002; Mckenzie-Mohr, 2000) to influence social norms (e.g., education), establish physical and institutional settings (e.g., infrastructure and legal limits), create economic incentives (e.g., tax incentives) and provide assistance (e.g., public services). This multi-faceted integrative use of policy instruments tends to address individual and organizational behaviors more systematically and through multiple pathways. Doing so helps to create sustained change (Yanarella & Levine, 2008), that leads to more fundamental changes in environmental and social conditions.

Taken together, comprehensive sustainability programs imply not only adopting more sustainability programs, but also designing them in more broadly across environmental issues and policy instruments through the coordination of different policy domains and policy instruments, all of which will subsequently lead to greater environmental performance outcomes than the less comprehensive sustainability programs.

Hypothesis) Local governments' sustainability programs that are designed more comprehensively are related to greater environmental performance outcomes in their locality.

Empirical analysis

Data

To assess the environmental performance outcomes of local governments' sustainability programs, I rely on the Environmental Protection Agency (EPA)'s air quality data. EPA air quality data are collected across the United States, Puerto Rico, and the U.S. Virgin Islands (EPA). There are approximately 4,000 EPA repositories of ambient air quality monitoring stations, and state, local and tribal agencies have responsibility for collecting the data and submit it to EPA's Air Quality System on a

periodic basis (EPA)⁸. The data includes information for the amount of pollution and other substances present in the atmosphere, such as ozone (O₃), particulate matter (PM₁₀ and PM_{2.5}), carbon monoxide (CO), nitrogen dioxide (NO₂), sulfur dioxide (SO₂), and lead (Pb). In each year the number of observations for each pollutant is inconsistent, with CO being the least observed pollutant and ozone being the most observed pollutant.

I relied on the EPA's ambient ozone concentration because it has the most observations per year. Moreover, among the other pollutants, ground-level ozone is the primary component of smog and has significant adverse health effects, such as breathing problems, asthma or other lung diseases (Agency, 2014). Because of these risks, in 2008, EPA increased the stringency of National Ambient Air Quality Standards (NAAQS) for ozone, from 0.08 to 0.075 ppm (8-hour, annual fourth-highest daily maximum). The ground-level ozone is mainly caused by emissions from fuel consumption, motor vehicles and industrial pollutants (Chen & Ye, 2015). In response, local governments developed a variety of sustainability programs to encourage individuals and organizations to voluntarily reduce their energy consumption, vehicle use, and other ozone producing activities. Therefore, in this study I focused on ozone quality as a proxy of local environmental quality.

The ozone quality data was combined with data from a variety of other sources that form my explanatory and control variables (discussed below). After the data merge, a total of 102 county governments remained in the sample. Specific measurements and data sources are described in the following sections.

⁸ EPA, accessed on 01/02/2016, at http://www.epa.gov/airdata/ad_basic.html

Measures

Dependent Variable

To measure the environmental performance of local governments' environmental programs, I examine changes in their ambient ozone concentration between 2003 and 2013. These years were selected because in 2005, the U.S. Conference of Mayors Climate Protection Agreement was first initiated by the Seattle Mayor, Greg Nickels. The agreement declared that local governments should advance the goals of the Kyoto Protocol, the international agreement to address climate change, through their local leadership and programs (The U.S. Conference of Mayors Climate Protection)⁹. The agreement was particularly relevant to U.S. local governments' voluntary initiatives because in 2005 the U.S. federal government had not ratified the Kyoto Protocol, even though 141 countries had officially ratified it into law. The agreement prompted many local governments to initiate a more coordinated effort to address climate change pollution through the development of decentralized local sustainability programs. Since then, many local governments' sustainability activities have begun focusing on air quality including ozone. While there may be local governments that have undertaken some environmental programs for sustainability before 2005, they rarely adopted the sustainability principle as an official policy objective, and therefore their programs were less likely to be systematically planned and designed in a name of sustainability. For instance, even though the American Planning Association (APA) established the first guideline for sustainability planning in 2000, only after 2005 have local governments

⁹ The U.S. Conference of Mayors, accessed on 04/02/2016, <http://www.usmayors.org/climateprotection/agreement.htm>.

officially begun adopting the sustainability principle as their official municipal policy objective in designing their sustainability programs¹⁰. Taken together, by examining data in 2003, I have a suitable baseline measure. Since many sustainability programs take years to have an effect, I consider 2013 as a post-implementation year. To assess the robustness of my findings, I also compared data collected in 2004 and 2014. Since the results were similar, but data limitations reduced the number of observations, I place more emphasis on the 2003 and 2013 comparisons.

There were 1,254 monitoring stations that collected ozone quality data in 2003 and 1,370 stations in 2013. As some counties often have more than one monitoring station in their jurisdiction, the number of unique counties were 708 (2003) and 786 (2013). For counties that had more than one ozone quality observation in a given year, these observations were averaged. Ozone quality change was calculated as follows:

$$\text{Change in ozone quality} = \Delta \text{Annual daily maximum of ozone level (ppm)}$$

10 Eco-Municipalities. Accessed on March 18th 2016. Available at <http://www.instituteeforecomunicipalities.org/Eco-municipalities.html>

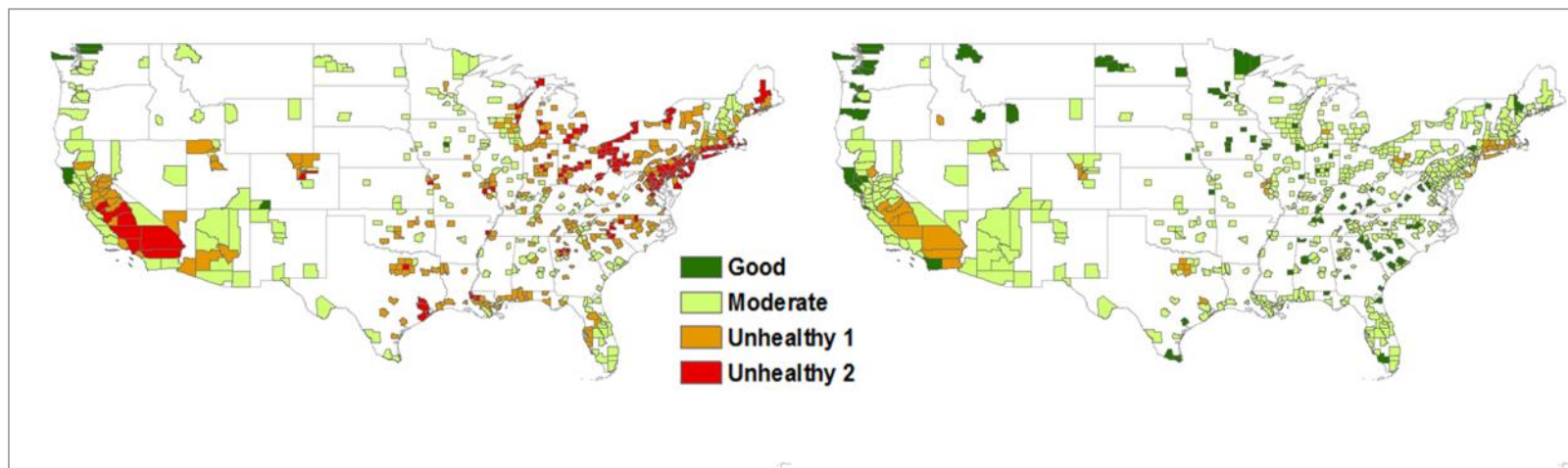


Figure 4.1

Ozone quality in 2003 (Left) and 2013 (Right)

Figure 1 shows spatial distribution of ozone quality in 2003 and 2013, respectively. The categories in Figure 1 were created according to the level of ozone quality (Anselin & Gallo, 2006): *Good* (0.0-0.064ppm), *Moderate* (0.065-0.084ppm), *Unhealthy 1* (0.084-0.104ppm), and *Unhealthy 2* (>0.104ppm). As shown in the Figure 1, in 2003, some counties in California and most counties in Northern U.S. and North East, in particular Michigan, Maryland, New York, Virginia, and Georgia show the unhealthy 1 level of ozone quality which is greater than 0.104ppm. However, in 2013, ozone quality in these counties were moderate, while other counties in Western area, such as Kings County, California, Jefferson County, Colorado, Hood County, Texas, and Tarrant County, Texas, still remain in the unhealthy 1 level of ozone quality.

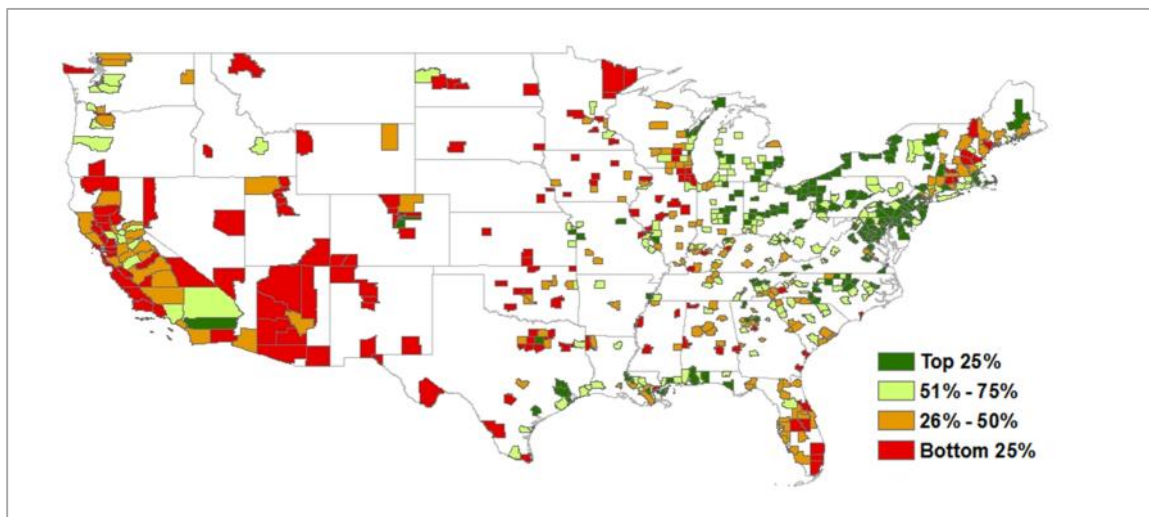


Figure 4.2

Ozone quality change between 2003 and 2013

While US ozone quality improved across entire area, some counties experienced greater improvements than others, as shown in Figure 2. When categorizing counties

according to the degree to which their ozone quality has improved between 2003 and 2013, counties in Maryland, Michigan, and Virginia are among those that experienced much greater ozone quality improvement (and were in the top 25%) than other counties. On the other hand, counties in Arizona, California, Colorado, and New Mexico are among those that experienced much less ozone quality improvement (and were in the bottom 25%) compared to other counties.

Explanatory Variables

To assess local governments' sustainability programs, I rely on the data from the 2010 International City/County Management Association (ICMA)'s Local Government Sustainability Policies and Programs survey. The survey was developed with the input of ICMA's Center for Sustainable Communities and other research institutes (Svara, 2011). The survey asked local governments' sustainability managers about their jurisdiction's sustainability programs. In the summer of 2010, the survey was mailed to sustainability managers of local governments in jurisdictions having more than 2,500 residents. Total 302 of 1,312 (23.01%) county governments responded (Svara, 2011).¹¹

I considered three measures of a local government's sustainability programs. While each measure commonly examines the degree to which its sustainability programs are designed comprehensively, each measure underscores slightly different dimension of

¹¹ The survey was originally sent to all local governments of which jurisdictions have more than 2,500 population, including counties, cities, and townships. Total 2,176 (25.39%) local governments responded, in particular 302 counties and 1,874 municipalities– responded (Svara, 2011). However, as this study focused on ozone quality in county areas only, I included responses from county governments in my sample.

their programs: size, the scope of environmental issues that they address, and the mix of policy instrument types that they use to achieve a policy goal respectively.

The first measure is number of programs, which has been widely used to measure the degree of local governments' commitment to addressing sustainability issues (Krause, 2011; Portney, 2003). It was assessed using data obtained by the ICMA survey.

Sustainability managers were provided with a list of 119 sustainability programs. Since this paper particularly focuses on environmental performance outcomes, sustainability programs that are related to non-environmental issues (e.g., social inclusion) were excluded, leading 111 programs. For each of the programs, respondents were asked to indicate whether or not their local government had implemented them. Responses were coded 1 if they responded 'Yes', otherwise 0. I then summed the number of programs for each local government.

The second measure I used to assess the design of a local government's sustainability programs is the breadth of environmental issues that are addressed by the programs. For each of the 111 programs identified in the ICMA survey, respondents were asked to indicate which actions their local government had taken to reduce seven environmental impacts: air, water, recycling, energy conservation, buildings, land use, and transportation. The remaining seven aggregate environmental issues were disaggregated based on their specific goals and target populations. For example, energy conservation programs were disaggregated based on their pollution source as sustainability programs that address more pollution sources have greater breadth (Daley et al., 2013). This step led to the generation of five types of energy items: energy in government, energy in residential homes, energy in business, energy in outdoor lights/vehicles, and alternative

energy generation. Similarly, the aggregate category of transportation was disaggregated into three types of transportation items based on their pollution source: public transportation, reduced commute trips (e.g., telework, compressed work week), and alternative modes of vehicles (e.g., walk, bike). After disaggregation, I identified 13 environmental issues. These 13 environmental issues were the basis for my measure assessing the breadth of environmental issues. I used Shannon's H entropy score (Jacquemin & Berry, 1979) to develop this measure. Shannon's H entropy score is one of the most widely used measures to assess the breadth of items because it is sensitive to high levels of scope and therefore leads to wider variation than other types of breadth measures (e.g. Herfindahl Hirschman Index) (Halpin & Thomas III, 2012). Local governments whose sustainability programs address a greater breadth of environmental issues therefore receive a higher entropy score (E_E). Shannon's H entropy score takes the following form:

$$E_E = \sum_{j=1}^m P_j * \ln(1/P_j)$$

where P_j is a proportion of sustainability programs addressing j th environmental issue in total adopted sustainable programs, *the logarithm of $1/P_j$* is a weight of each proportion and m is the number of total available environmental issues, which is in this case 13.

The third measure I used to assess the design of a local government's sustainability programs is the breadth of policy instruments that are used in the programs. To account for the breadth of local governments' policy instruments, I drew on prior research

categorizing policy instrument types in the local sustainability program context (Bengston, Fletcher, & Nelson, 2004; Cubbage, Harou, & Sills, 2007; Dietz et al., 2009; Kaufmann-Hayoz et al., 2001; Li & Geiser, 2005). In categorizing policy instrument types, these studies have commonly focused on the mechanism through which a policy instrument influences individual or organizational behaviors (Dietz et al., 2009; Kaufmann-Hayoz et al., 2001; Li & Geiser, 2005). Based on this criterion, I identified 12 types of policy instruments comprising the 119 programs in the 2010 ICMA survey: voluntary agreement, provision of service, establishment of new infrastructure, infrastructure upgrade, tax benefits, direct financial payment, reduced fees, other incentives, charges, limit, education, and public procurement. Although these policy instruments are not completely mutually exclusive, each policy instrument can be considered a distinctive type because each depends on a different mechanism to influence behaviors. Definitions and the mechanisms of each policy instrument type are discussed in Table 4.1.

Table 4.1

A typology of policy instruments

Policy Instrument Types		Definition	Mechanism	Examples from the ICMA list
Voluntary agreement		Non-binding commitments to achieve certain objectives	Guiding strategic decisions tied to overarching sustainability goal	<ul style="list-style-type: none"> · Energy efficiency rate · GHG reduction targets · Consumption standards
Provision of service		Practices, procedures, or actions that enable individuals or organizations	Assist or promote pro-environmental behaviors	<ul style="list-style-type: none"> · E-waste collection service · Commuter rail service · Compressed work week
Infrastructure	Establishment	Man-made, mobile or immobile physical objects that enable or promote sustainable behaviors	Creating new physical conditions	<ul style="list-style-type: none"> · Establishing bike lanes or sidewalks · Installing charging station for electric vehicles · New outdoor light fixtures
	Upgrade		Improving physical conditions that already exist	<ul style="list-style-type: none"> · Retrofitting streetlights · Upgrading facilities' water systems · Widening sidewalks
Economic Instruments	Tax benefits	Deduction or exemption of taxes paid for certain activities or services	Economic incentives	<ul style="list-style-type: none"> · Tax credits for conducting energy audit for residential homes
	Direct payment	Direct provision of financial subsidies	Economic incentives	<ul style="list-style-type: none"> · Direct grant for home audits · Funding for pre-school education
	Reducing fees	Discount of fees or prices	Economic incentives	<ul style="list-style-type: none"> · Development rights transfer · Reducing fees for sustainable development
	Other incentive	Others	Economic and non-economic incentives	<ul style="list-style-type: none"> · Incentives for water conservation · Incentives for public employees for taking mass transit to work, carpool, walk, bike
	Charges	Prices imposed for utilizing specific services	Economic disincentives	<ul style="list-style-type: none"> · Water price structure to encourage conservation · Charges based on the amount of waste discarded
Limit		Legal orders that mandate some forms of behaviors	Legal institutions	<ul style="list-style-type: none"> · Land use requirements · Zoning codes · Limits on impervious surfaces on private property
Education		Informing, educating, or communicating	Social norms	<ul style="list-style-type: none"> · Energy conservation education · Publishing reports on community quality of life indicators
Public Procurement		Public organizations' purchasing of products and services	Green consumption and market driver	<ul style="list-style-type: none"> · Purchasing of fuel efficient vehicles · Restriction on the purchase of bottled water by governments

By relying on the definitions and descriptions of the policy instrument types, I identified a policy instrument type for each of the 111 sustainability programs. Eight sustainability programs were excluded because their description did not include their policy instrument types, leading 103 categorized programs. Similarly, I utilized Shannon's H entropy score (Jacquemin & Berry, 1979) to measure the breadth of policy instruments. Local governments whose sustainability programs addressed a greater breadth of policy instruments therefore received a higher the entropy score (E_P).

$$E_P = \sum_{k=1}^l P_k * \ln\left(\frac{1}{P_k}\right)$$

where P_k is a proportion of sustainability programs addressing k th policy instrument in total adopted sustainable programs, *the logarithm of $1/P_k$* is a weight of each proportion and l is the number of total available policy instrument, which is in this case 12.

Control Variables

Local environmental quality is influenced by a variety of factors. First of all, industrial characteristics are salient factors to affect local environmental quality (Chan & Yao, 2008; Chen & Ye, 2015) because industrial entities are the main source of local environmental pollution (Daley et al., 2013). Since the *manufacturing industry* has been commonly employed as a proxy for polluting industries (Daley et al., 2013), I accounted for the size of the manufacturing industry by using NAICS industry codes and 2007 Economic Census data to determine the total number of employees in manufacturing industry and normalized by the total population of the locality.

I also controlled for other industry sectors, and especially the *new economy industry*. The new economy industry consists of emerging science and technology businesses, and particularly those associated with information technologies (Hirsch, 2001; Krueger & Gibbs, 2007). It differs from the manufacturing industry because the new economy industry's activities are more likely to generate little pollution and depend on high quality of labors who are well-educated and who prefer living in environmentally preferable community (Florida, 2005; Krueger & Gibbs, 2007). Therefore, the size of the new economy industry is also likely to influence local environmental quality, measured by the total number of employees in information technology (IT) industry divided by total population by relying on by using NAICS industry codes and 2007 Economic Census data.

Environmental NGOs in locality often reflects organized interest in environment protection in the community (Daley et al., 2013) and therefore influences local environmental quality. I measured local environmental NGO relevance by the number of environmental NGOs in a given locality (Daley et al., 2013). I relied on data from the National Center for Charitable Statistics (NCCS) to determine the number of environmental NGOs in a locality.

Local environmental quality is also influenced by local governments' policy priority in environmental protection (Daley et al., 2013; Sharp et al., 2010). I accounted for whether a county was *a member of the International Council for Local Environmental Initiatives (ICLEI)*. ICLEI is one of the most influential networks that assist local governments' environmental initiatives, and it has worked for more than a decade to encourage local governments worldwide to reduce their environmental impacts (Betsill &

Bulkeley, 2006) through its urban carbon dioxide reduction campaign, green fleets campaign, and cities for climate protection campaign (Bai, 2007). Local governments that are a member of ICLEI are therefore more likely to be socialized into having a greater commitment towards improving environmental quality (Sharp et al., 2010). Using data obtained from the ICMA 2010 survey, ICLEI membership was coded 1 if the local government had membership with ICLEI, otherwise coded 0.

Public employees, in particular those who work related to environmental protection, contribute to local environmental quality because greater public employees are more capable of identifying and resolving local environmental problems (Krause et al., 2016). To create this variable, I relied on the 2007 US Census Bureau Local Government Employment and Payroll data that include information about the number of public employees across functional areas of natural resources, park and recreations, public welfare, health, and solid waste management. The number of public employees was standardized by total population in the locality.

Income and *race* are also important community characteristics to determine community's interest in environmental quality (Edwards & Darnall, 2010). I used 2007 American Community Survey from U.S. Census Bureau to determine each locality's median household income and the proportion of Caucasian population.

Local environmental quality is also affected by the state governments. Each state has different policy priorities in environmental protection and often exerts influence on local governments' environmental priorities (Saha & Paterson, 2008). *Democratic states* typically support a pro-environmental political agenda, which therefore influences the overall environmental performance of local governments. To create this variable, I relied

on the governor's political affiliation in 2007. County governments that are located in the states with Democratic governors were coded 1, otherwise 0.¹²

I also controlled for whether the county was designated as *non-attainment areas* by the EPA to control for influence from the federal government. The EPA designates a geographic area as a nonattainment area if its air quality fails to meet the NAAQS. Once a county area is designated as a nonattainment area, the local government should develop implementation plan about how to attain and maintain the standard by reducing air pollutant emissions (Greenstone, 2004). Counties that are designated as non-attainment areas therefore are under greater pressures by EPA to improve local air quality. To measure this variable, counties that were designated as non-attainment areas for ozone quality coded 1, otherwise 0¹³.

Vehicle emission is the primary source of urban air pollution (Chen & Ye, 2015). To control for the number of vehicles in the locality, I relied on US Census's household vehicle usage and transportation data to determine the number of privately owned vehicles in each county in 2007.

Urbanization also affects local air quality because more urbanized localities have more complicated environmental problems (Bae & Feiock, 2013; Daley et al., 2013; Hawkins et al., 2016). To control for urbanization, I consider density measured as population given geographical size of the locality (Bae & Feiock, 2013; Hawkins et al.,

¹² Accessed on March 29, 2016. Multistate Associates Incorporated, 2012 Governors and Legislatures, http://www.multistate.com/site.nsf/G_L2012?OpenPage.

¹³ Accessed on March 29, 2016. EPA's Current Nonattainment Counties for All Criteria Pollutants, <https://www3.epa.gov/airquality/greenbook/ancl.html>.

2016), and the information is drawn from the 2007 US Census American Community Survey.

Finally, I account for meteorological conditions in the locality such as temperature, air pressure and precipitation (Chen & Ye, 2015). Among many factors, *temperature* and *barometric pressure* influence movement and the degree of concentration of air pollutants (Chan & Yao, 2008). By relying on the EPA air quality data, I included average temperature and average atmospheric pressure of each county in 2013. Since these control variables described above were included in the model predicting local governments' sustainability programs in 2010 due to potential endogeneity issue (described below), I considered these variables in 2007 except for the two meteorological variables. Because average temperature and barometric pressure are not expected to influence local governments' decision to adopt sustainability programs, I used the most recently available data for these two variables.

Table 4.2 reports descriptive statistics and correlations for the variables included in my analysis.

Table 4.2

Descriptive Statistics and Correlations

	1)	2)	3)	4)	5)	6)	7)	8)	9)	10)	11)	12)	13)	14)	15)	16)	17)
1) Number	1.00																
2) Number*E_E	1.00	1.00															
3) Number*E_P	0.99	0.99	1.00														
4) Fiscal constraint	-0.35	-0.36	-0.34	1.00													
5) Fiscal independence	-0.16	-0.15	-0.13	0.22	1.00												
6) Manufacturing	-0.43	-0.43	-0.43	0.31	-0.15	1.00											
7) IT Industry	0.31	0.31	0.31	0.13	0.29	-0.28	1.00										
8) ICLEI	0.36	0.37	0.37	-0.12	0.02	-0.28	0.19	1.00									
9) Democratic state	0.19	0.20	0.20	-0.28	-0.21	-0.04	-0.11	0.22	1.00								
10) Public employees	-0.06	-0.05	-0.09	-0.08	-0.14	0.07	-0.18	-0.09	0.08	1.00							
11) Env NGOs	0.39	0.38	0.39	-0.15	-0.09	-0.27	0.27	0.34	0.14	-0.15	1.00						
12) Income	0.45	0.44	0.45	-0.12	0.07	-0.31	0.71	0.28	0.15	-0.09	0.44	1.00					
13) White_race	-0.31	-0.31	-0.31	0.07	0.21	0.40	-0.12	-0.16	0.25	0.14	-0.28	-0.13	1.00				
14) # of Vehicle	0.27	0.25	0.27	0.03	-0.06	-0.18	0.25	0.26	-0.07	-0.18	0.79	0.35	-0.38	1.00			
15) Density	0.32	0.31	0.33	-0.10	0.15	-0.21	0.48	0.12	-0.04	-0.12	0.47	0.51	-0.29	0.43	1.00		
16) Temperature	0.20	0.19	0.19	-0.12	0.03	-0.32	-0.09	0.17	-0.15	0.03	0.22	-0.08	-0.42	0.32	0.16	1.00	
17) Barometric Pressure	-0.05	-0.05	-0.03	-0.37	0.05	0.07	-0.24	-0.03	0.00	-0.01	0.02	-0.11	-0.14	0.05	0.18	0.29	1.00
Mean	29.58	63.24	50.56	0.40	0.70	51.05	11.63	0.18	0.74	0.004	33.77	73,280	71.61	204,541	693.03	14.38	739.07
S.D.	16.58	42.14	34.47	0.49	0.16	29.31	6.00	0.38	0.44	0.009	34.03	19,012	18.22	265,116	1,036.58	5.98	36.16
Min	0.00	0.00	0.00	0.00	0.24	9.97	2.14	0.00	0.00	0.00	1.00	40,571	30.69	4,484	5.30	0.03	603.26
Max	74.00	185.97	149.74	1.00	1.00	130.80	35.74	1.00	1.00	0.07	180.00	131,054	98.66	1,644,653	7,993.60	44.35	770.40

Correlations > |.20| are statistically significant at p<.05

Empirical Model

To empirically examine the relationship between local sustainability programs and ozone quality within a locale, spatial dependence in ozone quality among neighboring counties becomes an important issue to be addressed (Chen & Ye, 2015). Spatial dependence occurs “when the value of the dependent variable corresponding to each cross-sectional unit is assumed to depend on a weighted average of that dependent variable corresponding to neighbouring cross-sectional units” (Kelejian & Prucha, 1998), p.99). Hence, in the presence of spatial dependence, the ordinary least squares (OLS) estimator is typically not consistent (Anselin & Gallo, 2006).

In the presence of spatial dependence (Chen & Ye, 2015), the spatial autoregressive disturbance (SARAR) model has been widely employed (Drukker, Prucha, & Raciborski, 2013), which takes a form as following:

$$y = \lambda Wy + X_x\beta + X_n\gamma + u, \quad (1)$$

$$u = \rho Mu + \epsilon, \quad (2)$$

where y is the dependent variable, X_x represents the independent variables that contain exogenous covariates, X_n represents the independent variables that contain endogenous covariates, W and M are $N \times N$ spatial-weighting matrices that parameterize the distance between neighborhoods. u is spatially correlated residuals, whereas ϵ is independent and identically distributed disturbances (Drukker et al., 2013). λ and ρ are scalars that measure, respectively, the dependence of y_i on nearby y and the spatial correlation in the errors (Anselin & Gallo, 2006). The weighted average of the dependent variable values observed for other cross sectional units, Wy , is typically referred to as a

spatial lag, whereas the weighted average of disturbances, Mu , is a spatial error (Anselin & Gallo, 2006; Drukker et al., 2013).

The spatial autoregressive disturbance (SARAR) model allows for the disturbances to be generated by a spatial autoregressive process (Anselin & Gallo, 2006; Chen & Ye, 2015; Kelejian & Prucha, 1998) by including spatial lags of other localities' dependent variable values in a model as the exogenous independent variables, as shown in the equation (1). In other words, it includes the spatial lag variable for y_i to be dependent on nearby y . It also addresses the issues of heteroskedasticity that shows the spatial dependence in the disturbances by allowing the disturbances to be generated by a spatial autoregressive process (Drukker et al., 2013), as shown in equation (2). Setting $\rho = 0$ yields the simple spatial lag model (equation (1)) $y = \lambda Wy + X_x\beta + X_n\gamma + \epsilon$ as $u = \epsilon$, while setting $\lambda = 0$ yields the spatial error correction model (equation (2)). Setting $\rho = 0$ and $\lambda = 0$ causes the model to reduce to a linear regression model as there is no spatial dependence existing in either the dependent variable or the disturbances (Drukker et al., 2013). Therefore, the spatial autoregressive disturbance (SARAR) model simultaneously estimates outcomes by controlling for the spatial dependence among unobservables in the dependent variable, exogenous variable and error terms } (Drukker et al., 2013).

To estimate the spatial models, it is important to specify the spatial weights matrix, W and M . The spatial weights matrix is usually specified for each location, $\omega_{i,j}$, (Anselin & Gallo, 2006) (Chen & Ye, 2015). One of the most widely used spatial weight scheme is the inverse geographical distance between the centroid of $location_i$ and the centroid of $location_j$, represented by $d_{i,j}$, which takes a following form (Anselin & Gallo, 2006; Chen & Ye, 2015):

$$\omega_{i,j} = \frac{1}{d_{i,j}}$$

The weights matrix is also row-standardized, such that $\sum_j w_{ij} = 1$ (Anselin and Gallo, 2006).

Related to ozone quality in county areas, since a county's ozone quality is expected to be influenced by the transported ozone from neighboring counties (Chen & Ye, 2015), improvement (or deterioration) of a county's ozone quality is affected by ozone quality change in neighboring counties. Thus, air pollution from neighboring counties is measured using a spatially-weighted ozone quality in neighboring counties that depends on physical distance between counties because air pollutants can transport from one locality to other localities (Anselin & Gallo, 2006). Following the spatial dependence specification (Chen & Ye, 2015), a county's air quality improvement may depend on air quality in surrounding counties, a county government's sustainability programs, and its socioeconomic and meteorological characteristics as following:

$$\Delta O_{3i} = \lambda W \Delta O_{3j} + Programs_i \beta_1 + Control\ vars_i \beta_2 + u_i, \quad (1)$$

$$u_i = \rho M u_j + \epsilon_i, \quad (2)$$

For the spatial weight matrix, I assign the value of the weights assigned equals the inverse geographical distance between *county_i* and *county_j*, $\frac{1}{d_{i,j}}$ (Chen & Ye, 2015).

Therefore, the greater weight is assigned to *county_i*, if it is surrounded by counties that are located in closer distance and have higher level of ozone quality.

In order to examine how varying design features of sustainability programs are related to environmental performance, I run three empirical models with different sustainability program variables that incorporate different design features into its

measurement. Specifically, in model (1), I include the number of local sustainability programs a basic model. In models (2) and (3), I include the breadth of environmental issues and breadth of policy instrument types, respectively. By examining coefficients associated with the sustainability program in each model, I can identify whether or not the sustainability programs that are designed more comprehensively in terms of number, environmental issues and policy instrument are associated with greater ozone quality changes. Since each sustainability program measure was scored in a different units (e.g. count and rate) and has a different distribution (e.g. Poisson and normal distribution), it is difficult to compare the relative extent to which each measure relates to ozone quality change. One possible alternative is to transform each measure into a standardized score, z-score. A z-score expresses how far a value is from the population mean, and expresses this difference in terms of the number of standard deviations by which it differs (Lundberg, 2007). The standardized score will allow calculating the probability of a score occurring within normal distributions and enable comparing scores that are from different units and distributions (Lundberg, 2007). In addition, it provides standardized coefficients, which allows me to discern whether or not the design features are associated with greater ozone quality changes. The estimated coefficients do not have the same interpretation as in a simple linear model because an explanatory variable has a direct effect and an indirect effect through a spatial lag of the dependent variable, implying its impact occurs simultaneously (Anselin & Gallo, 2006). Therefore, in this paper, I focus on the direction and relative magnitude of the coefficients in interpreting the results.

RESULTS

Environmental Performance of Local Governments' Sustainability Programs

The findings show that county governments' sustainability programs have contributed to improving ozone quality in their community. The pseudo R-squares for models assessing ozone quality improvements associated with local governments' sustainability programs were approximately 46%, but slightly different according to measures of sustainability programs. More specifically, the pseudo R-square is 46% for the model (1) that assesses the ozone quality improvement by using number of sustainability programs as a program measure. The model fit is almost same for the model (2), 47%, that includes the program measure that is the breadth of environmental issues that are addressed by the programs. However, the model (3) assessing ozone quality improvement by using the breadth of policy instrument types as a program measure has slightly lower R-squares, 38%.

The results indicate that there are strong spillover effects in local environmental performance in that ozone quality changes in a county area is influenced by ozone quality changes in neighboring counties. More specifically, the coefficient estimates of the spatially weighted dependent variable, λ , show evidence of positive spatial lag in the all three model specifications ($p < 0.01$). However, the spatial error, ρ , is not statistically significant, meaning disturbance terms are not spatially autocorrelated.

Despite the spatial dependence, individual local government's sustainability efforts are related to improvements in its environmental quality. As shown in the Table 4.3, the estimated coefficients of the local sustainability programs are associated ($p < 0.01$) with reductions in ozone level across all three models. More specifically, as shown in model

(1), more sustainability programs in a county government are associated with greater reduction in ozone level between 2003 and 2013 ($p < 0.01$).

The results in the model (2) also indicate that the design of local governments' sustainability program is related to improvement in its environmental quality, implying that sustainability programs that address environmental issues more broadly are related with greater reduction in ozone level between 2003 and 2013 ($p < 0.01$).

In model (3), I consider a different measure of the comprehensive program design feature: how broad types of policy instruments are used in sustainability programs. The coefficient estimate of the local sustainability programs is still statistically significant at 1% level. The results indicate that sustainability programs that use policy instruments more broadly are associated with greater reduction in ozone level between 2003 and 2013 ($p < 0.01$). Taken together, these findings offer strong support of my hypothesis, which state that *local governments' sustainability programs that are designed more comprehensively are related to greater environmental performance outcomes in their locality.*

Table 4.3

Spatial autoregressive estimation results: Basic model

Ozone quality change (2013 – 2003)	Model 1		Model 2		Model 3	
	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
Number of programs	-0.28***	(0.09)				
Breadth of environmental issues (E _E)			-0.32***	(0.08)		
Breadth of policy instrument(E _P)					-0.23**	(0.09)
Heavy polluting industry	-0.18**	(0.08)	-0.18**	(0.08)	-0.15**	(0.08)
New economy industry	-0.41***	(0.12)	-0.36***	(0.11)	-0.37***	(0.12)
ICLEI membership	0.12	(0.16)	0.08	(0.15)	0.07	(0.16)
Democratic state	-0.02	(0.08)	-0.03	(0.08)	-0.04	(0.08)
EPA nonattainment area	0.08	(0.11)	0.08	(0.11)	0.09	(0.11)
Public employees	-0.05	(0.09)	-0.06	(0.08)	-0.06	(0.09)
Environmental NGOs	-0.13	(0.13)	-0.13	(0.13)	-0.14	(0.13)
Median income	0.32**	(0.16)	0.26*	(0.15)	0.28*	(0.16)
White race	-0.09	(0.09)	-0.16*	(0.09)	-0.11	(0.10)
# of Vehicles	0.01	(0.13)	0.04	(0.13)	0.05	(0.13)
Density	0.18	(0.11)	0.16	(0.11)	0.17	(0.12)
Mean temperature	-0.08	(0.08)	-0.02	(0.07)	-0.06	(0.08)
Mean barometric pressure	-0.20**	(0.09)	-0.22***	(0.08)	-0.20**	(0.09)
_cons	0.17***	(0.05)	0.17***	(0.05)	0.17***	(0.05)
Obs	102		102		102	
Squared Correlation (R ²)	0.48		0.50		0.47	
Lamda (Spatial lag)	7.36***	(1.09)	7.06***	(1.06)	7.39***	(1.10)
Rho (Spatial error)	-4.40	(2.86)	-4.76*	(2.47)	-4.74*	(2.46)

* p<0.10 ** p<0.05 *** p<0.01

Related to the control variables, a county's industrial characteristics are associated with ozone quality change. More specifically, counties with greater number of employees working in manufacturing industry ($p < 0.01$ – $p < 0.05$) and in new economy industry ($p < 0.01$) experience greater reductions in ozone level between 2003 and 2013. By contrast, median household income was negatively associated with the ozone quality improvement between 2003 and 2013, meaning that the higher the income in the county area, the less the ozone quality improvement in the county area ($p < 0.05$). Moreover, the more urbanized county area has experienced less ozone quality improvement between 2003 and 2013 ($p < 0.1$). Finally, higher barometric pressure is associated with greater reduction in ozone quality level in the locality ($p < 0.01$ – $p < 0.05$).

To examine the robustness of my empirical results, I also ran a model including different combinations of these comprehensive sustainability program measures: both number of programs and entropy score for the breadth of environmental issues in model (1), both number of programs and entropy score for the breadth of policy instrument in model (2), and all three measures in model (3). Since the entropy scores are highly correlated with number of sustainability programs, I used the standardized entropy scores that divide entropy scores by logged number of programs, thereby addressing high correlation issue between number of programs and entropy scores in that their correlation score become approximately 0.11 ($p > 0.1$). The analysis results are summarized in the Table 4.4.

The results are consistent in that local governments implementing more sustainability programs are associated with greater ozone quality improvements between 2003 and 2013 as indicated from the statistically significant coefficients of the number of programs

across all three models ($p < 0.01$). The findings in model (1) also suggest that even after controlling for the number of programs, greater breadth of environmental issues covered in a local government's sustainability programs is associated with greater improvement of ozone quality in that locality ($p < 0.05$). In other words, even for local governments that adopt a similar number of programs, they could expect greater environmental performance outcomes by designing them in a broader array of environmental issues. However, as shown in model (2), breadth of policy instrument is not necessarily related to greater environmental performance outcomes when controlling for the number of sustainability programs.

Table 4.4

Spatial autoregressive estimation results: Nested model

Ozone quality change (2013 – 2003)	Model 1		Model 2		Model 3	
	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
Number of programs	-0.27***	(0.08)	-0.29***	(0.08)	-0.27***	(0.08)
Breadth of environmental issues (E_E)	-0.16**	(0.08)			-0.14	(0.08)
Breadth of policy instrument(E_P)			-0.10	(0.07)	-0.05	(0.08)
Heavy polluting industry	-0.18**	(0.08)	-0.18**	(0.08)	-0.18**	(0.08)
New economy industry	-0.38***	(0.11)	-0.39***	(0.11)	-0.38***	(0.11)
ICLEI membership	0.08	(0.15)	0.09	(0.15)	0.09	(0.15)
Democratic state	-0.04	(0.08)	-0.03	(0.08)	-0.04	(0.08)
EPA nonattainment area	0.07	(0.11)	0.05	(0.11)	0.06	(0.11)
Public employees	-0.04	(0.08)	-0.04	(0.08)	-0.04	(0.08)
Environmental NGOs	-0.15	(0.13)	-0.14	(0.13)	-0.15	(0.13)
Median income	0.28*	(0.15)	0.32**	(0.15)	0.29*	(0.15)
White race	-0.15	(0.09)	-0.12	(0.09)	-0.15	(0.09)
# of Vehicles	0.06	(0.12)	0.05	(0.13)	0.05	(0.12)
Density	0.17	(0.11)	0.17	(0.11)	0.17	(0.11)
Mean temperature	-0.03	(0.07)	-0.05	(0.07)	-0.03	(0.07)
Mean barometric pressure	-0.22***	(0.08)	-0.20**	(0.08)	-0.21***	(0.08)
_cons	0.17***	(0.05)	0.17***	(0.05)	0.17***	(0.05)
Obs	102		102		102	
Squared Correlation (R^2)	0.50		0.50		0.51	

Lamda (Spatial lag)	7.08***	(1.05)	7.28***	(1.06)	7.12***	(1.05)
Rho (Spatial error)	-5.10*	(2.70)	-4.96*	(2.64)	-5.35*	(2.76)

* p<0.10 ** p<0.05 *** p<0.01

Local Governments' Sustainability Programs as Endogenous Variables

In exploring the relationship between a local government's sustainability programs and its environmental performance, it is necessary to consider the endogeneity issue that results from the unobserved factors related to both a local government's decision to adopt sustainability programs and its environmental performance. To address this potential problem, I accounted for the factors that might affect local governments' decisions to voluntarily adopt sustainability programs. The literature suggests that a local government's fiscal condition is an important factor that leads to its decision related to sustainability programs (Wang et al., 2012) in that local governments are more likely to undertake the voluntary initiatives when they feel less constrained by fiscal rules and resources (Wang et al., 2012). However, a local government's fiscal condition is believed to be unrelated to ozone quality change in its locality. Therefore, in the baseline analysis, I instrumented the local sustainability program variable using fiscal condition variables.

For the instrumental variable, I consider two fiscal condition measures: a fiscal constraint (Mahdavi & Westerlund, 2011) and fiscal independence (Ji et al., 2015). Related to a fiscal constraint, a local government's fiscal condition is inextricably linked to state government's fiscal policy that influences local government's fiscal capacity (Ji et al., 2015; Mahdavi & Westerlund, 2011). For instance, some states have a debt limit provision in their fiscal rules, which imposes legal constraints on both the state and local governments in borrowing to cover their chronic deficits. These provisions therefore

exert legal pressures on local governments to be more fiscally balanced (Mahdavi & Westerlund, 2011). Under the fiscal constraint, local governments are less likely to conduct large investment (Ji et al., 2015) that is more likely to incur (long-term) deficits (Mahdavi & Westerlund, 2011). In other words, in such fiscally constrained situation, local governments are less likely to undertake new urban policies and services that are neither mandated nor financed (Ji et al., 2015), such as sustainability programs. Therefore, I considered if a county government is constrained by the debt limit provision as a fiscal constraint. The fiscal constraint was coded 1 if the state government where the county government is located has the provision of debt limit in its fiscal policy, and 0 otherwise. The information is drawn from Mahdavi and Westerlund's (2011) summary of state Balance Budget Requirement (BBR).

Local government's fiscal independence is the extent to which governments secure financial base from their own revenue sources (e.g. taxes, public service fees and charges) rather than intergovernmental aids (Ji et al., 2015). Securing greater revenues from their own revenue sources enhance local governments' autonomy to initiate new urban policies and services that are not earmarked by the intergovernmental revenues (Oates, 1999). Therefore, greater fiscal independence in a local government may create more stable fiscal conditions for the local government to implement sustainability programs. I calculated fiscal independence by subtracting intergovernmental revenues from general revenues and then divide the remaining revenue by general revenues of a locality. Financial information of local governments was obtained from US Census Bureau's 2007 Government Finance data that includes information about each local government's revenues and expenditures from different sources.

In addition to these instrument variables, all of the control variables described earlier were included in the program adoption models. However, since the two meteorological variables, average temperature and barometric pressure, are not expected to be related to a local government's decision to adopt sustainability programs, they are not included. Moreover, since the spatial autoregressive disturbance (SARAR) model does not provide the first stage results, I conducted the two stage least square (2SLS) model (Wooldridge, 2003) to gain the first stage results predicting local governments' adoption of sustainability programs, and to calculate statistics for checking validity of the selected instrumental variables. The 2SLS model projects the fitted values of local governments' sustainability program by using the instrument variables in the first stage, which will be used as regressors (Wooldridge, 2003) in the second stage to estimate its relationship with environmental performance outcomes. It therefore allows me to gain the first stage results that are projected using the selected instrumental variables, and provides the statistics for validity of the selected instrument variables.

Local Governments' Sustainability Program Adoption

The estimated coefficients of a county's sustainability programs are presented in Table 4.5. In order to check validity of the instrumental variables, I conduct the Wu-Hausman F test for checking whether or not the instrumental variables are weak, and the validity of the instruments is supported ($p < 0.01$).

The results illustrate that local governments' fiscal conditions are influential on local governments' decisions to implement sustainability programs. In model (1) to (3), the existence of the fiscal constraint was negatively associated with county governments' sustainability programs ($p < 0.05$). Related to fiscal independence, the results indicate that

greater fiscal independence in a county government was negatively associated with their implementation of sustainability programs ($p < 0.05$ – $p < 0.1$) except for the sustainability programs that are designed more broadly across environmental issues.

Table 4.5

Predicting county governments' sustainability program implementation

Local sustainability programs	Number of programs		Breadth of environmental issues		Breadth of policy instruments	
	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
Fiscal Constraint	-0.20**	(0.09)	-0.18**	(0.09)	-0.18**	(0.09)
Fiscal Independence	-0.22**	(0.11)	-0.17	(0.11)	-0.20*	(0.11)
Heavy polluting industry	-0.17*	(0.09)	-0.17*	(0.09)	-0.17*	(0.09)
New economy industry	0.18	(0.24)	0.20	(0.26)	0.19	(0.25)
ICLEI membership	0.17	(0.10)	0.18**	(0.10)	0.18*	(0.10)
Democratic state	0.01	(0.10)	-0.01	(0.10)	0.00	(0.10)
EPA nonattainment area	-0.08	(0.14)	-0.02	(0.14)	-0.08	(0.14)
Public employees	-0.15	(0.15)	-0.08	(0.15)	-0.15	(0.15)
Environmental NGOs	0.20	(0.14)	0.14	(0.14)	0.20	(0.15)
Median income	-0.12	(0.08)	-0.11	(0.09)	-0.12	(0.08)
White race	0.00	(0.13)	-0.08	(0.14)	-0.02	(0.14)
# of Vehicles	0.09	(0.07)	0.07	(0.08)	0.12	(0.08)
Density	-0.02	(0.09)	-0.01	(0.09)	-0.02	(0.09)
_cons	-0.22	(0.11)	-0.17	(0.11)	-0.20	(0.11)
Obs	102		102		102	
R-Squared	0.44		0.44		0.43	
Wu-Hausman F test for endogeneity	3.87**	(0.05)	4.17**	(0.04)	4.33**	(0.04)

* $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$

While prevalence of new economy industry had no statistically significant influences, prevalence of heavy polluting industry was negatively associated with county governments' sustainability programs in all three models ($p < 0.1$). ICLEI membership was positively associated with county governments' sustainability programs, and especially those county governments implementing sustainability programs across a broader array of environmental issues ($p < 0.05$) and policy instruments ($p < 0.1$).

Table 4.6

Two stage spatial autoregressive estimation results

Ozone quality change (2013 – 2003)	Model 1		Model 2		Model 3	
	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
Number of programs	-0.41***	(0.11)				
Breadth of environmental issues (E_E)			-0.38***	(0.11)		
Breadth of policy instrument(E_P)					-0.52***	(0.12)
Heavy polluting industry	-0.21**	(0.08)	-0.19**	(0.08)	-0.18***	(0.07)
New economy industry	-0.43***	(0.12)	-0.35***	(0.11)	-0.36***	(0.12)
ICLEI membership	0.01	(0.09)	-0.02	(0.08)	-0.01	(0.09)
Democratic state	-0.04	(0.09)	-0.05	(0.08)	-0.04	(0.08)
EPA nonattainment area	0.07	(0.11)	0.08	(0.11)	0.08	(0.11)
Public employees	-0.13	(0.13)	-0.13	(0.13)	-0.13	(0.13)
Environmental NGOs	0.14	(0.16)	0.08	(0.15)	0.07	(0.15)
Median income	0.36**	(0.16)	0.25*	(0.15)	0.34**	(0.16)
White race	-0.12	(0.09)	-0.19**	(0.10)	-0.21**	(0.10)
# of vehicles	-0.01	(0.13)	0.04	(0.13)	0.06	(0.12)
Density	0.20	(0.12)	0.15	(0.11)	0.20*	(0.12)
Mean temperature	-0.08	(0.08)	-0.02	(0.07)	-0.06	(0.07)
Mean barometric pressure	-0.20**	(0.09)	-0.23***	(0.08)	-0.22***	(0.08)
_cons	0.18***	(0.05)	0.16***	(0.05)	0.17***	(0.04)
Obs	102		102		102	

Squared Correlation (R2)	0.46	0.47	0.38
Lambda (Spatial lag)	7.37*** (1.08)	6.90*** (1.07)	7.42*** (1.01)
Rho (Spatial error)	-4.99 (3.12)	-4.91** (2.48)	-12.46*** (2.34)
Instrumented variable	Number of programs	Breadth of environmental Issue	Breadth of policy instrument
Instrumental variables	Fiscal independence, Fiscal constrain	Fiscal independence, Fiscal constrain	Fiscal independence, Fiscal constrain

* p<0.10 ** p<0.05 *** p<0.01

Even after treating local governments' sustainability programs as endogeneous variables through the two stage process, the substantive results remained exactly same as shown in Table 4.6. Magnitude of the corresponding coefficients of local governments' sustainability programs even increase. Overall, these findings offer evidence about the strength of the relationships I examine and additional support for each of the hypotheses, and in particular, the relationship between local government's sustainability effort and collective environmental quality improvement.

Discussion

When effective, local governments can play an important role in global environmental governance (Fiorino, 2010) particularly in an era where supportive national and international regime has been absent (Potoski, 2015). This study presents the first empirical investigation of the environmental impact of sustainability programs in 102 US county governments. Overall, the results show that compared to local governments that adopt fewer sustainability programs, local governments that adopt more sustainability programs are likely to experience more improved ozone quality. Even for local governments that adopt a same number of programs, these locales could expect

greater ozone quality improvements by designing their programs more comprehensively across a broad array of environmental issues and policy instruments.

My findings offer three important policy implications for moving local environmental protection effort forward. First, they provide an optimistic view about the decentralized, non-regulatory policy approach to improving collective environmental quality.

Increasingly, scholars have dismissed the decentralized environmental protection efforts by individual local government (Wiener, 2007), suggesting that they are merely symbolic gestures that create the appearance that government is addressing environmental problems rather than substantive policy actions (Posner & Weisbach, 2010). In other instances, scholars have questioned the role of local governments in addressing global environmental problems (K. Engel, 2006; Michaels, 2008; Posner & Weisbach, 2010; Wiener, 2007). However, this study offers evidence of the environmental impact of local governments' sustainability programs and suggests that local governments can play an important role in generating substantial environmental performance from their voluntary actions.

Second, my findings show that local governments can reduce their environmental impacts further if they address a broader array of environmental issues and using more diverse set of policy instruments in their sustainability programs. While previous literature has underscored the importance of the comprehensive approach to sustainability programs (Bae & Feiock, 2013; Daley et al., 2013; Krause, 2011), as yet, there has been very little understanding about its implications to designing sustainability programs. This paper characterizes both quantity and content aspects of comprehensive sustainability programs, and finds its relationship with actual environmental performance outcomes. These findings provide empirical evidence for the importance of comprehensiveness as a salient feature to designing local sustainability programs

(Bae & Feiock, 2013; Daley et al., 2013; Krause, 2011). My findings also reinforce the notion that local governments could have an important role in designing effective environmental programs based on their own local knowledge and expertise (Ayre & Callway, 2005; Betsill & Bulkeley, 2006). Innovative environmental programs are more likely to be designed at the local level compared to the state and federal level because of less political resistance, smaller scale of investment needed, greater feasibility to collaborate with local businesses, NGOs, and community groups for better policy alternatives (Ayre & Callway, 2005; Daley et al., 2013). Moreover, their distinctive authorities to provide a variety of public services enable them to experiment with different types of policy instruments across a broad range of policy areas, from recycling to land use, and tailor them for better environmental performance outcomes.

Finally, this study finds the strong and positive spatial dependence in ozone quality improvements, suggesting that spillover effects may exist in local governments' sustainability efforts. That is, the environmental performance created from one county's policy effort may benefit other counties. The findings point to the importance of horizontal collaborations among neighboring governments through strategic alliances and regional networks (Feiock, 2013) to achieve superior environmental performance outcomes over time. While in the short term, local governments may also benefit from improved environmental quality within their communities, in the long run, these uncoordinated efforts may lead to inefficient outcomes because of their fragmented approaches (Feiock, 2013) associated with neighboring counties that continue to pollute. My findings provide public managers and policy makers with important policy implications about the importance of coordinating their local sustainability efforts.

Despite these contributions, this study also has some limitations. First, my research is bounded by relatively small sample size, 102 county governments. Since I rely on

ICMA's sustainability program survey to measure county governments' sustainability programs, sample group was limited to those responding to this survey. Future research would benefit by including more observations from municipalities, townships, and other types of local governments, while carefully matching their geographic jurisdictions with locations of EPA's air quality stations.

Moreover, the findings are somewhat constrained in their ability to determine casual relationships between presence of sustainability programs and changes in environmental quality over time because the ICMA survey data are limited in their ability to demonstrate a temporal order of sustainability programs. As local sustainability research has relatively short history, there has been very little scholarly effort to collect longitudinal data to examine changes in sustainability programs within a local government. For a more systematic analysis on the impact of local governments' sustainability programs, more panel data analyses are needed, even though the data demands for such studies can be significant. This paper helps set that stage by conducting the preliminary analysis using cross sectional data on local governments' sustainability programs.

Finally, this study identifies two distinctive design features that are related to environmental performance outcomes, the breadth of environmental issues and the breadth of policy instrument types. However, there might be other salient design features to consider, such as stringency of environmental standards, monitoring and enforcement mechanisms. Examining these sorts of design features would offer a richer explanation about variations in local governments' sustainability effort and more accurate prediction of their environmental performance outcomes. My hope is that the results of this analysis

serves as a basis for undertaking future research in this area as there is still much to learn about how the design of local governments' sustainability programs.

Chapter 5

DISCUSSION AND IMPLICATIONS

This research investigates the research question of (1) how design features of sustainability programs vary across US local governments, (2) which factors influence variations in program design, (3) how these factors are related to environmental quality outcomes in communities. My findings suggest that pressures from external stakeholders and variations in local governments' organizational capacities are related to local governments' decisions to pursue different types of sustainability strategies, which subsequently affect their environmental performance outcomes.

In my first essay, by assessing 70 local governments' sustainability programs, I find that although local governments might adopt the same number of sustainability programs, these programs are designed very differently. Some local governments design their sustainability programs more narrowly by focusing on a more limited number of environmental issues (e.g., recycling and internal government energy use) and constraining their policy instrument types (e.g., provision of services and infrastructure upgrade). However, other local governments design their sustainability programs more broadly by focusing on more environmental issues and incorporating more diverse types of policy instruments to address them. Findings suggest that local governments' sustainability programs are not designed equivalently.

The results of my first essay are a foundation for my second essay, which examines the question of why local governments pursue different types of sustainability strategies that lead to variations in design features of their sustainability programs. Building on previous management literature on organization's voluntary environmental strategy, I

categorized local governments into three types of sustainability strategies: reactive, middle-group, and proactive. By assessing the sustainability strategies of 1,146 US local governments, I find that pressures from new economy stakeholders, along with more robust organizational capacities are associated with local governments pursuing a proactive sustainability strategy (designing sustainability programs across greater breadth of environmental issues). On the other hand, external pressures from stakeholders in heavy polluting industries and limited organizational capacities are associated with local governments pursuing a reactive sustainability strategy (designing sustainability programs across narrower breadth of environmental issues). These findings imply that local governments assess their external and internal settings to frame their decision of which type of sustainability strategy makes most sense for them.

Finally, in my third essay, I provide the first empirical evidence of the environmental impact that local governments' sustainability programs have by analyzing 102 US county governments. Additionally, I find that for local governments that adopt the same number of programs, those that design their programs more comprehensively by addressing a broader array of environmental issues and using a more diverse set of policy instruments are more likely to improve their environmental conditions. These findings imply that local governments that pursue a proactive sustainability strategy (with more sustainability programs that cover a broader array of environmental issues and more diverse policy instruments) may lead to greater environmental performance outcomes compared to those pursuing other types of sustainability strategies.

Taken together, my dissertation responds to the increasing questions being asked by scholars and practitioners about why some local governments' sustainability programs

have been successful, while others have not. Given the importance of program design and its link with improved sustainability performance (Darnall & Kim, 2012), my findings have important implications for distinguishing among local governments' sustainability strategies. These differences might otherwise go unnoticed if I focused exclusively on the number of programs that they implement (Schaffrin et al., 2015).

My research also responds to growing concerns that more nuanced examinations are needed to understand variations in local governments' sustainability programs and how these variations affect environmental performance outcomes (Feiock & Coutts, 2013). My findings offer an optimistic view about the decentralized, non-regulatory policy approach that some US governments are using to improve environmental conditions in their local areas, and especially local governments that pursue proactive sustainability strategies. These findings reinforce the notion that when effective, local governments can play an important role in global environmental governance (Fiorino, 2010) particularly in an era where supportive national and international regime has been absent (Potoski, 2015). My research helps advance the policy debate toward a more productive discussion on how to design local sustainability programs for better policy outcomes.

REFERENCES

- Al-Saleh, Y., & Mahroum, S. (2015). A critical review of the interplay between policy instruments and business models: greening the built environment a case in point. *Journal of Cleaner Production*, 109(16), 260-270.
- Anselin, L., & Gallo, J. L. (2006). Interpolation of Air Quality Measures in Hedonic House Price Models: Spatial Aspects. *Spatial Economic Analysis*, 1(1), 31-52.
- Aragón-Correa, J. A. (1998). Strategic proactivity and firm approach to the natural environment. *Academy of management Journal*, 41(5), 556-567.
- Ayre, G., & Callway, R. (2005). Outcomes from the world summit for sustainable development. In G. Ayre & R. Callway (Eds.), *Governance for Sustainable Development* (pp. 114-142). London: Earthscan.
- Bae, J., & Feiock, R. (2013). Forms of Government and Climate Change Policies in US Cities. *Urban Studies*, 50(4), 776-788.
- Bai, X. (2007). Integrating global environmental concerns into urban management: the scale and readiness arguments. *Journal of Industrial Ecology*, 11(2), 15-29.
- Baker, I., Peterson, A., Brown, G., & McAlpine, C. (2012). Local government response to the impacts of climate change: An evaluation of local climate adaptation plans. *Landscape and urban planning*, 107(2), 127-136.
- Barnett, W. P., Greve, H. R., & Park, D. Y. (1994). An evolutionary model of organizational performance. *Strategic Management Journal*, 15(S1), 11-28.
- Barney, J. B., & Hansen, M. H. (1994). Trustworthiness as a source of competitive advantage. *Strategic management journal*, 15(S1), 175-190.
- Basu, K., & Palazzo, G. (2008). Corporate social responsibility: A process model of sensemaking. *Academy of management review*, 33(1), 122-136.
- Bengston, D. N., Fletcher, J. O., & Nelson, K. C. (2004). Public policies for managing urban growth and protecting open space: policy instruments and lessons learned in the United States. *Landscape and urban planning*, 69(2), 271-286.
- Berry, J. M., & Portney, K. E. (2013). Sustainability and interest group participation in city politics. *Sustainability*, 5(5), 2077-2097.
- Betsill, M. M., & Bulkeley, H. (2006). Cities and the multilevel governance of global climate change. *Global Governance: A Review of Multilateralism and International Organizations*, 12(2), 141-159.

- Borck, J. C., & Coglianese, C. (2009). Voluntary environmental programs: assessing their effectiveness. *Annual Review of Environment and Resources*, 34, 305-324.
- Bowen, F. E. (2002). Does size matter? *Business and Society*, 41(1), 118-124.
- Brody, S. D. (2003). Measuring the effects of stakeholder participation on the quality of local plans based on the principles of collaborative ecosystem management. *Journal of planning education and research*, 22(4), 407-419.
- Braun, R. (2007). Sustainability at the local level: Management tools and municipal tax incentive model. *Environment, Development and Sustainability*, 9(4), 387-411.
- Bryson, J. M., Cunningham, G. L., & Lokkesmoe, K. J. (2002). What to do when stakeholders matter: The case of problem formulation for the African American Men Project of Hennepin County, Minnesota. *Public Administration Review*, 62(5), 568-584.
- Buffardi, A. L., Pekkanen, R. J., & Smith, S. R. (2015). Shopping or specialization? Venue targeting among nonprofits engaged in advocacy. *Policy Studies Journal*, 43(2), 188-206.
- Bulkeley, H. (2010). Cities and the governing of climate change. *Annual Review of Environment Review*, 35, 229-253.
- Buysse, K., & Verbeke, A. (2003). Proactive environmental strategies: A stakeholder management perspective. *Strategic management journal*, 24(5), 453-470.
- Camagni, R., Capello, R., & Nijkamp, P. (1998). Towards sustainable city policy: an economy-environment technology nexus. *Ecological Economics*, 24(1), 103-118.
- Carley, S., & Miller, C. J. (2012). Regulatory stringency and policy drivers: A reassessment of renewable portfolio standards. *Policy Studies Journal*, 40(4), 730-756.
- Chan, C. K., & Yao, X. (2008). Air pollution in mega cities in China. *Atmospheric environment*, 42(1), 1-42.
- Chen, X., & Ye, J. (2015). When the wind blows: Spatial spillover effects of urban air pollution. *Environment for development discussion paper series* (Vol. 15): EfD.
- Collins, B. K., & Gerber, B. J. (2008). Taken for granted? Managing for social equity in grant programs. *Public Administration Review*, 68(6), 1128-1141.
- Collins, E., Roper, J., & Lawrence, S. (2010). Sustainability practices: trends in New Zealand businesses. *Business Strategy and the Environment*, 19(8), 479-494.

- Crawford-Brown, D., & Crawford-Brown, S. (2011). The precautionary principle in environmental regulations for drinking water. *Environmental science & policy*, 14(4), 379-387.
- Cubbage, F., Harou, P., & Sills, E. (2007). Policy instruments to enhance multi-functional forest management. *Forest Policy and Economics*, 9(7), 833-851.
- Daily, B. F., & Huang, S.-c. (2001). Achieving sustainability through attention to human resource factors in environmental management. *International Journal of Operations & Production Management*, 21(12), 1539-1552.
- Daley, D. M., & Garand, J. C. (2005). Horizontal diffusion, vertical diffusion, and internal pressure in state environmental policymaking, 1989-1998. *American Politics Research*, 33(5), 615-644.
- Daley, D. M., Sharp, E. B., & Bae, J. (2013). Understanding city engagement in community-focused sustainability initiatives. *Cityscape*, 15(1), 143-161.
- Darnall, N., & Kim, Y. (2012). Which types of environmental management systems are related to greater environmental improvements? *Public Administration Review*, 72(3), 351-365.
- Dietz, T., Gardner, G. T., Gilligan, J., Stern, P. C., & Vandenberg, M. P. (2009). Household actions can provide a behavioral wedge to rapidly reduce US carbon emissions. *Proceedings of the National Academy of Sciences*, 106(44), 18452-18456.
- Dietz, T., Ostrom, E., & Stern, P. C. (2003). The struggle to govern the commons. *science*, 302(5652), 1907-1912.
- Dietz, T., & Stern, P. C. (2002). Exploring new tools for environmental protection. In T. Dietz & P. C. Stern (Eds.), *New tools for environmental protection: Education, information, and voluntary measures* (pp. 1-16). Washington, DC: National Academy Press.
- Donaldson, T., & Preston, L. E. (1995). The stakeholder theory of the corporation: Concepts, evidence, and implications. *Academy of management Review*, 20(1), 65-91.
- Drukker, D. M., Prucha, I. R., & Raciborski, R. (2013). Maximum likelihood and generalized spatial two-stage least-squares estimators for a spatial-autoregressive model with spatial-autoregressive disturbances. *Stata Journal*, 13(2), 221-241.
- Dupuis, J., & Biesbroek, R. (2013). Comparing apples and oranges: the dependent variable problem in comparing and evaluating climate change adaptation policies. *Global Environmental Change*, 23(6), 1476-1487.

- Edwards, D. D., & Darnall, N. (2010). Averting environmental justice claims? The role of environmental management systems. *Public Administration Review*, 70(3), 422-433.
- Eesley, C., & Lenox, M. J. (2006). Firm responses to secondary stakeholder action. *Strategic Management Journal*, 27(8), 765-781.
- Eikenberry, A. M., & Kluver, J. D. (2004). The marketization of the nonprofit sector: Civil society at risk? *Public administration review*, 64(2), 132-140.
- Engel, K. (2006). State and local climate change initiatives: what is motivating state and local governments to address a global problem and what does this say about federalism and environmental law. *Urb. Law.*, 38, 1015-1026.
- Engel, K. H., & Orbach, B. Y. (2008). Micro-motives and state and local climate change initiatives. *Harv. L. & Pol'y Rev.*, 2, 119-137.
- English, M. R. (2000). Who are the stakeholders in environmental risk decisions? *Risk: Health, Safety & Environment* 11, 243-254.
- Environmental Protection Agency (2014). *Health risk and exposure assessment for ozone*. (EPA-452/R-14-004a). Retrieved from <https://www3.epa.gov/ttn/naaqs/standards/ozone/data/20140829healthrea.pdf>.
- Feiock, R. C. (2013). The institutional collective action framework. *Policy Studies Journal*, 41(3), 397-425.
- Feiock, R. C., & Coutts, C. (2013). Guest Editors' Introduction: Governing the Sustainable City. *Cityscape*, 15(1), 1-7.
- Fiorino, D. J. (1999). Rethinking environmental regulation: perspectives on law and governance. *Harv. Envtl. L. Rev.*, 23, 441.
- Fiorino, D. J. (2004). Flexibility. In R. F. Durant, D. J. Fiorino, & Rosemary O'Leary (Eds.), *Environmental Governance Reconsidered: Challenges, Choice and Opportunities* (pp. 393-425). Cambridge, MA: MIT Press.
- Fiorino, D. J. (2010). Sustainability as a conceptual focus for public administration. *Public Administration Review*, 70(s1), s78-s88.
- Florida, R. (2005). *Cities and the creative class*. New York, NY: Routledge.
- Frame, B. (2008). 'Wicked', 'messy', and 'clumsy': long-term frameworks for sustainability. *Environment and Planning C: Government and Policy*, 26(6), 1113-1128.

- Freeman, R. E. (2010). *Strategic management: A stakeholder approach*. New York, NY: Cambridge University Press.
- Gaines, S. E., & Katz, R. (2002). Nonregulatory Approaches to Environmental Protection for Cuba: Lessons from the United States and Chile. *Tul. Envtl. LJ*, 16, 831-861.
- Gan, L., Eskeland, G. S., & Kolshus, H. H. (2007). Green electricity market development: Lessons from Europe and the US. *Energy Policy*, 35(1), 144-155.
- Greenstone, M. (2004). Did the Clean Air Act cause the remarkable decline in sulfur dioxide concentrations? *Journal of environmental economics and management*, 47(3), 585-611.
- Gunningham, N., & Sinclair, D. (1999). Regulatory pluralism: Designing policy mixes for environmental protection. *Law & Policy*, 21(1), 49-76.
- Halpin, D. R., & Thomas III, H. (2012). Evaluating the breadth of policy engagement by organized interests. *Public Administration*, 90(3), 582-599.
- Hart, S. L., & Milstein, M. B. (2003). Creating sustainable value. *The Academy of Management Executive*, 17(2), 56-67.
- Hawkins, C. V., Krause, R. M., Feiock, R. C., & Curley, C. (2016). Making meaningful commitments: Accounting for variation in cities' investments of staff and fiscal resources to sustainability. *Urban Studies*, 53(9), 1902-1924.
- Hirsch, D. D. (2001). Symposium Introduction: Second Generation Policy and the New Economy. *Cap. UL Rev.*, 29(1), 13-14.
- Hood, C. (2007). Intellectual obsolescence and intellectual makeovers: Reflections on the tools of government after two decades. *Governance*, 20(1), 127-144.
- Howlett, M. (2009a). Governance modes, policy regimes and operational plans: A multi-level nested model of policy instrument choice and policy design. *Policy Sciences*, 42(1), 73-89.
- Howlett, M. (2009b). Policy analytical capacity and evidence-based policy-making: Lessons from Canada. *Canadian public administration*, 52(2), 153-175.
- Howlett, M. (2011). Public managers as the missing variable in policy studies: An empirical investigation using Canadian data. *Review of Policy Research*, 28(3), 247-263.

- Jacobsen, G. D., Kotchen, M. J., & Clendenning, G. (2013). Community-based incentives for environmental protection: the case of green electricity. *Journal of Regulatory Economics*, 44(1), 30-52.
- Jacquemin, A. P., & Berry, C. H. (1979). Entropy measure of diversification and corporate growth. *The Journal of Industrial Economics*, 359-369.
- Ji, H., Ahn, J., & Chapman, J. (2015). The role of intergovernmental aid in defining fiscal sustainability at the sub-national level. *Urban Studies*, 0042098015601600.
- John, D. (1994). Civic environmentalism. *Issues in Science and Technology*, 10(4), 30-34.
- Jordan, A., Wurzel, R. K., & Zito, A. (2005). The rise of 'new' policy instruments in comparative perspective: has governance eclipsed government? *Political studies*, 53(3), 477-496.
- Kaufmann-Hayoz, R., Bättig, C., Bruppacher, S., Defila, R., Di Giulio, A., Flury-Kleubler, P., . . . Jäggi, C. (2001). A typology of tools for building sustainability strategies. In R. Kaufmann-Hayoz & H. Gutscher (Eds.), *Changing things-Moving people* (pp. 33-108). Birkhäuser Vera, Basely, Switzerland: Springer.
- Kelejian, H. H., & Prucha, I. R. (1998). A generalized spatial two-stage least squares procedure for estimating a spatial autoregressive model with autoregressive disturbances. *The Journal of Real Estate Finance and Economics*, 17(1), 99-121.
- Kemp, R. (2000). *Technology and Environmental Policy—Innovation effects of past policies and suggestions for improvement Innovation and the Environment* (pp. 35-61). Paris, France: OECD.
- Kerr, R., Cosbey, A. J., & Yachnin, R. (1998). *Beyond regulation: Exporters and voluntary environmental measures: International Institute for Sustainable Development*, Winnipeg.
- Koski, C. (2007). Examining state environmental regulatory policy design. *Journal of Environmental Planning and Management*, 50(4), 483-502.
- Kim, Y., & Darnall, N. (2015). Business as a Collaborative Partner: Understanding Firms' Sociopolitical Support for Policy Formation. *Public Administration Review*.
- Knill, C., Schulze, K., & Tosun, J. (2012). Regulatory policy outputs and impacts: Exploring a complex relationship. *Regulation & Governance*, 6(4), 427-444.

- Kollmuss, A., & Agyeman, J. (2002). Mind the gap: why do people act environmentally and what are the barriers to pro-environmental behavior? *Environmental education research*, 8(3), 239-260.
- Kosloff, L. H., Trexler, M. C., & Nelson, H. (2004). Outcome-oriented leadership: how state and local climate change strategies can most effectively contribute to global warming mitigation. *Widener LJ*, 14(1), 173-204.
- Krause, R. M. (2011). Symbolic or substantive policy? Measuring the extent of local commitment to climate protection. *Environment and Planning C: Government and Policy*, 29(1), 46-62.
- Krause, R. M., Feiock, R. C., & Hawkins, C. V. (2016). The administrative organization of sustainability within local government. *Journal of Public Administration Research and Theory*, 26(1), 113-127.
- Krueger, R., & Gibbs, D. (2007). *The sustainable development paradox: urban political economy in the United States and Europe*. New York, NY: Guilford Press.
- Kuh, K. F. (2008). Using Local Knowledge to Shrink the Individual Carbon Footprint. *Hofstra L. Rev.*, 37, 923-941.
- Lafferty, W., & Hovden, E. (2003). Environmental policy integration: towards an analytical framework. *Environmental politics*, 12(3), 1-22.
- Lane, M. B., & Morrison, T. H. (2006). Public interest or private agenda?: A meditation on the role of NGOs in environmental policy and management in Australia. *Journal of rural studies*, 22(2), 232-242.
- Lee, T., & Koski, C. (2012). Building green: local political leadership addressing climate change. *Review of Policy Research*, 29(5), 605-624.
- Li, L., & Geiser, K. (2005). Environmentally responsible public procurement (ERPP) and its implications for integrated product policy (IPP). *Journal of Cleaner Production*, 13(7), 705-715.
- Li, Y., Vanhaverbeke, W., & Schoenmakers, W. (2008). Exploration and exploitation in innovation: Reframing the interpretation. *Creativity and innovation management*, 17(2), 107-126.
- Lin, H., & Darnall, N. (2015). Strategic alliance formation and structural configuration. *Journal of Business Ethics*, 127(3), 549-564.
- Logan, J. R., & Molotch, H. (2007). *Urban fortunes: The political economy of place*. Los Angeles, CA: University of California Press.

- Long, B. L. (1997). *Environmental regulation: The third generation*. The OECD Observer, 206 (June-July), 14-18.
- Luft Mobus, J. (2005). Mandatory environmental disclosures in a legitimacy theory context. *Accounting, Auditing & Accountability Journal*, 18(4), 492-517.
- Lundberg, J. (2007). Lifting the crown—citation z-score. *Journal of informetrics*, 1(2), 145-154.
- Lutsey, N., & Sperling, D. (2008). America's bottom-up climate change mitigation policy. *Energy policy*, 36(2), 673-685.
- Mahdavi, S., & Westerlund, J. (2011). Fiscal stringency and fiscal sustainability: Panel evidence from the American state and local governments. *Journal of Policy Modeling*, 33(6), 953-969.
- Mani, M., & Wheeler, D. (1998). In search of pollution havens? Dirty industry in the world economy, 1960 to 1995. *The Journal of Environment & Development*, 7(3), 215-247.
- March, J. G. (1991). Exploration and exploitation in organizational learning. *Organization science*, 2(1), 71-87.
- Martens, P. (2006). Sustainability: science or fiction? *Sustainability: Science, Practice, & Policy*, 2(1), 36-41.
- Matland, R. E. (1995). Synthesizing the implementation literature: The ambiguity-conflict model of policy implementation. *Journal of Public Administration Research and Theory*, 5(2), 145-174.
- Mckenzie-Mohr, D. (2000). New ways to promote proenvironmental behavior: Promoting sustainable behavior: An introduction to community-based social marketing. *Journal of social issues*, 56(3), 543-554.
- Meyer, J. W., & Rowan, B. (1977). Institutionalized organizations: Formal structure as myth and ceremony. *American journal of sociology*, 80, 340-363.
- Michaels, R. J. (2008). National renewable portfolio standard: smart policy or misguided gesture. *Energy LJ*, 29, 79-119.
- Miles, R. E., Snow, C. C., Meyer, A. D., & Coleman, H. J. (1978). Organizational strategy, structure, and process. *Academy of management review*, 3(3), 546-562.
- Moffet, J., Bregha, F., & Middelkoop, M. J. (2004). Responsible care: a case study of a voluntary environmental initiative. In K. Webb (Ed.), *Voluntary codes: Private*

- governance, the public interest and innovation* (pp. 177-208). Ottawa, Canada: Carleton Research Unit for Innovation, Science and Environment.
- Moynihan, D. P. (2008). Learning under uncertainty: Networks in crisis management. *Public Administration Review*, 68(2), 350-365.
- Nelson, K. L., & Svara, J. H. (2012). Form of government still matters: Fostering innovation in US municipal governments. *The American Review of Public Administration*, 42(3), 257-281.
- Nutt, P. C., & Backoff, R. W. (1993). Organizational publicness and its implications for strategic management. *Journal of Public Administration Research and Theory*, 3(2), 209-231.
- O'Connell, M. A., & Noss, R. F. (1992). Private land management for biodiversity conservation. *Environmental Management*, 16(4), 435-450.
- Oates, W. E. (1999). An essay on fiscal federalism. *Journal of economic literature*, 37(3), 1120-1149.
- Outka, U., & Feiock, R. (2011). Local promise for climate mitigation: an empirical assessment. *Wm. & Mary Env'tl. L. & Pol'y Rev.*, 36(3), 635-670.
- Owen, A. L., & Videras, J. (2008). Trust, cooperation, and implementation of sustainability programs: The case of Local Agenda 21. *Ecological Economics*, 68(1), 259-272.
- Porter, M. E., & Kramer, M. R. (2006). Estrategia y sociedad. *Harvard business review*, 84(12), 42-56.
- Porter, M. E., & Kramer, M. R. (2007). The Link Between Competitive Advantage and Corporate Social Responsibility. *Harvard business review*, 84(12), 78-92.
- Portney, K. E. (2003). *Taking sustainable cities seriously: Economic development, the environment, and quality of life in American cities*. Cambridge, MA: MIT Press.
- Posner, E. A., & Weisbach, D. (2010). *Climate change justice*. Princeton, NJ: Princeton University Press.
- Potoski, M. (2015). Green clubs in building block climate change regimes. *Climatic Change*, 1-11.
- Saha, D., & Paterson, R. G. (2008). Local government efforts to promote the "Three Es" of sustainable development survey in medium to large cities in the United States. *Journal of Planning Education and Research*, 28(1), 21-37.

- Sarkis, J., Gonzalez-Torre, P., & Adenso-Diaz, B. (2010). Stakeholder pressure and the adoption of environmental practices: The mediating effect of training. *Journal of Operations Management*, 28(2), 163-176.
- Schaffrin, A., Sewerin, S., & Seubert, S. (2015). Toward a Comparative Measure of Climate Policy Output. *Policy Studies Journal*, 43(2), 257-282.
- Schneider, A., & Ingram, H. (1993). Social construction of target populations: Implications for politics and policy. *American political science review*, 87(02), 334-347.
- Schultz, P. W. (2002). Knowledge, information, and household recycling: Examining the knowledge-deficit model of behavior change. In T. Dietz & P. Stern (Eds.), *New tools for environmental protection: Education, information, and voluntary measures* (pp. 67-82). Washington, DC: National Academy Press.
- Segev, E. (1989). A systematic comparative analysis and synthesis of two business-level strategic typologies. *Strategic Management Journal*, 10(5), 487-505.
- Selman, P., & Parker, J. (1997). Citizenship, civicness and social capital in Local Agenda 21. *Local Environment*, 2(2), 171-184.
- Selsky, J. W., & Parker, B. (2005). Cross-sector partnerships to address social issues: Challenges to theory and practice. *Journal of management*, 31(6), 849-873.
- Sharma, S. (2000). Managerial interpretations and organizational context as predictors of corporate choice of environmental strategy. *Academy of Management journal*, 43(4), 681-697.
- Sharma, S., & Vredenburg, H. (1998). Proactive corporate environmental strategy and the development of competitively valuable organizational capabilities. *Strategic management journal*, 19(8), 729-753.
- Sharp, E. B., Daley, D. M., & Lynch, M. S. (2010). Understanding local adoption and implementation of climate change mitigation policy. *Urban Affairs Review*, 47(3), 433-457.
- Simons, T., Pelled, L. H., & Smith, K. A. (1999). Making use of difference: Diversity, debate, and decision comprehensiveness in top management teams. *Academy of Management journal*, 42(6), 662-673.
- Singleton, S. (2000). Co-operation or capture? The paradox of co-management and community participation in natural resource management and environmental policy-making. *Environmental Politics*, 9(2), 1-21.

- Slater, S. F., & Mohr, J. J. (2006). Successful development and commercialization of technological innovation: insights based on strategy type. *Journal of Product Innovation Management*, 23(1), 26-33.
- Sovacool, B. K. (2009). The importance of comprehensiveness in renewable electricity and energy-efficiency policy. *Energy Policy*, 37(4), 1529-1541.
- Stead, D., & Meijers, E. (2009). Spatial planning and policy integration: Concepts, facilitators and inhibitors. *Planning Theory & Practice*, 10(3), 317-332.
- Stern, P. C. (2000). New environmental theories: toward a coherent theory of environmentally significant behavior. *Journal of social issues*, 56(3), 407-424.
- Steurer, R. (2011). Soft instruments, few networks: How 'New Governance' materializes in public policies on corporate social responsibility across Europe. *Environmental Policy and Governance*, 21(4), 270-290.
- Stevens, C. (2010). Linking sustainable consumption and production: The government role. *Natural Resources Forum*, 34(1), 16-23.
- Stewart, R. B. (1993). Environmental regulation and international competitiveness. *The Yale Law Journal*, 102(8), 2039-2106.
- Stewart, R. B., & Wiener, J. B. (1992). Comprehensive Approach to Global Climate Policy: Issues of Design and Practicality, The. *Ariz. J. Int'l & Comp. L.*, 9(1), 83-130.
- Sussman, E. (2007). Building stock offers opportunities to foster sustainability and provides tools for climate change mitigation and adaption. *Sustainable Development Law & Policy*, 7(3), 17-21.
- Svara, J. H. (2011). The early stage of local government action to promote sustainability. *The Municipal Year Book*, 2011, 43-60.
- Swann, W. L. (2016). Examining the Impact of Local Collaborative Tools on Urban Sustainability Efforts Does the Managerial Environment Matter? *The American Review of Public Administration*.
- Terman, J. N., & Feiock, R. C. (2015). Improving outcomes in fiscal federalism: Local political leadership and administrative capacity. *Journal of Public Administration Research and Theory*, 25(4), 1059-1080.
- Underdal, A. (1980). Integrated marine policy: what? why? how? *Marine Policy*, 4(3), 159-169.

- Vogel, R. K., & Swanson, B. E. (1989). The Growth Machine versus the Antigrowth Coalition The Battle for our Communities. *Urban Affairs Review*, 25(1), 63-85.
- Walker, W. E., Rahman, S. A., & Cave, J. (2001). Adaptive policies, policy analysis, and policy-making. *European journal of operational Research*, 128(2), 282-289.
- Wang, X., Hawkins, C. V., Lebrede, N., & Berman, E. M. (2012). Capacity to Sustain Sustainability: A Study of U.S. Cities. *Public Administration Review*, 72(6), 841–853.
- Wheeler, S. M. (2008). State and municipal climate change plans: the first generation. *Journal of the American Planning Association*, 74(4), 481-496.
- Wiener, J. B. (2007). Think globally, act globally: the limits of local climate policies. *University of Pennsylvania Law Review*, 155(6), 1961-1979.
- Woods, N. D., & Potoski, M. (2010). Environmental Federalism Revisited: Second-Order Devolution in Air Quality Regulation. *Review of Policy Research*, 27(6), 721-739.
- Wooldridge, J. M. (2003). Further results on instrumental variables estimation of average treatment effects in the correlated random coefficient model. *Economics letters*, 79(2), 185-191.
- Yaffee, S. L., & Wondolleck, J. M. (2000). Making collaboration work: lessons from a comprehensive assessment of over 200 wideranging cases of collaboration in environmental management. *Conservation in Practice*, 1(1), 17-24.
- Yanarella, E. J., & Levine, R. S. (2008). Research and solutions: Don't pick the low-hanging fruit! Counterintuitive policy advice for achieving sustainability. *Sustainability: The Journal of Record*, 1(4), 256-261.
- Young, D. R. (2000). Alternative models of government-nonprofit sector relations: Theoretical and international perspectives. *Nonprofit and voluntary sector quarterly*, 29(1), 149-172.
- Zahran, S., Grover, H., Brody, S. D., & Vedlitz, A. (2008). Risk, stress, and capacity explaining metropolitan commitment to climate protection. *Urban affairs review*, 43(4), 447-474.
- Zeemering, E. S. (2009). What does sustainability mean to city officials? *Urban Affairs Review*, 45(2), 247-273.