

Policy Innovation for an Uncertain Future:
Regulating Drone Use in Southern California Cities

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ABSTRACT

Over the past six years, the use of drones for recreational and commercial purposes has increased dramatically. There are currently over one million registered drones in the United States, and this number is expected to increase in the foreseeable future. For now, drones are a local phenomenon. The operational limitations prevent them from long range activity and federal policies prevent them from operating beyond the visual line of sight of the controller. The localized nature of drone operation makes them a particularly salient issue at the local regulatory level. At this level, cities must contend with the uncertainty of drone operation and a complex regulatory environment. Within a single metropolitan region, there are cities that may attempt to restrict the use of drones through various local ordinances while neighboring cities may have not even considered, let alone adopted, any type of regulation. The reasons behind these policy choices are not clear.

In an effort to understand the factors involved in the decisions to adopt a local drone use policy, this dissertation leverages qualitative methods to analyze the policy process leading to local decisions. The study capitalizes on rich contextual data gathered from a variety of sources for select cities in Orange and Los Angeles Counties. Specifically, this study builds a conceptual framework from policy innovation literature and applies it in the form of content analysis. This initial effort is used to identify the catalysts for policy discussion and the specific innovation mechanisms that support or detract from the decision to adopt a local drone use ordinance. Then, qualitative comparative analysis is used to determine which configuration of factors, identified during the content analysis, contribute to the causal path of policy adoption. Among other things, the results highlight the role that uncertainty plays in the policy process. Cities that adopt a drone use ordinance have low levels of uncertainty, high numbers of registered drone users, and at least two neighboring

cities that also have drone use policies. This dissertation makes a modest contribution to policy innovation research, highlights how a configurational analysis technique can be applied to policy adoption decisions, and contains several recommendations for regulating drone use at the local level.

DEDICATION

To my family, who have supported me throughout this journey.

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TABLE OF CONTENTS

	Page
LIST OF TABLES	VIII
LIST OF FIGURES	IX
CHAPTER	
1 INTRODUCTION TO THE DISSERTATION	10
Research Gap and Identification of the Problem.....	11
Research Questions.....	14
Significance of the Research	16
Preview of the Chapters	18
2 THE POLICY INNOVATION LITERATURE AND METHODOLOGICAL PRIMERS	21
Policy Innovation: A Brief History	24
Policy Innovation: Theory and Models.....	29
Policy Innovation Study Contexts	43
Quantitative Models of Policy Innovation	47
Qualitative Analysis of Policy Innovation	48
Limitations of Existing Research	50
Methods Overview	53
3 RESEARCH DESIGN	63
Post-positivism and Policy Research	65
Conceptual Framework	66
The Current State of Drone Use Regulation.....	78

CHAPTER	Page
Data	82
Analytic Approach.....	86
A Note on Validity	87
Conclusion.....	89
4 CATALYSTS FOR CONCERN AS DRIVERS OF DISCUSSION.....	91
Introduction	91
Technology and the Good Society.....	93
Emerging Technologies.....	97
Drone Policy Context	103
Methods	105
Findings.....	107
Discussion.....	112
Conclusion.....	114
5 INFLUENTIAL FACTORS IN DRONE USE POLICY ADOPTION	116
Introduction	116
Literature Review.....	120
Method.....	127
Results	132
Discussion.....	155
Conclusion.....	159
6 QUALITATIVE COMPARATIVE ANALYSIS APPLIED TO POLICY INNOVATION	162

CHAPTER	Page
Introduction	162
The Complex Process of Drone Use Technology Policy.....	166
Addressing Drone Use Policy Using QCA.....	169
Analysis	172
Results	180
Discussion.....	185
Limitations.....	189
Conclusion.....	191
7 CONCLUSIONS AND DISCUSSION.....	192
An Approach to Drone Governance	196
What Drives the Spread of Emerging Technology Policy Adoption?.....	198
The Role of Uncertainty in Policy Adoption Decisions.....	202
An Alternative Approach to Policy Innovation Research.....	204
BIBLIOGRAPHY	206
APPENDIX	
A. INTERVIEW PROTOCOL.....	223
B. CODING PROTOCOL USE FOR THE CONTENT ANALYSIS	225
C. THE NUMBER OF RECREATIONAL AND COMMERCIAL DRONE OPERATORS IN LOS ANGELES AND ORANGE COUNTY.....	228
D. DATA TABLE FOR THE SAMPLE OF CITIES USED IN THE QCA.....	231
E. THE INTERMEDIATE SOLUTION FOR THE NEGATION OF AN ORDINANCE.	233

LIST OF TABLES

Table	Page
1 Example Truth Table with Three Conditions.....	58
2 Data Table Listing the Sample of Cities Used in the Analysis.....	84
3 List of Cities which had Publicly Available City Council Meeting Recordings of Drone Policy Discussion.....	107
4 Summary of Themes Derived from the City Council Meeting Review	108
5 List of Cities, the Data Type, Analysis and Whether the City has an Ordinance.	130
6 Details on the Most Frequently Mentioned Internal Determinants and Diffusion Mechanisms Identified by Adopting and Non-adopting Cities.....	133
7 Frequency of Diffusion Mechanisms and Internal Determinants Based on the Content Analysis.....	173
8 Coding Protocol for Influential and Frequently Identified Codes.....	174
9 Descriptive Statistics and Calibration for the Conditions Used in Causal Path.....	179
10 Truth Table for the Causal Conditions	180
11 Intermediate and Parsimonious Causal Paths with Descriptive Measures for Evaluating Strength of Support.....	181

LIST OF FIGURES

Figure	Page
1 Example Minimization Procedure. Each Box Represents a Configuration that is Sufficient for the Outcome of Interest.	60
2 The Number of Drone Use Policy Adopters by Year in Los Angeles and Orange County.....	81
3 Study Area and Sample Cities (red outline) for this Study.	82
4 Interactions Among Ethics, Regulation and Governance of Technology.....	97
5 The Percent of the Total Number of Recreational and Commercial Drones Registered by County.....	105
6 The Study Area and the Cities that are Associated with the Two Main Causal Paths	185

CHAPTER 1

INTRODUCTION TO THE DISSERTATION

Over the past several years, unmanned aerial vehicle (UAV, hereafter referred to as drones) use in the United States and abroad has gained momentum. This is occurring across a variety of application areas. Governments can use drones to monitor jurisdictions, hobbyists build and race them, and companies are researching how they can be used for goods and service delivery. Perhaps as a testament to the breadth of their applicability, the way in which drones are regulated has been questioned since this broader introduction. While the word “drone” is now a widely known term, the concept of using unmanned aircraft to gain geospatial intelligence is a novel advancement in many of these application areas. In the past, drone use has taken place under the auspices of military and mapping applications. Recently, however, technology has progressed to the point where consumer grade drones capable of advanced and remote operation for surveillance is readily available. Along with this growth in capability and availability, policy questions are emerging related to drone regulation. In particular, the use of drones bring about questions of ethics, especially related to public safety and privacy. As a result, considerable policy activity has taken place at all levels of government. At the federal level, the Federal Aviation Administration (FAA) has been tasked with the design and implementation of policies for drone use with the majority of the specific drone regulations aimed at commercial operation.

The focus on commercial drone operation by the FAA has left open many questions on the regulation of recreational drone use. In fact, recreational drone use is likely the largest concern at the city and state level of governance. Over the past several years city and state policy makers have been actively deciding on the implementation of recreational drone use

regulations. If and when they do, cities face significant uncertainty in how and to what extent the operation of recreational drone use can/should be regulated. Perhaps in response to this realization, a discontinuous policy landscape is evolving. It is at the point where some cities have created drone use regulations aimed at strict “no drone zone” policies while other cities have no regulation at all. What explains these policy discrepancies is not yet clear.

Research Gap and Identification of the Problem

Drones have many—if not all—the characteristics of an emerging technology. They have broad application areas, large potential for economic and social change and are shrouded in uncertainty. The uncertainty comes in the form of not knowing exactly who is going to be using drones and what they will be used for. Moreover, it is unclear where drones will be used in the future, in a geographic and economic sense. Whereas policy decisions for well-known topics are difficult and complicated in-and-of-themselves, drone policy is complex because of the added uncertainty that comes with new and emerging technologies. The lack of similar technologies that often provide some sort of model for decision makers to draw upon is also absent. The city attorney from Hermosa Beach, California put it best when he described drones and the policy surrounding their use as “unchartered waters.” That said, it should come as no surprise that very little has been done to explain how drone use policy is being crafted and the factors that determine the decision to adopt them.

There are two theoretical frameworks commonly used to explain policy adoption decisions. They are the internal determinants model and policy diffusion models, collectively termed as models of policy innovation. Researchers use these models to explain determine the factors that influence a jurisdictions decision to adopt a policy. Diffusion models seek to

isolate the processes which are significant in the spread of similar policies from one jurisdiction to another. The internal determinants models suggest that there are a series of variables that make it more or less likely a city will adopt a policy. A great majority of the policy areas studied by innovation scholars occur at the state or national level, covering everything from social to environmental policies. Less work has taken place on local policy and even fewer have focused on emerging technologies. Some scholars suggest the dearth is due in part to low policy salience at the local level. That is, local level policies are simply not as interesting to study. In addition, there is also the possibility of federal or state policy preemption. A local policy that attempts to address a situation in a way that is more restrictive than a policy at a higher level of government is often ruled moot if taken to court. Yet the policies at the local level are the ones that individuals are most likely to interact with on a day-to-day basis and furthermore, are on the front lines when it comes to this new wave of local emerging technology. The lack of research on local policy and emerging technology has left a noticeable gap in policy innovation literature.

From a methodological perspective, policy innovation researchers predominately take a quantitative approach. For many years, researchers have been working to understand the individual independent effects of diffusion and internal determinants on the policy adoption process using increasingly advanced statistical methods. The current approach, par excellence, is a form of pooled cross sectional analysis. Coined as event history analysis it was first introduced by Berry and Berry in 1990 and has come to be the most common way to explain the effects of internal determinants and policy diffusion on policy adoption. However, the limitations of its use are widely recognized. Many scholars have noted the difficulty in precisely measuring the strength of policy innovation and in the same vein, note

the difficulty in teasing apart all the possible mechanisms of diffusion. Furthermore, many studies hypothesize and test for interactions between diffusion mechanisms and internal determinants but are limited in their ability to fully address multiple interactions and mostly assume linear relationships. After years of study, it turns out that the policy innovation process is increasingly complicated. What is true for one policy context is not guaranteed to be true in another. There are a variety of unique factors that influence the decision to adopt policies and many of these can interact in ways that are not obvious when viewed through a purely quantitative lens. This dissertation holds that a more holistic picture of the policy innovation context can be achieved through alternative methods that are better suited for identifying the nuances of policy adoption within the context in which it is made.

This study sets out to gain a better understanding of the factors contributing to the adoption of emerging technology policy at the local level using drones as a proxy for emerging technologies. It achieves this by first acknowledging the pitfalls of existing approaches to policy innovation research and taking an alternative, qualitative methodology. In doing so, the potential effect of multiple factors that configure in unique ways and result in policy adoption decisions can be realized. As will be explained in detail in the following chapters, content analysis combined with qualitative comparative analysis (QCA) is well suited to analyze the complex configuration of factors that are hypothesized to lead to an outcome of interest across cases. For this work, the outcome of interest is drone use policy adoption at the local level. QCA has been growing in use over the past several years but has yet to be applied to the context of policy innovation. To this extent, this study offers a fresh approach to the study of policy adoption using a topic which has also yet to be addressed in the literature.

Research Questions

The central question of this research is: what leads to drone use policy adoption in cities? While simple, the study of drones also provides some important insights into emerging technology policy adoption in general. Implicit in the study of emerging technology is understanding the role that uncertainty plays and how to best address the complexity involved in the decision to adopt a drone use policy. In setting out to answer this question, several additional questions are explored in this dissertation. Together, the answers provide a more complete picture of the integration of drones into society:

- What are the primary concerns that begin the discussion of a drone use policy?
- What are the main policy innovation processes that influence drone use policy adoption decisions?
- What is the role of uncertainty in drone use policy adoption?
- How does the existence of uncertainty in the policy process combine with diffusion and internal determinants to support or detract from the adoption of a drone use policy?

To narrow the scope of these questions this dissertation focuses on two counties in Southern California: Orange and Los Angeles. This serves several purposes. First, drone use across the United States is rapidly increasing in heavily urbanized areas. These two counties are incredibly populous and heavily urbanized, providing a generalizability angle. Second, these two counties have some of the highest number of registered drone users in the United States. As a result, drone use policy in these counties has been actively taking place since 2014. Third, the mix of socio-economics in this region supports the transferability of these

findings to other urbanized regions that are currently facing an increase in drone use or will be in the near future.

This dissertation answers the research questions by analyzing media and documents related to city council decisions to adopt a drone use ordinance. Since the broader introduction of drones in the United States, and beginning at about the time that the Section 333 exemption process was released with the 2012 FAA Modernization and Reform Act (FMRA, (FAA, 2012)), cities began their discussions of drone use ordinances. The original FMRA lacked any regulation for recreational drone use. Rather, it merely offered a set of safety guidelines for recreational drone use operation. At the onset of the drone revolution, the FAA was, and in many ways still is, more interested in the safe integration of *commercial* drones into U.S. airspace. This focus is supported by the growing interest of commercial entities to use drones for longer distance goods and services delivery. Interestingly, privacy and trespass rules were surprisingly absent from the 2012 FMRA. This placed the regulatory burden and questions of ethical drone use on the states and local municipalities. The catch here was that any state or local rule could not stray too far into the domain of the FAA. States and local rules could not regulate the airspace by restricting where/how drones could fly, denote operational limits within a city or above landmarks, or enact ordinances requiring special equipment or training. Doing so would risk federal preemption if it were to ever be challenged in a court of law.

The FMRA has since been revisited. There was an update in 2016 when the FAA added the Part 107 rule. This made the process of obtaining a commercial flight certification easier and much more widely available. At about this same time the FAA was starting to clarify where local ordinances fit into the larger drone regulatory environment. There were,

and still are, three basic options. One was to codify the FAA recreational safety guidelines into a local ordinance. This option gave local law enforcement the ability to enforce errant operators but was limited by the fact that only the safety guidelines could be enforced. Second, cities could restrict where drones took off and landed from because this fell within the local land-use and management jurisdiction. Lastly, cities could modify existing privacy and trespass rules to explicitly include drone use. Within Southern California all three of these options exist in addition to situations where cities do not have any policy at all.

There are 118 incorporated cities in the two counties of interest and from that 24 have been selected as the study sample. All of these cities have extensive qualitative data surrounding the drone use ordinance decision in the form of city council meetings, staff reports, and other supporting information. The data is analyzed using two methods, qualitative content analysis and qualitative comparative analysis and the conceptual framework guiding the analysis draws from the literature on policy innovation and emerging technologies. The use of two distinct methods serves two purposes. First, the content analysis is used to identify the presence and influence of policy innovation factors that are influential in the decision to either adopt or not adopt a drone use policy. Second, the factors identified in the content analysis are leveraged to support their theoretical and practical inclusion as possible conditions that lead to a policy adoption decision. The second method, QCA, is used to analyze how these conditions configure to form causal paths towards policy adoption.

Significance of the Research

The study of city decisions to adopt drone use regulation is important for several reasons. At the broadest level, this study considers drones to be an example of an emerging

technology. To this extent, the study of drone use regulation offers a glimpse into influential processes involved in local level policy adoption for emerging technologies. This is important because more technologies that share the characteristics of emerging technologies will continue to be developed and introduced for use in day-to-day life. The policies must take on an inherent balancing act—one that considers the potential for economic and social benefits while keeping in mind the potential negative consequences of their use. The present study offers a chance to document this balancing act and further our understanding of the relevant concerns from the policy makers and the public, the role that these factors play in the emerging technology policy process, and ultimately provide insight into how these types of policies will be transferred from city to city in the future.

Relatedly, cities represent the lowest echelon of the policy making machine—often having to contend with top down influence from the state and federal level as well as bottom up through public opinion and outreach. They must also take into account hyper-local governance such as homeowner associations. Local policy innovation studies are relatively limited and this study provides another avenue for studying local policy adoption for a highly salient policy topic.

Next, the policy innovation literature has yet to cover emerging technology policy and much of this has to do with the limited number of examples to draw on. As will be demonstrated in the following chapters, one of the critical factors that any policy on emerging technology must contend with is the inherent uncertainty regarding how the technology will be used, where it will be used, and who will be using it. Existing work on emerging technology policy tends to focus on the individual level factors related to the need for regulation such as the safety, health, and privacy concerns of citizen, but less is known

about the influence that uncertainty has on policy innovation. This study informs policy innovation research by identifying where the uncertainty is found during the policy adoption process and how that influences policy makers decisions to adopt (or not) a policy.

This research also aims at expanding the methodological approaches used to investigate questions of policy innovation. To this aim, it examines how qualitative comparative analysis can be used to gain a better understanding of the complexity that exists in the policy innovation process. It is particularly well suited to investigate unique configurations of conditions that lead to an outcome of interest. In the context of this study it will be used as a way to address which combination of diffusions mechanisms and internal determinants result in policy adoption.

Finally, policy innovation research, as a whole, tends to suffer from a pro-innovation bias. That is, policy innovation scholars focus on the factors that lead to policy *adoption*. Less is known about why, after having an item on the policy agenda, governments *do not* adopt a policy. The present study context offers a chance to investigate these two policy outcomes simultaneously. The juxtaposition offers an even more nuanced distinction between these policy adoption decisions and fresh insight to policy innovation scholarship.

Preview of the Chapters

This dissertation consists of three parts. Part 1 contains three chapters that introduce the reader to the conceptual framework and the research design. Chapter 1 provides an overview of the dissertation and details the research questions of interest, the methodological approach, and its significance. Chapter 2 provides a thorough review of the literature on policy innovation, emerging technologies, and the methods that are used for

data analysis. Chapter 3 details the research design, including the theoretical framework, an overview of the study context, data, and the analytic approach to the analysis.

Part 2 of this dissertation consists of three chapters. Each of these chapters provides an analysis of the drone use policy situation in Southern California. Together, these chapters provide the reader with a panoptic overview of the drone use policy process. Specifically, Chapter 4 is an open coding content analysis that explores the confluence of ethics, governance, and regulation of drones. It identifies the ethical concerns of policy makers and the public while characterizing which of these ethical concerns are the most important to address with the introduction of a new policy. Chapter 5 draws from the conceptual framework built from policy innovation and emerging technologies to guide the development of a coding protocol for the content analysis of data describing the factors involved in the city councils decisions to adopt a local drone use policy. The content analysis identifies the existence of a complex mix of diffusion mechanisms and internal determinants, as well as an explicit concern for the uncertainty that is present in various forms during the discussions of drone use policy. Chapter 6 rounds out Part 2 by using the findings and insights from Chapter 5 to inform the QCA analysis. The most factors identified in the analysis performed in Chapter 5 are support the inclusion of conditions that determine what the necessary and sufficient conditions for drone use policy adoption to occur.

Part 3 provides a conclusion and discussion of key results from each of the analyses. It briefly summarizes the findings and offers some practical insights to what explains transfer of drone use policy from one city to another. It also provides the reader with several practical and theoretical policy implications that can be used to guide future research on

emerging technology policy adoption as well as the role that diffusion, internal determinants, and uncertainty, factors into the decisions to adopt a drone use policy.

CHAPTER 2

THE POLICY INNOVATION LITERATURE AND METHODOLOGICAL PRIMERS

This dissertation examines the development and adoption of emerging technology policies through the lens of policy innovation. Emerging technologies can be broadly classified by their fast rate of growth, potential for economic and social change, expanding knowledge base, and broad areas of application (Cozzens et al., 2010). Many technologies can be described under this definition at some point during their onset, however some qualify more than others. Nano-, bio-, neuro-, nuclear, and more recently surveillance technology (Brossard & Nisbet, 2007; Giordano, 2012; Scheufele et al., 2007) are exemplary emerging technologies that scholars have used to deepen the understanding of the use implications associated with their broader introduction. Because emerging technology use and the associated risks and benefits are uncertain, social scientists have often focused on understanding how society responds to their use in an attempt to minimize the potential for negative public outcry (Cobb & Macoubrie, 2004; Scheufele et al., 2007).

Emerging technology scholars have been particularly interested in how the public views these technologies with respect to risks and benefits. This involves the investigation of individual perceptions via surveys (Scheufele & Lewenstein, 2005), measuring differences in attitude between expert and layperson (Corley, Scheufele, & Hu, 2009; Scheufele et al., 2007), and the identification of antecedents of opinion about the risks and benefits in relation to the broader public dissemination of the technology (Scheufele, Corley, Shih, Dalrymple, & Ho, 2008). Underpinning this effort is the notion that nanotechnology, biotechnology, and other emerging technology fields are/will be the defining technology of the 21st century (Besley, Kramer, & Priest, 2008; Corley et al., 2009). Researchers have touted

the importance of understanding public perceptions related to emerging technology because “public opinion is one of the key deciding factors of future governmental policies that could affect the international competitiveness of the United States” (Ho, Scheufele, & Corley, 2011). Public opinion can undoubtedly be swayed by a number of things, especially in-person interaction, anecdotes, media, and the opinion of subject matter experts (Sabatier, 1988; Siegrist, Keller, Kastenholz, Frey, & Wiek, 2007). Similarly, the perception of risk vs. benefit can also be influenced by these external factors which can polarize public debate, and ultimately influence how the emerging technology is regulated (Mandel, 2009).

One way to address the multitude of factors that affect emerging technology policy adoption decisions is through policy innovation. Policy innovation is broadly defined as the adoption of a policy new to the jurisdiction adopting it (Allen & Clark, 1981). There are two models in the policy innovation literature that receive the majority of attention, the internal determinants model and the diffusion model. Internal determinants models focus on the characteristics of local, state, or federal governments that are thought to be associated with policy adoption. They work to support or prevent a policy from being adopted. Often it is socioeconomic, demographic, or political factors that determine how feasible it is for a jurisdiction to adopt a policy. Policy diffusion models focus on the pathways that influence how the idea of the policy moves from one government to another. That is, diffusion models seek to understand the processes that influence how prior adoption of a policy alters the probability of adoption among the non-adopters (Maggetti & Gilardi, 2016).

Policy innovation studies have yet to address emerging technologies. This gap in policy innovation research is understandable given the dearth of readily available, highly salient, emerging technologies and the need for their governance. For example,

nanotechnology and other emerging technologies have largely been developed and used in laboratory settings or as part of a larger and better known technology. The use of nanotechnology is embedded in more commonly available goods and often obscured from its users. For example, nanotechnology is used in cloud computing infrastructure but many people do not think about it when uploading documents to the cloud. As another example, biotechnologies in the form of genetically modified organisms (GMO) have been in the public eye for quite some time. However, policies governing their use are created, implemented, and enforced at the federal level by the U.S. Department of Agriculture's Animal and Plant Health Inspection Service (Lynch & Vogel, 2001). While GMOs exist within the public lexicon, policy innovation studies addressing GMO policy would focus on the international level of government (Kuzma, Romanchek, & Kokotovich, 2008). Certainly interesting in their own right, these studies do not provide the insight required for the emerging technologies of today which are broadly available to consumers of all types.

New emerging technologies have been trickling into the public realm, many of which share in the characteristics of the classic emerging technologies just detailed. However, they are much more common and widely accessible by the general public. They are growing rapidly in use and many are quickly becoming the go-to technological solution for a number of application areas (Rathore, Ahmad, Paul, & Rho, 2016). One prime example are surveillance and computer technologies in the form of unmanned aerial systems, commonly referred to as drones.

Drone use policies are evolving at all levels of government (Gruber, 2015). The most interesting of which is occurring at the local level where the effects of increasing drone use are seen, felt, and heard about most readily. It is at the local level where this dissertation

takes place. In subsequent sections, the argument will be made that drones are indeed an emerging technology and by studying drones through a policy innovation conceptual framework a unique opportunity is presented. First, policy innovation studies have yet to address emerging technologies due in part to the reasons listed above. To that extent, drones offer a way to study emerging technology policy adoption as it is being developed *in-situ*. Second, due to the arguably limited direct public consumption of other emerging technologies, the policy research tends to be more hypothetical or only applicable to much higher (federal, international) levels of government. Drone use is a local phenomenon and studying drone use policy adoption provides a unique perspective on local-level policy innovation for a topic that is just beginning to come to fruition.

The next section provides a detailed review of the literature concerning policy innovation, emerging technology, and then reviews the current state of research on drone use and its associated policies. This background will provide the reader with a broad overview of the policy innovation field and elucidate some of the difficulties that policy innovation researchers face when addressing policies for emerging technologies, such as drones.

Policy Innovation: A Brief History

Research on policy innovation has developed over many decades and progressed steadily since it first began. The early 1960's saw a resurgence in policy innovation research following some of the earliest work on the impact of diffusion and municipal characteristics on policy adoption decisions (Key & Heard, 1949; McVoy, 1940). Where municipal characteristics are concerned, scholars like Dawson & Robinson (1963), Hofferbert (1966), and Walker (1969) were working to answer questions related to the socioeconomic,

demographic, and political factors that made it more or less likely for a state to adopt a policy. More specifically, these early investigations sought to uncover the institutional or environmental factors that shape a state's willingness to adopt a policy and/or effect the type of policy that is adopted. Dawson & Robinson (1963) are considered to be the purveyors of the first analysis of interrelationships between political party competition, socioeconomic conditions, and welfare policy outcomes. Their study concluded that the socioeconomic characteristics of the state are particularly influential when considering the adoption of welfare policies.

Closely following the analysis by Dawson and Robinson (1963) was Dye (1965) and Hofferbert (1966). Both Dye and Hofferbert focus on state level policy adoption to investigate the sociodemographic (Dye) and socioeconomic (Hofferbert) characteristics of states and their relation to policy outcomes. Hofferbert found little significance for the influence of socioeconomic characteristics and state political control, ultimately concluding that these variables had little to do with policy outcomes at the state level. On the other hand, Dye, in his investigation of the role that malapportionment has on policy outcomes, controlled for a handful of factors related to education, welfare, and tax policies.¹ After controlling for socioeconomic variables, malapportionment had no statistical influence, leading Dye to conclude that differences in policy adoption are a product of socioeconomic variability among states. Dye would go on to dive deeper into the analysis of these socioeconomic variables of the state and found more support for the importance of

¹ For education, this included items such as state spending annual staff salary, pupil-teacher ratio, and dropout rate. For welfare controls included average monthly payment per recipient, and local and state expenditures per capita. For tax policies, controls included tax revenue per capita, state revenue, and a breakdown of tax revenue by type (income, sales, alcohol and tobacco, and motor fuel).

economic development variables over political systems in shaping public policy in the states (Dye, 1966).

Around this same time, policy innovation researchers were recognizing the role that diffusion mechanisms also have on policy adoption (Crain, 1966; Katz, Hamilton, & Levin, 1963). Diffusion in these early studies referred to municipalities looking to one another for “advice” on policies. In particular, several diffusion mechanisms were posited to have an effect on policy innovation including emulation, spatial proximity, and competition. As these diffusion mechanisms became more specific, they were further conceptualized as the processes that facilitated policy transfer by formal or informal communication across different government jurisdiction. Early work by Crain (1966), provides support for the importance of geographic proximity on diffusion. Drawing from early theories on mass media effects and formal communication pathways (Coleman, Katz, & Menzel, 1957; Katz et al., 1963), Crain argued that diffusion will also occur through informal channels, and that communication delivered through those channels would precipitate more readily if the geographic distance between two municipalities was small. In effect, Crain was one of the first to formally test the geographic diffusion hypothesis and to a lesser extent, other diffusion mechanisms including emulation and learning (Crain, 1966). The geographic influence of diffusion was also supported by several seminal pieces by Brown. While not explicitly focused on policy adoption innovation, he did provide substantial evidence for the diffusion of innovations across space (Brown, 1969; Brown & Cox, 1971).

In 1969, Walker provided a comprehensive analysis of the innovation mechanisms in U.S. states (Walker, 1969). This was a path-breaking study as it acknowledge the role of both internal determinants and regional diffusion. Other path-breaking works continued to appear

throughout the 1970's, including the work by Gray (1973) who one of the first to address the regional diffusion mechanism through a regression based approach. More specifically, Gray took into account diffusion between states and highlighted the idiosyncrasies in policy making across states and policy areas. Another important contribution made during this time was by Grupp & Richards (1975), who focused on the type of policy and the idea of a policy leader. They surveyed top policy makers in each state for a variety of different policy areas to determine which state was seen as the leader for each policy area. Using Gini coefficients they were able to measure the level of consensus about a policy leader within each policy area. Their work provided researchers with additional insight into how learning from a policy leader and regional diffusion may begin to take shape. The work in this time period shed light on some of the more nuanced ways that diffusion can occur.

Diffusion and innovation research continued through the 1980's with more work advancing the methods and approaches used to address both models included in policy innovation. The majority of research during this time remained at the state level, tackling policy issues related to state energy, education, and tort law, just to name a few. Research during this time also expanded the methodological approaches used to address policy innovation. For example, Regens (1980) and Friedlander & Sawyer (1983) both focused on energy policy innovation using forms of discriminant analysis. They were both interested in specifying which set of internal factors relate to states that had and had not adopted energy policies. Other examples include step-wise regression in the study by Allen & Clark (1981), which focused on the importance of internal determinants for education policy innovation, and to a lesser extent, the differing effects of internal determinants on education policy adoption across innovation leaders and laggards.

An interesting characteristic shared by most of these studies was their strong focus on capturing the overall level of innovativeness by the states and then identifying the factors that these innovators had in common. In many ways this was an attempt to work towards a cohesive theory of policy innovation for strong innovators. The studies built off the early work by Walker (1969) and Savage (1978) to quantify the level of innovation of states. Interestingly, until the late 1980s the internal characteristics of the adopters were the most widely studied aspect of innovation studies (Friedlander & Sawyer, 1983). Diffusion was still difficult to formalize and some scholars were quick to point out the contradictory evidence produced by the studies on internal determinants (Savage, 1985). In particular they noted how the characteristics were not always consistent across different policy areas—something that is still seen in studies today.

In 1990, Berry and Berry published their seminal piece on the Unified Model of State Policy Diffusion. In it the authors combined the internal determinants and diffusion models to explain the influence that each have on a state's likelihood to adopt a new policy. As the name implies this model and the associated analysis was focused on state level policy making decisions, using a regression based form of pooled event history analysis. This methodology has been applied across a variety of policy areas and can safely be regarded as the method of choice when it comes to policy innovation. Notable policy areas where event history analysis (EHA) has been applied include tax policies (F. S. Berry & Berry, 1992), education (Mintrom & Vergari, 1998), social welfare (Emmert & Traut, 2003), and more recently “stand-your-ground” laws (Butz, Fix, & Mitchell, 2015). The original model has since undergone several iterations with various scholars molding its original formulation to improve upon the original model (Mooney, 2001). It continues to be utilized even in the most recent work (LaVenía,

Cohen-Vogel, & Lang, 2015) to isolate the independent effects of internal determinants and the role of regional diffusion (Bouché & Wittmer, 2015).

Policy innovation in the 21st century has expanded the scope and methodological approaches used in the fusion of the internal determinants and diffusion models. Research has also attempted to gain more precise measures of the effect of different types of diffusion. Along with this distinction has come more methodological approaches to clarify which diffusion mechanisms are influential (Shipan & Volden, 2008) while also controlling for internal determinants. However, as will be made explicit in the following sections, findings from internal determinants and diffusion models continue to suffer from contradictory findings (Savage, 1985). That is, the significance and direction of these variables often changes within and across different policy contexts. Perhaps this is due to the methodological choice employed by the majority of scholars, or maybe it is the fact that accurately identifying which diffusion mechanisms are acting on the policy adoption decisions is difficult to isolate. Regardless of the reason, the field as a whole could benefit from a new vantage point, which is the goal of this dissertation.

Policy Innovation: Theory and Models

What factors influence the decision to regulate the use of uncertain and unfamiliar technologies in an evolving policy space? How do these factors influence the decision to regulate these technologies? With the introduction of new and rapidly expanding emerging technologies in cities, policy makers are left to make decisions about whether or not policies governing their use should be adopted. To that extent, the policy innovation literature offers some explanation. As the theories posit, cities may turn to other, similar cities, for guidance about the type of policy and how it should be adopted. Cities may also turn to regional

policy leaders to determine policy adoption choices. At the same time, the observation of the success or failure of a policy, as well as the problems with the policy process, is another way that these cities can determine whether or not to adopt a similar policy. In other words, cities learn from the policy process and decisions of other governments.

As alluded to previously, diffusion processes alone rarely tell the entire story (Mooney, 2001). After a policy is seen or heard about by a city, there are characteristics internal to the city that may support or hinder policy adoption from taking place. These can include a multitude of factors including the socio-demographic, economic, and policy characteristics of the city (Daley & Garand, 2005; Sapat, 2004), and those cities that align along these dimensions are often more likely to look to one another with respect to the policies they adopt (Berry & Berry, 2018; Maggetti & Gilardi, 2016).

Research on the introduction of emerging technologies into cities and the decision to adopt an emerging technology policy differs from the policy focus of previous studies in several key ways. For one, an emerging technology that is widely available to all members of the public has until very recently, been absent. This means that widespread growth of emerging technology policy has not been available for study by innovation scholars. For two, the mechanisms surrounding emerging technology policy adoption are not clear. We know from the emerging technology governance literature (Wiek, Zemp, Siegrist, & Walter, 2007) that cities may be adopting policies proactively and in anticipation of future outcomes which they think (but cannot be sure at this point) may become salient (Quay, 2010; Sarewitz, 2011). That is, there is a significant amount of uncertainty in the policy making process and it is not known how this will affect policy adoption decisions.

Policy Innovation: Models and Policy Contexts

Policy innovation in its most basic form, occurs when a government adopts a new-to-them policy (Walker, 1969). Understanding the influence of different factors involved in the policy adoption process is critical for explaining which factors are salient to predict the spread of different policies. As Berry & Berry (2018) described “one cannot claim to understand policymaking unless one can explain the process through which governments adopt new programs” (p. 223). To reiterate, internal determinant models are those that advance the idea that internal factors, such as political, economic, or social characteristics, influence whether or not a jurisdiction chooses to innovate. Diffusion models are those that explain how the process of policy choice in one jurisdiction is influenced by the policy choices in another jurisdiction (Graham, Shipan, & Volden, 2013). The two innovation processes—internal determinants and diffusion—are indeed connected and it is often the simultaneous effects of both that influence policy innovation (Berry & Berry, 1990).

Diffusion Models

In a meta-analysis of the diffusion model literature, Maggetti & Gilardi (2016) detail three major types of diffusion: *learning*, *emulation*, and *competition*, which they distill from Graham et al.’s (2013) mechanisms of learning, competition, coercion, and socialization. When investigating these processes, scholars routinely rely on the spatial relationships between governments to control for variation in which diffusion effects are at work. That is, the nuanced forms of diffusion are often ignored. The idea of spatial proximity promoting the transfer of policy is referred to as regional diffusion and explains how the geographic proximity to a policy adopter influences the decision to adopt. It is by far the most studied diffusion effect but is probably the most assumptive. Spatial proximity can surely play an

active role in facilitating policy movement, but the exact processes can be far more nuanced. Furthermore, without an explicit consideration and measurement of the processes that facilitate the learning about policies, spatial or otherwise, a general understanding of policy movement is difficult if not impossible to capture (Haider-Markel, 2001; Shipan & Volden, 2008).

That said, policy *learning* is often defined as the process of one jurisdiction making policy adoption decisions based on the success of a policy in another jurisdiction (Maggetti & Gilardi, 2016) which would be done through an active information search by governmental actors (Rose, 1991). Success as it is most often used in the policy innovation literature is defined as a policy doing what it was intended to do. That is, success is measured by observing improvement towards an intended goal (Boyne, 2003). For example, a successful welfare policy might expand the number of individuals covered by health insurance or a successful climate change policy will reduce the levels of Co2 in a city to a level previously identified. Therefore, learning and success are often intertwined where the movement of a policy from one government to another is taken as it being both successful and that governments are learning from that success. However, this a fairly strong assumption to make. It suggests that if policy adoption steadily increases over time and space it indicates that the policy is being observed as successful without any evidence to say whether these governments are actively “learning” about the policy (Bouché & Wittmer, 2015). As Nicholson-Crotty & Carley (2015) as well as Volden (2006) correctly point out this is not always the case. A policy makers rational decision to adopt a policy should be based on their belief that the policy can be successful in their own jurisdiction (Nicholson-Crotty & Carley, 2015). On other words, there is a question implementation. Furthermore, without

making it explicitly clear whether an active assessment of the policy is taking place it can be mistaken for other forms of diffusion, such as copying for normative reasons or competition. Volden (2006b, p. 796), in discussing the diffusion of welfare policy notes that “the most fundamental element that would still be neglected...is whether state policymakers learn from the policy experiments of other states. This seems to be the most widely understudied aspect of welfare policy making (and of policy diffusion more generally).”

The assumption that learning is occurring if policies are observed to be both successful and moving across a region runs the risk of missing the nuances of not being able to definitively say whether it is occurring or not and also not knowing fully understanding the role that learning has in making policy adoption decisions. As several innovation scholars have aptly pointed out, learning goes beyond simply observing the success of a policy. For example, Rose, (1991) details the concept of lesson drawing. Lesson drawing is the process of systematically and comprehensively reviewing the past experiences of what has been done elsewhere while making amendments and/or changes to the policy in order to suit the needs of the adopting jurisdiction. Relatedly, Mossberger (1999, p. 33) explains that learning is “an understanding of the referent” where there is “some deliberation about a program’s (policies) appropriateness for emulation.” She then elaborates on this definition to describe three necessary items that must be present in order to say that learning has occurred. These are distilled from work by other scholars (May, 1992; Rose, 1991) and include 1) policymakers should demonstrate accurate knowledge about another jurisdiction’s policy, 2) conclusions should be drawn from accurate knowledge about policies elsewhere, and 3) a policymakers should demonstrate they are aware of both the positive and negative experiences of other jurisdictions (states).

Thus, learning is more than just observing success. This is an important distinction to make in contexts that are uncertain and when the success of a policy, as previously defined, is difficult to observe. In the case of emerging technologies, for example, the novelty of their use and relatively recent attempts at regulation provide few opportunities to observe success. As such, learning might entail an active search for as much information as possible without fully understanding what the outcome will be. Although the work and the definition of learning by Mossberger (1999) was made with respect to vertical diffusion, the conceptualization and operationalization of the learning process is highly relevant for other diffusion studies, including the present one.

Emulation can be a result of learning. Cities may learn about another policy and choose to copy it. In other cases, emulation refers to the adoption of a policy for the socially constructed and symbolic characteristics of the policy. Walker (1968) notes that as a legislator gains in their ability to point to the successful implementation of a program in some other setting it has a markedly increased chance of others accepting and subsequently adopting it. As the number of jurisdictions that adopt a policy increases, it becomes extremely difficult for decisions makers to resist. Once a program receives some sort of legitimacy, it gains in momentum, prompting reluctant policy makers to accept the policy. When a policy achieves this level of acceptance, the chance that governments will adopt the policy without much (any) learning is more likely. Nationally or regionally recognized interest groups supporting the policies increase this pressure and add another layer of observed legitimacy to the policy, supporting policy adoption decision that may have more to do with norms than rational decision making.

In these situations, policy adoption does not depend on the success or failure of a policy since the decision to adopt is not made rationally. Emulation reflects a desire to conform to a normative environment (Greenhill, 2010; Walker, 1969) where jurisdictions copy a policy without attempting to gain additional information about whether that policy will be successful or whether it can be used in its current form. When there are obvious similarities between governments (politics, ideology, geography) or a clear policy leader in a region, governments may copy the leader or the similar jurisdictions to demonstrate their desire to stay up to date on current policy activity (Volden, 2006b). Berry & Berry (2018) and others (Collier & Messick, 1975) have stressed the importance of ideological similarities when this form of irrational policy adoption is hypothesized to be taking place, while others have noted the importance of understanding the desire to conform to a peer group (Greenhill, 2010).

In other situations, governments may be competing through policy adoption. *Competition* refers to policy adoption for the purposes of attracting or retaining resources in a competitive environment. For example, tax policies that create incentives for companies to move their business to new more favorable locations are often pointed to as examples (Basinger & Hallerberg, 2004). When a government wants to attract industry they may participate in a “race to the bottom” when it comes to tax incentives and policies. Yet other motivations also exist. With higher education policies, Cohen-Vogel, Ingle, Levine, & Spence (2007) found that states compete to attract and retain students, especially those who were born and raised within the state. But competition can also be conceptualized as the “process of attracting good things and repelling bad things” (Mooney, 2001, p. 105). When considering human trafficking policies, states were hypothesized to be competing to keep

“bad things” out by adopting increasingly severe human trafficking penalties (Bouché & Wittmer, 2015). This notion of competing to keep “bad” things out has also been extended to anti-smoking policies (Shipan & Volden, 2008), abortion (Mooney & Lee, 1995), and welfare (Volden, 2006a).

While many scholars are interested in the horizontal movement of ideas, the policies of different government levels can impact one another. *Vertical diffusion* refers to the influence that policy activity at different levels of government have on one another. For example, state policies can shape federal level initiatives or federal policies can effect state policy activity (Karch, 2012; Mossberger, 1999). Scholars have examined both of these top-down and bottom –up influences with mixed results. Krause (2011) examined the role that state policy initiatives have on city policies created to deter free-rider tendencies when it comes to greenhouse gas reduction targets. Krause notes the reluctance of cities to invest their own funds into climate protection initiatives and thus examines whether the intensity of state policy initiatives changes climate change policies at the local level. Krause did not find support for the top down influence of state policies on local policies. However, when Karch (2012) investigated the influence of national level policy influence on state adoption of stem cell research policies, the findings suggested that the activity at the national level positively impacts the probability that a state would not only introduce stem-cell-related regulation but in some cases adopt it.

In another interesting piece, Haider-Markel (2001) focused on the activity of advocacy groups at national and regional levels for same-sex marriage bans in the 1990s. He argues that that policies such as same sex marriage bans are more likely “pushed” into states from the action of national level groups rather than state level actors “pulling” the policies

from other states. What is interesting about this article is that the author finds very little evidence of regional diffusion and furthermore, that state level communication networks are not nearly as influential as national level interest groups and policy activity. He notes that “Although state actors may seek new policy ideas actively, national coalitions may also push policy ideas on states” (p. 20). Similarly in the analysis by Karch (2012), federal level policy activity was particularly influential in moving state level stem cell policies to the policy agenda. Of course, in both of these examples there were other factors that were tested for and found to be significant. Moreover, both of these approaches used quantitative methods which, it can be argued, are not as flexible when it comes to understanding the nuances of diffusion. A fairly significant amount of communication can take place among state-federal policy networks which provide may provide the connective tissue for policy learning and movement (Mossberger, 2000). These avenues of information exchange can go unnoticed and underrepresented if not explicitly considered.

Regional Diffusion

The regional diffusion hypothesis, a central tenant of many diffusion studies, focuses on the role spatial proximity. Regional diffusion posits that the closer one is to a policy adopter, the more likely it is that policy will be adopted in the proximal areas. Scholars studying regional diffusion do not always make a distinction about possible alternative reasons why diffusion is occurring in a region, just that it is occurring and that proximity has something to do with it. This is usually operationalized by measuring the number of jurisdictions that have a policy and share a border with a non-adopting jurisdiction. As that number increases the likelihood that adoption will take place in a non-adopting location will also increase (Berry & Berry, 1990; Crain, 1966). From a purely geographical perspective this

would be referred to as the first law of geography (Tobler, 1970), which states “everything is related to everything else, but near things are more related than distant things.”

The idea of spatial proximity implies a number of confounding factors which is why so many scholars use it as the main focus of their diffusion studies. Neighboring jurisdictions are more likely to have similarities across more than just policies. Things like problem context, demographics, politics, and economics also display a spatial pattern (Conley & Topa, 2002). If these similarities influence policy adoption with respect to which policies are emulated and where policies are learned then the pattern of adoption should generally follow the spatial trend of the internal determinants (Karch, 2007b; Shipan & Volden, 2008; Stream, 1999).

Regional diffusion also assumes a greater ease in communication among policy makers in neighboring jurisdictions. For example, there may be overlapping media markets for those jurisdictions which will alert the populace of new policies or problems taking place in neighboring areas (Karch, 2007b). Furthermore, regional meetings or associations can increase how often these neighboring jurisdictions are made aware of policy decisions (Wong & Langevin, 2007). Due to the ease of communication and socio-demographic similarities, regional diffusion suggests that jurisdictions look to neighbors more readily when there is uncertainty in the policy process. They are interested in seeing how a policy does in a similar geo-political context. Yet the geographic influence will also depend on the region of interest and the associated distance decay function (Eldridge & Jones, 1991). As Walker (1969) noted, there can be a regional clustering effect for policy adoption and as one begins to move away from the center of the region, the effect of regional diffusion will decrease until you begin to get closer to the center of the next region.

In more recent studies, purely regional influences do not seem to play as crucial of a role in the movement of policy. Scholars that isolate and control for various diffusion mechanisms while also controlling for space have observed mixed results. For example, Matisoff & Edwards (2014) investigate climate change policies at the state level to understand whether states learn from their peer groups (as defined by similar internal characteristics). In their model they assume that states which are similar on a number of socio-demographic variables will learn from each other. The authors control for geographic policy regions (Walker, 1969) and similarities between states, finding that region is not a significant indicator of policy adoption but that states which are more similar (and not necessarily close together) tend to have an influence on policy adoption. Thus, they conclude (or rather assume) that learning is taking place between these similar states and that geographic proximity does not predict adoption. A similar finding was reported by Greenhill (2010) and Shipan & Volden, (2014) who found little support for the spatial influence but strong support for the influence of membership in an intergovernmental organization and learning from leaders in the policy area, respectively.

Be that as it may, there exists many studies investigating the spatial effects of policy diffusion that find support for the notion that spatial proximity matters in policy decisions (Godwin & Schroedel, 2000; Karch, 2007b; Mintrom & Vergari, 1998). However spurious diffusion is difficult to detect (Starke, 2013) and it is often the case that the spatial effects are the only thing being tested for. There is no explicit testing of multiple diffusion mechanisms (Graham et al., 2013). Calls to support the measurement of the geographical diffusion hypothesis with additional empirical evidence are increasingly common (Maggetti & Gilardi,

2016). Doing so will certainly help to determine the importance of other mechanisms and also clarify the role that regional diffusion has in policy innovation studies (Volden, 2006a).

Internal determinants models

Internal determinants are those characteristics that are internal to the jurisdiction. This includes the political, economic, and social characteristics, but could also include the severity of the problem, similar regulations, or the existence of advocate groups, to name a few. These models recognize that jurisdictions do not adopt policies completely independent of other jurisdictions with similar policies. To be clear, there is some assumption that diffusion, in one form or another, has taken place via a form of institutionalized communication that makes policymakers aware of a policy (Sharman, 2010). Internal determinants models assert that upon learning about the policy, the decision to adopt depends on the characteristics of the jurisdiction (Berry & Berry, 1992).

The monetary health of a jurisdiction, both at the level of the government and its citizens, is routinely included as a variable of interest for internal determinants models. Of course, the direction and strength of this measure will change with the type of policy under study. For example, scholars looking at environmental policy will work under the idea that governments with a larger tax base will have more money to spend on regulatory innovation and enforcement, or can support costly policy initiatives such as broad welfare reform (Dawson & Robinson, 1963; Matisoff & Edwards, 2014; Tolbert, Mossberger, & McNeal, 2008). Governments with more money are considered to have more “slack” resources to apply to the enforcement and implementation of a new policy. Likewise, in other studies citizens with higher socioeconomic status are assumed to demand more from their government such as clean air and greater environmental quality (Krause, 2011). Thus a state

or city with a higher level of income per capita is often hypothesized to increase the likelihood of policy adoption. However, studies on education and welfare policy have found that lower socioeconomic status can also be positively related to adoption (Ingle, Cohen-Vogel, & Hughes, 2007). The direction of a socioeconomic variable depends on the policy context.

One of the more consistent internal determinants related to the adoption of a new policy is the existence of a problem (Berry & Berry, 2018). Many studies on policy diffusion explicitly include some measure of the degree that a problem exists. This has included high pollution levels supporting climate change policy innovation (Krause, 2011), poor educational performance as a driver for educational reform (LaVenía et al., 2015; McLendon, Hearn, & Deaton, 2006), and depressed economic conditions influencing the adoption of aid programs (Allard, 2004). The severity of a problem, especially when it is localized and easily observable is usually found to be a significant predictor of policy adoption (Matisoff & Edwards, 2014).

Another internal determinant that receives attention are the numerous obstacles to innovation. Some examples of obstacles are related to the cost of implementing a policy or researching the policy outcomes, dealing with policy opposition groups, or contending with powerful political actors (Daley & Garand, 2005). Where implementation is concerned, jurisdictions must already have or be able to acquire the resources necessary to implement a new policy (Matisoff & Edwards, 2014; Sapat, 2004). This may include building out infrastructure, adding additional personnel, or even having to create additional supporting policies.

Advocacy groups, professional organizations, and even other levels of government can be influential when it comes to making policy adoption decisions (Nicholson-Crotty & Carley, 2015) or anti-smoking policies (Shipan & Volden, 2008). Intergovernmental policy networks facilitated through conferences or workshops can help move ideas from one government to another (Mintrom, 1999). As an example, when investigating school choice among American States, Mintrom (1999) noted a high number of policy entrepreneurs contributing the ideas about school choice. Using the EHA model to test what the effect of having a policy entrepreneur does for the likelihood of adopting a school choice policy, Mintrom (1999) showed a significant increase between states with no entrepreneur activity and states with higher entrepreneur activity. Particularly when policies are divisive and support or opposition are drawn along party lines, policy entrepreneurs in the form of individual lobbyist, groups, or others can have a strong influence on policy adoption decisions (Haider-Markel, 2001).

Strong conservative or liberal ideologies in the legislature have very specific influences on adoption decisions. In fact, much of the early policy innovation research was heavily focused on the role that political ideology (Dawson & Robinson, 1963) and the effect that competition between political parties have on policy outcomes (Dye, 1965, 1966). Some of these obstacles, specifically those related to resources, can tie back to fiscal health or other measures of a jurisdictions ability to implement a policy. Others, such as the influence of policy actors, must be observed or carefully measured using proxies.

Finally, the presence of similar policies is often a good indicator of whether or not policymakers choose to innovate. Jurisdictions that have a track record of being policy innovators in general, or have adopted policies along similar lines in the past, are found to be

more likely to adopt policies in the future. For example, when attempting to predict American charter school policies across states, Lee (2014) used the percent of private K-12 schools as a proxy for a state's willingness to adopt charter school policies. The idea was that if states have more favorable policies toward private schools, they would be more willing to adopt policies allowing for charter school expansion within the state. In the context of states adopting renewable portfolio standards, Nicholson-Crotty & Carley, (2015) controlled for whether or not states had net metering policies under the premise that previous adoption of energy policies would encourage future adoption of similar policies.

Policy Innovation Study Contexts

To date, policy innovation has been studied broadly across the fields of political science, international relations, comparative politics, and policy science (Graham et al., 2013) with a strong focus on international, federal, or state policy innovation. Studies on city to city adoption within larger regions are not nearly as prevalent (Shipan & Volden, 2008). Although a variety of policies across many unique policy areas have been covered by policy innovation scholars, researchers are still missing a systematic, general understanding of how the diffusion process works. Thus, they continue to explore innovation in an effort to strengthen the theoretical base that policy innovation research draws from (Graham et al., 2013).

At the international level, policy innovation has focused on the spread of major political ideas and policies that span international borders. For example, work has been done on the spread of democracy to other regions or countries of the world (Gleditsch & Ward, 2006; Starr, 1991) and on the spread of economic and political liberalization to other countries (Jahn, 2006; Simmons, Dobbin, & Garrett, 2006; Simmons & Elkins, 2004). In

other work, the focus has been on broad social policies including human rights, environmental protections, and public health (Greenhill, 2010; Krook, 2006; Massey, Biesbroek, Huitema, & Jordan, 2014; True & Mintrom, 2002).

Research on policy innovation at the state level has seen a tremendous amount of activity, mostly following the seminal innovation work of Walker (1969) and the development of Berry and Berry's (1990) EHA model for state policy innovation. Policy topics at the state level cover a diverse mix of topics, ranging from climate change and environmental policy (Daley & Garand, 2005; Krause, 2011; Sapat, 2004), to living will laws (Glick & Hays, 1991) and social policies like stand your ground laws (Butz et al., 2015) and the use of capital punishment (Emmert & Traut, 2003). Broader still are studies focused on campaign funding laws, crime victim compensation laws, and child abuse reporting (Hays, 1996), as well as the role of E-government in the American states (Tolbert et al., 2008). Education policy remains a widely studied policy topic at the state level (LaVenita et al., 2015; J. Lee, 2014; McLendon et al., 2006; Mintrom & Vergari, 1998; Wong & Langevin, 2007) partly because the deliberate testing and monitoring of these policies makes them easy to observe and emulate in other areas.

Local level policy innovation studies are not as prevalent within the policy innovation literature. It is often the case that city ordinances must contend with the possibility of state and federal preemption, especially for the salient policy areas that scholars tend to gravitate towards in their studies (Koski, 2010). Still, innovation scholars have addressed a handful of local level policy adoption cases. For example, the diffusion of city level anti-smoking laws has been studied in multiple U.S. states and in municipalities in

Canada (Nykiyoruk, Eyles, & Campbell, 2007; Skeer, George, Hamilton, Cheng, & Siegel, 2004).

While focusing on cities, Shipan & Volden (2006) investigate the influence of bottom-up policies using local anti-smoking law movement to state level initiatives. They found that local policies do bubble up from local to the state level but is contingent on the level of legislative professionalism at the local level. Other local level policies investigated through more traditional approaches include legislation on gun control in California (Godwin & Schroedel, 2000) as well as transportation policy among North American and European cities (Marsden, Frick, May, & Deakin, 2011). The use of technology by local governments (e-government) is increasingly studied by policy innovation scholars which is interesting because it is an innovation in and of itself. It provides some insight into policies that are outside the normal realm of regulating or restricting the use or activity by residents of the jurisdiction. (Chung-pin Lee, Chang, & Berry, 2011; Ma, 2013; Weare, Musso, & Hale, 1999).

Even with the breadth of literature on policy innovation, research related to emerging technologies is surprisingly rare. To date, there is only one policy innovation study that uses emerging technology policy as an example. The work by Karch (2012) addresses embryonic stem cell policy and the role of vertical diffusion (top down) from the federal government to U.S. states. Also, rather than focusing on adoption, Karch is mainly interested in policy agenda setting, or the way in which certain policy topics are pushed to the fore of the policy debate. She argues that the diffusion processes that spark policy makers to adopt a policy are not always the same as the mechanisms that place the policy on the political agenda. Among other controls were those related to religious affiliation, similar

policies, socio-demographics, and policies of neighboring states. The EHA model showed a positive and significant influence of national level activity, research capacity of the state, religious affiliation, and political ideology on the intensity of stem cell policy activity.

Unfortunately, Karch did not control for the level of stem cell research actively taking place in each state, which has been shown to play a strong role in other policy areas (Matisoff & Edwards, 2014). He concludes that attributes related to the states (internal determinants) have a stronger effect on agenda intensity than on the timing of bill introduction. That is, internal determinants play a stronger role on policy activity when it comes to regulating this emerging technology. It is unfortunate that only agenda setting was investigated in the study by Karch, but it does provide some indication of what might be expected when studying other emerging technology policy adoption decisions.

With the exception of the above study, research on emerging technologies is scarce in the policy innovation literature. Perhaps this is due to the minimal amount of direct interaction that citizens have with these emerging technologies on a regular basis or the way that traditionally recognized emerging technology, like stem cell research, is regulated. As previously mentioned, until quite recently there has not been a technology that requires regulation beyond what the federal or state government requires. This could change in the next few years as new technological innovations that are more readily apparent and accessible make their way into day-to-day life. The introduction of drones is the first of several new technologies that provide an opportunity to examine policy innovation for a newly introduced, widely accessible, emerging technology.

Quantitative Models of Policy Innovation

Mooney (2001) and others have pointed out that separate models of diffusion and internal determinants are not sufficient to explain why a government adopts a new policy. In an effort to move towards generalization and unification, Berry & Berry (1990) proposed what has become the most widely used approach for measuring policy diffusion. Their model, known commonly as event history analysis (EHA) accounts for internal determinants and diffusion mechanisms, with the caveat that the original formulation was geared towards state level adoption and a “general” measure of regional diffusion. It is a form of pooled cross sectional time series analysis, resembling a logistic regression model with an additional variable used to account for regional diffusion.

The dependent variable in traditional EHA models is modeled as the probability that a state will adopt a policy during a specific time period (Mintrom & Vergari, 1998). It is most commonly represented with a binary indicator; either a government has adopted (or considered for adoption) a policy (1) or not (0) during a specific year (Berry & Berry, 1990). The regional diffusion mechanism is captured using a variable coined as the “hazard rate” and reflects the number of adopting jurisdictions in a region. The assumption is that as more jurisdictions adopt policies, the hazard rate for that region increases and in turn, increases the likelihood that adoption in the surrounding areas will occur. EHA has been applied to a number of policy settings since it was first conceived in 1990, including state adoption of educational reforms (McLendon et al., 2006), state adoption of common core standards (LaVenita et al., 2015), the adoption of abortion and death penalty legislation at the state level (Langer & Brace, 2005), and even state adoption of animal cruelty laws (Allen, 2005).

As policy innovation matured as a discipline, and even before EHA was first introduced, other methods for evaluating policy innovation were explored. In the earliest work, scholars relied almost exclusively on significant correlations between innovation mechanisms and the number of policies adopted (Fenton & Chamberlayne, 1969; Hofferbert, 1966). More recently, Krause (2011) used a multilevel regression model to address climate change policy innovation while Shipan & Volden (2014) and Nicholson-Crotty & Carley (2015) both use dyadic comparison between adopters and non-adopters to determine the influence of policy learning among jurisdictions that share similar internal determinants. Outside of EHA, the most common methods are various forms of traditional regression models such as ordered probit (Greenhill, 2010) and logistic regression (Godwin & Schroedel, 2000; Skeer et al., 2004) which draw many methodological similarities to EHA.

Qualitative Analysis of Policy Innovation

Qualitative studies are certainly not as prevalent when it comes to policy innovation, but they do offer some distinct advantages. Cohen-Vogel et al. (2007) claim that “well-planned qualitative approaches have the potential to consider at once multiple reasons for observed geographic diffusion patterns where they exist.” Indeed, qualitative analysis through interviews or document analysis provide rich detail regarding the processes involved in policy innovation with respect to the policy outcome. One of the most distinct advantages that qualitative studies have over quantitative is the ability to directly observe the processes leading to the policy adoption decision or to ask policy makers directly about why certain policy decisions were made when they were. That is, qualitative studies are particularly well equipped to identify if policy diffusion is occurring and what the processes underlying that diffusion are (Starke, 2013). Ingle et al. (2007) provides a good example of this approach

when investigating the adoption of postsecondary merit aid programs in southeastern states. The researchers were particularly interested in comparing the diffusion mechanisms and internal determinants between “hold-out” states, or those that did not adopt policies to those states that did adopt the programs. The qualitative methods they employed allowed for specific diffusion mechanisms to be identified, in addition to internal characteristics that were influential in the policy decisions by states. It also enabled the identification of specific policy actors and the processes that these actors went through when seeking out information about policies in neighboring states.

There have been several books written on policy diffusion and/or innovation, many of which were conducted as cross-case comparison, within-case comparison, or a mixture of both. For example, Karch (2007a) and Horowitz (2010) use cross-case comparison to illustrate how diffusion mechanisms contribute to the outcomes under review. To get at a causal path, both authors use a combination of content analysis and process tracing for the cases that they investigate. The use of qualitative methods allowed them to address the interdependence of policy movement, the specific forms of communication, and the role those played in leading up to a policy adoption decision.

One of the books with arguably more salience for this dissertation is by Mossberger (2000) with an analysis of state enterprise zone policy. What makes it particularly salient is the choice of cases which, among other things, are differentiated by adoption timing and in effect, the level of information states had about the policy. The case selection provided critical opportunities to study how the process of learning changes with variations in the amount of available information. Of particular interest is the framework described as

informed decision making—the amount of information gained by states and how it was used to make policy decisions.

Mossberger assigns her cases to one of two information categories, low or high, depending on the level of active information searching that took place among the states. Although all of the cases showed some signs of active information search (learning), the qualitative analysis allowed for the identification of unique differences. For one, there were differences in how the information was used to formulate the policies to meet the needs of the adopters. For two, differences materialized in how states incorporated internal and external criticism of existing policies. As a whole this work provides evidence that the level of information a jurisdiction has about a policy can affect the process of learning and also the final structure of the adopted policy. These nuanced findings would not have been identified using quantitative methods. Through qualitative analysis, such as those listed here, the nuances of not only diffusion but also other factors can be more easily identified.

Limitations of Existing Research

Graham et al. (2013) claimed that scholars in the policy innovation field are “nowhere near having a systematic, general understanding of how diffusion works” (p. 3), some of which is due to the variation in policy context and associated findings. In the case of McLendon et al. (2006) on the study of educational performance and reform policies, variables related to the political conditions of the jurisdictions were significantly related to educational reform adoption. In a topically similar analysis of educational common core standards some support for political condition was significant, but only for one of the researcher’s model specifications (LaVenita et al., 2015), while policy network and prior policy adoption (of similar policies) were significant. Political condition was again found to

be a significant predictor of anti-smoking laws for two model specifications in Shipan & Volden (2008), but political condition was not significant in their model that also tested for learning and imitation diffusion mechanisms.

As alluded to previously, regional diffusion is a tricky variable with respect to significance. Regional diffusion was found to be a significant factor in the work analyzing anti-smoking laws by Shipan & Volden (2008) and Skeer et al. (2004). However, when McLendon et al. (2006) implicitly tested for geographic proximity, the results suggested no statistical significance. Regional variables and political condition had strong significance when testing for gun-control laws in California (Godwin & Schroedel, 2000), but problem severity was not significant. Part of this may be explained by variations in the measurement of regional diffusion which has been operationalized in number of ways (Berry & Baybeck, 2005), some of which are better than others. Moreover, “regional diffusion” has been used as a catchall phrase by researchers who do not test whether some other diffusion mechanism is really at work. Regional diffusion has been distilled into its hypothesized components and tested by some scholars (Graham et al., 2013) and also treated as several independent variable alongside other diffusion mechanisms by others (Greenhill, 2010). The mixed findings of significant mechanisms indicate, at least to some extent, that the type of variables that matter for policy innovation may change with the policy context. Without directly observing which diffusion mechanisms are influencing policy decisions, scholars are left to assume whether it is truly learning, emulation, competition, or vertical diffusion effecting policy innovation. It also supports the notion made by Maggetti & Gilardi (2016) that “the same type of interdependence can be interpreted as evidence of different mechanisms of

policy diffusion” (p. 14). Simply put, some studies that claim to identify a particular diffusion mechanism could be misidentifying what is actually going on.

EHA and other quantitative approaches used to investigate policy innovation suffer from the possibility that the identified diffusion effect could be nothing more than a function of domestic or internal causes that are independent of the innovation process (Braun & Gilardi, 2006). Further still, the detection of policy clusters in time and space while controlling for internal determinants can provide strong evidence of diffusion, but won’t explain how the diffusion occurred (Starke, 2013). When assessing the conditional effects of these quantitative models, researchers are assessing the strength of the hypothesized types of diffusion rather than the actual processes being used. And even when the strength of a particular diffusion mechanisms is isolated, little attention is paid to the individual elements of the policy that are most salient for the adopting jurisdictions. It is assumed that the policy is adopted in its entirety.

So, while existing methods can be a powerful tool to help uncover the independent effects of hypothesized variables, their full effects and underlying processes involved can be much more complex than what is identified as significant. That being said, policy innovation research can benefit from alternative approaches, especially when dealing with highly uncertain policy areas such as emerging technologies. Making this specific policy situation more difficult is the fact that the newness of emerging technologies and associated policies limit the effectiveness of EHA. For one, there are not enough temporal data points to run an effective EHA analysis on city level emerging technology policy. For two, EHA will not capture the anticipatory nature and the effect of uncertainty that comes with emerging technologies. The latter is critical for understanding the policy environment and motivation

for the decision to adopt emerging technology policy since the lack of experience and contextual examples force policy makers to anticipate how these technologies may be used and then create policies bearing that in mind. That being said, this dissertation uses qualitative methods to help pull out the nuances embedded within policy innovation. As detailed next, content analysis and Qualitative comparative analysis are used in conjunction with one another to decrease the reliance on assumptions about the innovation process and move the data collection and interpretation closer to reality.

Methods Overview

Content Analysis

As will be detailed in the next chapter, the majority of the data in this study was gathered from online documents, video/audio recordings of city council discussions, and a few interviews with city staff members. In other words, the majority of the data is textual. Ethnography, grounded theory, phenomenology, and historical research could all be used to conduct text-based research analysis but content analysis was determined as the best method given the aims of this study. Content analysis is a somewhat general term used to describe several strategies for analyzing text using systematic coding techniques to categorize the data (Vaismoradi, Turunen, & Bondas, 2013). The traditional form of content analysis (termed conventional) is used when a researcher is seeking to describe a phenomenon and when existing research on the topic is limited or under developed (Hsieh & Shannon, 2005). Although early content analysis research was rooted in the process of understanding the “meanings, symbolic qualities, and expressive contents (of participants) and the communicative roles it plays in the lives of the data sources” (Krippendorff, 2018), modern content analysis has been increasingly applied to communications media with a quantitative

focus (Merriam & Tisdell, 2015). That is, the content of the data source is analyzed by measuring the frequency in which certain concepts are used in order to explore the hypothesized causal relationships.

According to Hsieh & Shannon (2005) there are three forms of content analysis. The first has already been mentioned as the *conventional* approach. The second is *directed* content analysis where existing theory about a phenomenon is only partially described and could benefit from additional contextual analysis. The goal of directed content analysis is to extend a theoretical framework or theory and, in turn, help conceptualize relationships between the variables of interest. The third type is *summative* content analysis. This tends to be more quantitative in nature, whereby the researcher is attempting to quantify the number of times a particular word, phrase, or theme appears in the text. However, summative content analysis takes this one step further by also investigating latent meanings. Certain words or phrases can be counted and then summed, but they would also be investigated in the context in which they appear. The decision regarding which approach to use depends on the research question and existing knowledge around the phenomenon of interest.

Regardless of the approach to content analysis, it excels at distilling a large volume of data into fewer categories and themes (Krippendorff, 2018; Stemler, 2001). The aim of the process is a condensation of broad descriptions into smaller concepts representing the phenomenon of interest. Similar to QCA, content analysis is used in both inductive and deductive research (Elo & Kyngäs, 2008). In a low information research situation an inductive approach is more appropriate. This would imply the use of a conventional content analysis. Conversely, when the research topic is theoretically well established, content analysis can be used as a way to test and/or extend the existing theories—a directed or

summative content analysis would be more appropriate. Where the latter two are concerned, a general awareness of what one might find or should be looking for can be outlined with a protocol prior to beginning the analysis. It should be based on existing theories that specify the relationship between the variables of interest. The protocol would act as a systematic “blueprint” for the identification of concepts across each unit of analysis (Merriam & Tisdell, 2015).

In content analysis, the unit of analysis can vary substantially. It can be a word, theme, an entire document, or even a set of documents describing a case (Elo & Kyngäs, 2008). When choosing a unit of analysis the researcher must be careful to balance specificity and generality. Too specific and the analysis may become fragmented. Too broad and a single unit of analysis may take on multiple meanings and complicate the analysis (Graneheim & Lundman, 2004). Elo & Kyngäs (2008) suggest using a unit of analysis that is at the same time large enough to be considered a whole but small enough to retain unique meaning when analyzing the data later on. Using a document or an interview as the individual unit of analysis may work well but a specific theme or concept can also be advantageous depending on the amount and type of data. After a unit of analysis is decided it is coded for concepts and compared to the other units of analysis to address similarities and differences. For this study, the unit of analysis is the individual case (city). Using the city as the unit of analysis also allows for comparisons across cities and to isolate the nuances involved in the drone policy process.

Qualitative Comparative Analysis

QCA has been used in a variety of research contexts and is particularly advantageous when used in conjunction with other qualitative methods (Beach, 2018; Beach & Rohlfing,

2018). QCA is a term used to describe several methods of comparative analysis. Its original formulation was developed by Charles C. Ragin in 1987 as a way to integrate case-based research with research based on the analysis of individual variables—a blending of the strengths between qualitative and quantitative analysis methods (Ragin, 1987). It is a case-oriented approach, built on set theory and Boolean algebra. QCA is most commonly used for the systematic comparison of a medium number of cases which is regarded as less than 100 (Marx & Dusa, 2011). The underlying aim of the method is to identify and examine causal configurations. That is, QCA is used to identify sets of variables across multiple cases that result (or not) in an outcome of interest (Ragin & Rihoux, 2004). This implies that solutions in QCA can be produced by multiple paths and importantly, can have different outcomes in different contexts. The causal complexity that defines the use of QCA comes from the notion of conjunctural causation, equifinality, and causal asymmetry (Schneider & Wagemann, 2012).

That being said, QCA should be used when the “type of causal complexity derived from theory-guided hunches on the one hand, and assumptions built in by default into set-theoretic methods on the other” (Schneider & Wagemann, 2012, p. 78) are matched within the research area where it is applied. It is therefore critical to understand the characteristics of causal complexity that define QCA. *Conjunctural causation* is the idea that important causal factors do not occur in a vacuum, it occurs in conjunction with some other precisely specified condition. *Equifinality* means that multiple pathways to achieve a given end state can exist. There can be (but do not have to be) different ways of getting the same outcome. Lastly, *causal asymmetry* is defined by two important points; a causal condition only refers to one of the qualitative states (presence/absence) in which it can be found and the solution is

only in reference to one of the causal states (presence/absence). Simply put, a configuration of conditions that lead to an outcome does not mean that the absence of that condition leads to the contradictory result. It must be tested separately.

The use of conditions, sets, variables, and outcomes for describing what QCA is/does may require additional clarification. Within QCA, what would normally be termed as a variable in quantitative approaches is referred to as a condition. Conditions are evaluated for each case and depending on the type of QCA being used, indicates the presence or absence of the condition (crisp set QCA) or the degree to which that condition is present (fuzzy set QCA) for that case. A condition by itself can make up a set and cases have membership in sets. Sets combine into configurations which are conceptualized using existing theories. Prior to analysis the researcher will hypothesize which set of conditions (configuration) they believe will result in the outcome of interest. Configurations are evaluated using the logical operators AND, OR, and NOT. Recall the components of causal complexity in the previous paragraph. A logical AND expresses conjunctural causation—something AND something else must both be present to arrive at the outcome of interest. logical OR suggests equifinality—this OR that can be present and both get you to the outcome of interest. These operators are used in the assessment of the *necessary* and *sufficient* conditions—another important component of QCA.

QCA evaluates sets based on the necessity and/or sufficiency of conditions. Necessary conditions are those that *must* be present for the outcome to occur in a case or set of cases. In addition, the outcome cannot occur without the necessary condition being present. This latter point is what differentiates necessary from sufficient. For sufficient conditions, the outcome can be present without the condition, but the presence of a

sufficient condition implies that the outcome will also be present (Thomann & Maggetti, 2017).

Necessary and sufficient conditions are evaluated through a truth table (Grofman & Schneider, 2009). This table is oriented with the conditions as columns and logically possible AND combinations as rows. Each row denotes one of the 2^k possible unique combinations of conditions within the data set where K is the number of conditions used in the model (for example a model with 3 conditions has 8 possible configuration, a model with 4 conditions has 16 possible configurations). Once the researcher builds the truth table each case can be associated with one of the possible combinations of conditions that it exemplifies, keeping in mind that multiple cases can be associated with a single row. Then, the outcome (0 or 1) for each of the possible combinations of conditions is assigned to its outcome, in effect determining which mix of conditions are sufficient for an outcome to occur (Table 1).

Table 1. Example truth table with three conditions

Row	Condition 1	Condition 2	Condition 3	Outcome (Y)	Cases
1	0	0	0	1	A, B, C
2	0	0	1	1	D
3	0	1	0	0	E
4	0	1	1	0	G
5	1	0	0	0	F
6	1	0	1	1	H, I
7	1	1	0	0	K
8	1	1	1	0	J, L

Table 1 will be used to graphically demonstrate how a truth table is analyzed. Notice how this table can grow quickly as the number of conditions increases. This necessitates the use of computer software to build and analyze the truth table. As detailed above, the rows of the truth table correspond to the possible combination of conditions, the outcome of those

combinations, and the cases associated with each of the outcomes. If the researcher is interested in a positive outcome, they can see that cases A, B, C have a positive outcome and have the combination of conditions shown in row 1. The truth table also shows that case D is a positive outcome with the combination of conditions shown in row 2 and that the cases H and I in row 6 also have a positive outcome. Each of the positive outcomes indicates that the associated conditions are sufficient for the outcome to occur. However, we do not know which conditions are necessary. For that the researcher must move to minimization where Boolean algebra comes into play.

The minimization procedure produces the necessary and sufficient conditions mentioned above. Most conditions revealed as necessary will not be without the presence of another condition highlighting the conjunctural causation causal complexity assumed in QCA where more than one condition needs to be present in order to get the outcome. These situations are known as insufficient but non-redundant parts of an unnecessary but sufficient (INUS) condition for the positive occurrence (Mackie, 1974). The configurations are revealed through a summarized solution statement from minimization—a solution about the patterns among conditions that result in the outcome of interest. Minimization is a way to achieve a more parsimonious explanation for a given research question by reducing the abundance of individual case information into the parts that are common across multiple cases that have the outcome of interest (Marx, Rihoux, & Ragin, 2014). The solution to the truth table above, through Boolean minimization, is graphically illustrated in Figure 2.

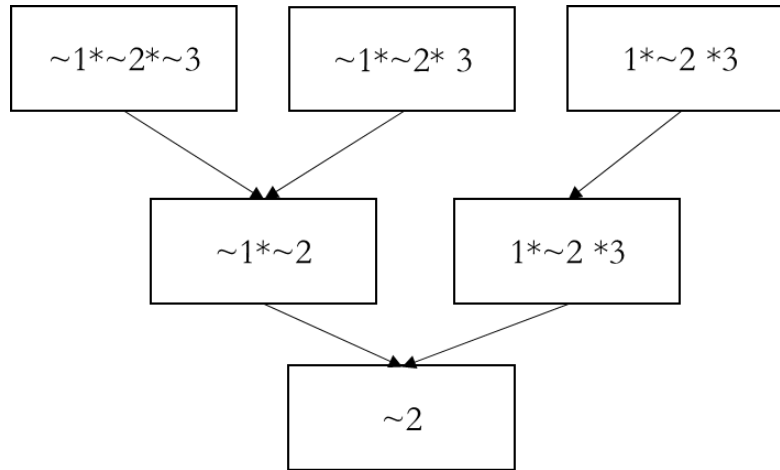


Figure 1 Example minimization procedure. Each box represents a configuration that is sufficient for the outcome of interest.

Solution: $\sim 2 \rightarrow Y$

Notation is as follows: a $\sim$ indicates the absence (NOT) of a condition, $*$ indicates AND, and $+$ indicates OR. The most parsimonious solution in this simple example is NOT condition 2 is necessary and sufficient for the outcome to exist. The top three squares relate to the rows in Table 1 with the outcome of interest. On the left is row 1, the middle is row 2, and the right square is row 6. They can be combined and minimized by removing the third condition since its presence in row 1 (left box) and absence in row 2 (center box) cancel it out. After the first two rows are minimized the result is combined with row 6. Since the absence of condition 2 is the only common condition between all the rows it is both a necessary and sufficient condition for this example and is also the most parsimonious condition.

A major part, and indeed one of the strengths of QCA, is the interpretation of the solution within the context of the study. After the solution is obtained through minimization the researcher should return to the in-depth case studies and evaluate the solution with

respect to how the data was collected, the context it was collected in, and why (or maybe why not) the solution makes sense for the cases (see Giugni & Yamasaki (2009) for an excellent example). Understanding the deeper meaning of a solution affords the researcher an opportunity to add new cases or conditions to help improve the overall interpretability of the solution. However, one common issue that researchers using QCA will face is the presence of contradictory cases—cases with identical combinations of conditions that result in different outcomes (Grofman & Schneider, 2009). These contradictions can be addressed in several ways.

Schneider & Wagemann (2012) suggest several approaches to address contradictory cases. The researcher can begin by adding an additional condition. This will hopefully differentiate the contradictory cases but one must be sure that the additional condition is theoretically and substantively justified. In some situations an additional condition will not differentiate contradictory cases and in the case where a large number of conditions are already present, the addition of another can make the solution too large to deal with effectively. If there are a small number of cases, an additional condition can add to the number of logical remainders (possible configurations with no empirical cases to match it) which is also not ideal. A second approach is revisiting the case selection but must be done with caution. The selection of cases should be theoretically justified prior to beginning the research. Contradictory cases should not be thrown out on the basis of them being contradictory. The justification should be based on whether they are qualitatively different than the others. A third approach is to reconsider the outcome variable and how it is conceptualized. This is more difficult when it is dichotomous and the criteria for a positive and negative outcome might be theoretically justified upon further inspection.

As alluded to, QCA can be, and often is an iterative process (Thomann & Maggetti, 2017). Revising conditions, outcomes, and cases as preliminary empirical evidence is gained is not unheard of. In fact, it is considered standard practice by the QCA guru himself (Ragin, 2000). However, even with the iterative process detailed above, logical contradictions will remain. When this occurs Schneider & Wagemann (2012) suggest the use of *coverage* and *consistency* which is akin to model fit statistics in regression and other statistical analyses (Ragin, 2006). Coverage assesses the degree to which a given cause accounts for the outcome of interest across the total number of cases being explored. For example, if there are multiple causal paths that lead to an outcome, the coverage may be small. Consistency, on the other hand, is a measure of the degree that cases share a given condition or combination of conditions that result in the outcome of interest (Ragin, 2006). Contradictory cases will lower the consistency of a solution. Both coverage and consistency measures are evaluated within QCA software and can be evaluated for both necessary and sufficient conditions. Those solutions with higher coverage and consistency are good candidates for explanatory causal pathways and configurations related to the outcome. However, the nuances of the cases that fall outside the solution should still be considered when interpreting results.

QCA is an umbrella term for several comparative case-based methods including crisp set QCA (csQCA), fuzzy set QCA (fsQCA), and multi value QCA (mvQCA). This study will use crisp set QCA (csQCA), where the outcome and conditions are dichotomized (Ragin, 1987). The outcome condition of interest for this study is the adoption of drone use regulation and it is coded as 1 if the city has adopted drone use regulation or 0 if it has not. More details on the calibration of the continuous variables are offered in Chapter 6.

CHAPTER 3

RESEARCH DESIGN

As discussed in Chapter 2, the bulk of the studies on policy innovation are quantitative, mostly adopting some form of event history analysis (Berry & Berry, 1992) with modification (Mooney, 2001). Others have paved the way for promising new approaches including dyadic analysis (Boehmke, 2009; Nicholson-Crotty & Carley, 2015), ordered probit (Greenhill, 2010), multilevel models (Krause, 2011), and, of course, qualitative approaches (Ingle et al., 2007). Regardless of which method is used some assumptions must be made. One of the largest assumptions that must be made in quantitative approaches is determining the specific innovation mechanism influencing policy adoption. Without directly asking policy makers why they chose to adopt a policy when they did or which barriers prevented them from adopting a policy, it is difficult to know with certainty whether those variables truly played a role or whether it was just a matter of spurious diffusion (Mossberger, 1999; Starke, 2013).

One of the advantages of qualitative policy innovation research is the level of detail provided by the data collection process (Merriam & Tisdell, 2015). Researchers using qualitative approaches are able to dive deep into a single or a few case studies to achieve a strong sense of the processes underlying the innovation process. The implicit tradeoff, of course, is the generalizability of the findings. It can be argued that the depth of qualitative research comes at the expense of breadth. This is certainly true for many studies where the goal is something like grounded theory yet there are several added benefits of exploring a handful of cases in depth as these will ultimately inform the studies that emphasize breadth. For example, many years of research on policy innovation has provided a strong theoretical

and conceptual base from which to work. Yet some scholars still hold that policy innovation theory on the whole, is underdeveloped (Graham et al., 2013). In this way, qualitative research is particularly well suited to identify the more nuanced aspects of theory that would only be apparent through an examination of individual cases. As these caveats are uncovered they can be operationalized and tested by studies that seek breadth and generalizability which will ultimately help in strengthening theory. Both approaches to innovation research make important contributions and should be used in conjunction with one another when possible (Starke, 2013).

This qualitative investigation of policy innovation uses multiple qualitative methods. Content analysis and qualitative comparative analysis (QCA) are used in tandem to help facilitate the internal and external validity of the findings. QCA is designed to take advantage of the strengths of both qualitative and quantitative designs. It is a method that is growing in both popularity and application areas. Combined with other qualitative analysis approaches, such as content analysis, the results of QCA can contribute important insight into the factors related to policy adoption and allow for a more generalizable investigation through the analysis of a larger numbers of cases.

Prior to delving into the research design of this dissertation will be a brief discussion of the world view from which this research is conducted. The theoretical framework is then discussed followed by an outline of the study context. Next is a discussion of the data and its collection which leads into the analytic strategies that are used to conduct this research. The last section includes a note on the validity of this approach and a conclusion.

Post-positivism and Policy Research

This study approaches the research questions through a post-positivist world view. This approach is particularly well equipped to deal with the increasingly complex structure of social phenomenon and does not stress subjectivity or objectivity. In an increasingly complex world, post-positivist research emphasizes multiplicity and complexity in social phenomenon (Ryan, 2006). Post-positivists rely on interpretation, meaning, and context to address social phenomena with an understanding that we cannot “separate a thing from a thing’s context, for context creates meaning” (Kelly & Maynard-Moody, 1993). Complexity, and more specifically complexity science, is understood as the various properties of a system emerging through dynamic behavior and interactions. Social phenomenon can easily be conceptualized in this way. Many topics of social research are composed of open systems with multiple layers of nested systems which interact with other open and nested systems which then result in changes in another system (Byrne, 2005). The complexity and interaction of the world is rooted in the context in which it takes place (Gerrits & Verweij, 2013) and while many positivist approaches to understanding take a linear approach to knowing, in reality the world doesn’t necessarily work in a strictly linear way. A post-positivist approach embraces both the complexity and the context in which a phenomenon occurs.

Relating back to the current study, the policy process is increasingly complex (Hill & Varone, 2014). There are multiple interacting political and social systems that combine to result in a policy decision. A post-positivist approach to research stresses the ability to see this process as a whole, at a distanced view; a holistic approach to understanding. Evidence is not seen as proof, but offered as a form of support for the credibility of theoretical or

practical propositions identified in the observations (Fischer, 1992). With this in mind, the present study uses two methods that are particularly well suited for the post-positivist approach to understanding. Qualitative Comparative Analysis (detailed below) is embedded within the idea of complexity. It aligns with the post-positivist assertion of multiplicity and assumes that cause is necessarily part and parcel with the complex social world. Therefore, it allows for the existence of multiple causal paths to a given outcome. With the understanding that one cannot separate a “thing from the things context,” this study also employs content analysis to understand the decision to adopt a drone use policy within the context in which it is created.

Conceptual Framework

The central research question for this dissertation is: “What factors contribute to drone use policy adoption in cities?” Many innovation scholars have sought to address various forms of this question but in the context of other policy areas. As detailed in Chapter 2, quantitative methods are often used to identify the independent net effects of hypothesized explanatory variables contributing to policy adoption. However, as noted previously, this exploration of net effects and generalization of “regional policy diffusion” will obfuscate the nuanced reasons for policy adoption. This study considers the policy adoption process as multifaceted and complex. Different policy contexts reveal different configurations of variables that relate to policy adoption. Further, the quantitative approaches that researchers normally use cannot account for the idiosyncratic nature of specific cases within a study. Thus, the use of case-based methods is particularly advantageous – it is sensitive to complexity, diversity, and the uniqueness within each case (Ragin, 1987). As Yin (2013) notes, the most important application of case study research is

“to explain the presumed causal links in real-life interventions that are too complex for the survey or experimental strategies”, which is one of the goals of this dissertation.

QCA provides an appealing approach for understanding complexities. It is, at the same time a research approach and method driven by theory. It is also configurational at its core where the possibility of multiple complex causal paths to a given outcome are explicitly considered. The selection of the conditions that make up the causal paths should be theoretically and/or practically grounded beliefs regarding the relationship between conditions, their combination, and the outcome (Marx et al., 2014). The need for a strong theoretical foundation is amplified by the nature of Boolean minimization which is at the core of QCA (detailed later). Too many conditions in the model can result in each case having its own unique solution or too many logical remainders. Too few conditions and the researcher runs the risk of omitting important casual conditions (aka omitted variable bias). Thus, the selection of conditions should come from a strong and defensible conceptual foundation.

QCA can be an inductive or deductive process depending on how the expectations or hypotheses are generated. On the one hand, it can be exploratory when used in conjunction with theorized phenomenon (Thomann & Maggetti, 2017). The results can be leveraged to form causal explanations, alternative theoretical models, or used to extend existing knowledge about the topic (Ragin & Rihoux, 2004; Rihoux, 2003; Straatmann, Rothenhöfer, Meier, & Mueller, 2018). For example, Woodside (2015) approaches theories of price-setting in an alternative form using qualitative and quantitative data in QCA. Using interviews, talk-aloud methods, ethnographic research and field experiments with fuzzy set QCA (fsQCA), Woodside presents a set of tenets that “offer a new reality-based behavioral

pricing theory” (p. 47). Other studies, such as the one by Huarng (2015), use QCA as a way to establish new theories for ICT development. Other researchers begin to develop theories for cultural phenomenon such as heavy drinking (Eng & Woodside, 2012) or shopping (von Janda & Woodside, 2014) using QCA.

On the other hand, it has also been used to test well-established theories and the configurational nature of causal patterns in a more deductive approach to analysis (De Meur & Rihoux, 2009; Pruitt, 2015). Using the original formulation of social entropy theory, Mitar (2010) employs QCA along with other methods to test the patterns posited by the original theory, finding support through the configuration of conditions found by the QCA model. Portions of environmental justice theories have also been tested using QCA. For example, Grant, Trautner, Downey, & Thiebaud (2010) extended the theory of the path of least resistance to show that it is not only the characteristics of the community that influence where hazardous facilities are sited but also the characteristics of the facility itself. Furthermore, building upon frameworks that explain state policy adoption, Kim & Verweij (2016) use QCA to examine the posited causal pathways to state environmental policy adoption with respect to external political factors, internal political factors, and policy specific factors. The framework used by Kim & Verweij (2016) have many similarities to the policy innovation literature but only a few other studies have considered some aspect of policy innovation using QCA (Gran & Aliberti, 2003), but none have explicitly investigated policy innovation using QCA.

Prior to beginning a QCA analysis the conditions that contribute to the outcome must be made explicit. This dissertation uses a conceptual framework based on policy innovation and emerging technologies to guide the identification of possible conditions that

cause policy adoption to occur. This conceptual framework provides the basis for the coding protocol that will guide the content analysis. An overview of the conditions that are expected to play the largest role in policy adoption for this context are detailed in the conceptual framework below. These are general expectations and it is expected that other conditions and codes will emerge during the analysis process.

Internal Determinants from Policy Innovation

Privacy is something that individuals worry about the most when it comes to increased drone use (Nelson & Gorichanaz, 2019). Privacy scholars often classify privacy as a social good (Kasper, 2007) and as with other social goods, the wealth of an individual or community a community positively correlates with the level of access to the social good. Researchers have identified and commonly included wealth as a strong predictor of policy innovation. Wealth has been operationalized as per-capita income, average household income, per capita city revenue, and gross product per capita, to name a few (detailed in chapter 2). As is usually the case, wealth is used as a measure of how capable a jurisdiction is to coordinate resources and effectively administer whichever policy is in question. That is, wealth is used to operationalize a jurisdictions ability to implement a policy. For the case of drone use regulations, wealth can play a dual role. First, it may be a good measure of a city's ability to implement a policy, as is the usual operationalization. The second role wealth can play this study is related to privacy. As wealth increases, the amount of privacy that one can afford will also increase (Kasper, 2007). This is evidenced by gated communities, private security, homeowners associations, high privacy walls, and other physical mechanisms used to establish private space. In both roles, wealth will have a positive influence on policy adoption and cities with more wealth will adopt policies aimed at restricting drone use.

Related to the idea that more wealthy cities will be able to afford to implement these new policies is the availability of resources. Shipan & Volden (2014) help to progress the conversation on resources through their investigation into two key resource factors. The first is a jurisdiction's perception on their ability to implement a policy. The second is a jurisdiction's determination of whether the policy will be successful once implemented. It is therefore a two part process. The policy needs to be perceived to be successful and the city must have the resources available to implement the policy once it is adopted. In the context of drone use regulations, the ability to enforce a new drone use policy depends on the ability of the local law enforcement to respond to errant operators. A city will need to have enough slack law enforcement resources to add a new regulation that would require additional time and effort. That is, the law enforcement agency for a city will need to be able to effectively respond to additional disturbances such as drone calls. Cities that have larger law enforcement budgets or higher numbers of law enforcement personnel to resident ratios will be more willing to adopt an additional ordinance. It is expected that cities that do not have the resources to enforce a policy will voice that concern during the city council discussions of drone use policy adoption.

The existence of a problem has been found in many cases to be positively related to policy innovation. For example, in disenfranchised jurisdictions where educational levels are low, poverty is high, medical care is less than ideal, and/or crime is high, there is more of a willingness to take policy action to alleviate the problem (Butz et al., 2015; Matisoff & Edwards, 2014; Mintrom & Vergari, 1998). It is important to note that drones have an obvious physical presence. The propellers of the drones are audible and the drones are easily identified when they are operating at lower altitudes and in densely populated areas. Virtually

any altercation with a drone will be noticeable, and a malfunction that results in an accident will likely be documented, especially in an urban area. To put it simply, any increase in the use of drones, especially in a densely populated urban area is likely to be noticed. Currently, drone incidents are not widely tracked and many law enforcement agencies report drone incidents under a general category of disturbance. Consequently, it is difficult to assess the actual severity of the problem and therefore a proxy will need to be used.

It is expected that if drones are indeed a problem, then it will be brought up during city council discussions surrounding the adoption of a drone use ordinance. If it can be determined that cities are reporting an increase in drone use via anecdotes and experiences at the discussion then the existence of a problem can be measured by determining the total number of drones registered in the city. To reiterate, the visual and auditory signature of drones makes them particularly noticeable so cities with higher numbers of registered drones are going to have more residents that see or hear them, causing them to voice their concern about a drone problem. Therefore, it is expected that those cities with high numbers of drone registrations will also adopt a drone use policy.

Internal Determinants from Emerging Technology

There is a broad and varied literature on emerging technologies. Traditionally, emerging technologies are those that grow quickly, use could be considered socially contentious, are novel, or have an ability to overthrow the status quo (Rotolo, Hicks, & Martin, 2015). They are also uncertain with respect to how they will be used. As Cozzens et al. (2010) note, emerging technologies demonstrate high potential but haven't yet come into their own (so to speak) with regard to how and where they will be used in society. In response, researchers were spent a great deal of time identifying the factors that made

emerging technology the most contentious and how to best address the uncertainty of their use through different policy approaches (Mandel, 2009). With an understanding that drones have many of the characteristics of an emerging technology comes several important factors that may influence drone use policy adoption.

The participation of experts in the policy process plays an important role in whether or not an emerging technology will be seen as favorable. Most of this is due to limited information about the use of the emerging technology (Chul-joo Lee & Scheufele, 2006). As such, the influence of science and scientific communication on opinion and subsequent policy has been documented extensively across several policy areas—most finding that scientific communication influences public opinion (Zhao, Leiserowitz, Maibach, & Roser-Renouf, 2011). Furthermore, studies on emerging technologies find that science media and communication have a strong influence on public opinion with respect to their attitudes about the risks and benefits of emerging technologies (Anderson, Scheufele, Brossard, & Corley, 2011; Brossard & Nisbet, 2007; Ho et al., 2011; Scheufele et al., 2007). Generally speaking, favorable scientific opinion decreases the perception of risks that emerging technologies pose (Cobb & Macoubrie, 2004; Siegrist et al., 2007) and individuals that perceive the risk of an emerging technology to be greater than the benefit are more hesitant to accept the use of a technology. Thus, if experts are involved in the policy process their opinion about the use of a technology is likely to influence the views of both the policymakers and the general public, which will in turn, impact decisions about regulations.

More to this point, Sabatier (1988) has noted the important role that scientific and technical information plays in modifying the beliefs of policy participants. Researchers—including university scientists, policy analysts, and topic experts—are assumed to be some of

the most central players in a policy process. The advocacy coalition framework assumes that these actors try to embed their core beliefs into the policy process by advocating for or against certain courses of policy action. As a way to enhance the potential to embed their beliefs in the policies, individuals and groups align themselves with others groups that share similar values. As an allied group, there is a better chance of manipulating policy in a direction that is favorable to their own values. Thus, a strong presence of commercial drone operators or participation in the policy process by aeronautical groups is expected to sway policy in the direction of what those groups support. Because it is recreational operators and not commercial operators that are usually seen as the problematic drone users, it is unclear whether policy actors will support or oppose drone use policy.

There are at least two major frameworks explicitly designed to aid in the development of emerging technology policy. There is the real time technology assessment framework (Guston & Sarewitz, 2002) and the anticipatory governance model (Barben, Fisher, Selin, & Guston, 2008; Sarewitz, 2011). Both build on the idea that coalitions of individuals and groups influence policy design and emphasize a process of collaboration between stakeholders—experts, policy makers, and the general public—to identify future risks and benefits of an emerging technology. Through analogical case studies, research program mapping, and communication, the frameworks “observe, critique, and influence social values as they become embedded in innovations” (Guston & Sarewitz, 2002). While these frameworks are mostly aimed at influencing the research and development process, they underpin the heterogeneity of opinions associated with emerging technologies.

However, findings suggest that expert and layperson attitude and opinion toward emerging technologies diverge in several notable areas, but namely in the areas of risk and

benefit (Scheufele et al., 2007). Since local governments do not have the time or resources to conduct a formal technology assessment (Butler, Volden, Dynes, & Shor, 2015) there exists the potential for considerable uncertainty in the policy making process (Moor, 2005). This forces policy makers to rely on anecdotes, opinions of stakeholder groups and experts to inform their decisions about the risks and benefits of emerging technologies (Corley et al., 2009). However, if considerable uncertainty exists in the absence of these policy stakeholders it could halt the policy process until more information can be gained. As Walker (1968) explains “uncertainty and the fear of unanticipated consequences have always been formidable barriers to reform.” The presence of uncertainty is expected to play an influential role in the policy process, but it is not clear how it will impact policy decisions.

Policy Diffusion

Research on policy innovation finds strong support for the presence of diffusion. Most studies note that a policy adopted by one jurisdiction will have some influence on whether another jurisdiction also adopts that policy. The reasons for this interaction vary, but as mentioned in Chapter 2, can be captured through the concepts of learning, emulation, competition, and geographic proximity. In the context of drone use regulation where a substantial amount of uncertainty exists with respect to how they will be operated, regulations will likely be influenced by what other cities are doing. Which one of these diffusion factors will play the largest and most influential role is not clear. As such, this study seeks to not only identify whether diffusion plays a role but also to differentiate which diffusion mechanism(s) are at work. To date, the ability to clearly specify which diffusion mechanism is influential has proven to be difficult. It also seems to be assumed when approaching policy innovation through a purely quantitative lens. By using a qualitative

method of data collection, the specific mechanism can be identified and then used in a quantitative approach.

The regional nature of the policy context suggests that geographic proximity will play a role. Those cities that are closer in proximity to one another will have a better chance of hearing about neighboring drone policies. Furthermore, having heard about the possibility of having a problem with drones neighboring cities may be even more willing to adopt a policy in anticipation of increased drone use, regardless of whether or not it is currently an issue. People and drones are mobile. If a problem is occurring in a neighboring location it is highly likely that the problem will eventually diffuse across city lines. Neighbors with a policy are expected to play a strong role because they indicate that a problem is increasing and could soon effect surrounding areas.

To elaborate further on the spatial effects consider, for example, two neighboring cities where one has adopted a drone use policy (city A) and the other has not (city B). There are several possible diffusion outcomes in this situation that would be obfuscated if only measured based on geographic coincidence. City B may choose to adopt a drone policy out of competition. That is, having heard about city A's policy, city B may adopt a policy to dissuade those individuals who were once operating in city A to not then move their operations to city B. As was the case in Bouché & Wittmer (2015), cities may be competing to keep the operation of drones out of their city through varying degrees of regulating drone use.

Another possibility is that the geography of city A and B make it easier for city B to observe the outcome of city A adopting a drone use policy. City B may choose to wait and see what the greater implications of city A's policy are and whether or not it is successful.

Having seen that the policy works and is a viable option, city B could choose to adopt the policy. In this case, learning would be the diffusion mechanism at work.

Yet another potential outcome that would be overlooked if only measuring geographic influence is the possibility of emulation. Again, geography might facilitate the ease of observation, but if city A is a leader when it comes to policy making in the area, city B may choose to adopt a similar policy because of competitive inducement. The choice of city B to adopt a similar policy may also be due to similar socio-demographics to city A and thus want to maintain a similar policy environment. Further still, the uncertain characteristics of drones and their regulation suggest that emulation might be due to an uncertainty operating environment. Rather than tempt fate with a unique local policy which may or may not work, cities may copy one another in an act of “policy plagiarism” to decrease the uncertainty in their decision of how to develop and implement a drone use policy.

However, cities may respond to uncertainty differently. Uncertainty in this study is defined as not having enough information to be confident in the outcome of the policy decision. In other words, cities are operating in low information environments. In Mossberger’s (2000) analysis of enterprise zones in U.S. states, five cities were purposely chosen to include variation in when the enterprise zone policies were adopted. The earliest adopters faced lower levels of information availability due to the fewer numbers of adopting states while later adopters were able to observe how the enterprise zones developed in the earlier adopting states. Regardless of the adoption timing, all of the states faced some degree of uncertainty as there were differences in tax structures and contexts across the states. As such, the findings showed that all the states were partaking in active information gathering. Each of the sampled states identified and adopted at least part of the national proposal for

enterprise zones, but where they differed was in the level of policy adaptation. Results suggested a “piecemeal borrowing and adaptation” (p. 130) of existing policies from states and the federal proposals with higher levels of policy borrowing and adaptation occurring in the later adopting states. As for the two earliest adopting states with arguably the lowest amount of information available to “borrow” from, there was a much more concerted information gathering effort with less freedom to adapt the policies due to the lack of information that could be used from policies elsewhere.

For drone use regulation, not only are cities having to contend with a new policy context but are also having to deal with unclear definitions of what can be regulated (detailed next), a lack of policy examples to borrow from, and uncertainty inherent to the operation of drones. That said, it is expected that learning by cities will take at least two forms. Following Mossberger’s (2000) continuum of decision making, cities that are larger with arguably more resources may take a more rational approach to policy making. Learning will take place through a comprehensive search of possible policy options through a longer information gathering phase. In smaller cities with fewer resources, learning will be bounded and will likely follow the policies of the early adopters.

Given the documented role that uncertainty plays in the governance and regulation of emerging technologies and in the policy diffusion process, it is important to document its influence in policy adoption decisions. If the goal of policy innovation, as a whole, is to understand the processes that influence the decision to adopt a policy, then understanding whether uncertainty changes the policy innovation process should be evaluated with respect to where it enters in to the policy innovation framework and what it affects. Furthermore, if uncertainty is explicitly recognized by policy makers, it should be considered as an additional

factor that ultimately affects the decision to adopt a policy. The approach that this dissertation takes allows for that uncertainty to be identified and evaluated in the conceptual framework.

The Current State of Drone Use Regulation

Drones are a rapidly emerging technology growing in use among hobbyists, governments, and commercial operators. Along with this increase in drone use is the rapid evolution of regulations (Ison, Terwilliger, & Vincenzi, 2014). The FAA is tasked with the safe integration of drones into U.S. airspace (Marshall, 2016). Their responsibilities include the establishment of safe altitudes for navigating and protecting aircraft, protecting individuals and property on the ground, managing the navigable airspace, and preventing collision between aircraft. With respect to drone use, this means the FAA develops and implements drone rules aimed at designating types of airspace, creating general operating and flight rules, and air traffic rules (Raley, 2017).

Until recently, the FAA did not operate outside this scope. Trespass, privacy, and other unlawful drone-bystander interactions were left up to the states and local governments to manage. An informative quote by Jim Williams, a retired drone integration office manager, illustrates the approach that the FAA had towards drone enforcement:

The FAA is not about enforcement but about compliance. We can't be everywhere. We only want to get involved in identifying the really bad actors. We communicate with people who disregard the rules. We have a standard letter we send. Enforcement is a last resort. The only rules people need to know is to stay out of the way of manned aircraft and not to put people on the ground at risk. It's that simple. But unfortunately people don't even know that. New York City police arrested two guys who chased after one of their police helicopters (Marshall, 2016).

The hands-off approach to recreational drone regulation by the FAA seems fairly obvious from the quote. The FAA will only get involved when a severe violation of the rules

occurs repeatedly. New FAA legislation in the proposed 2018 reauthorization act changes some of the rules for recreational users but the approach to enforcement at the federal level likely won't change. However, in the new reauthorization act is specific language acknowledging privacy in the guidelines for recreational drone operators, specifying that "drone use shall be carried out in a manner that respects and protects personal privacy consistent with the United States Constitution and Federal, State, and local law"(FAA, 2018). Enforcement of these laws still falls on the local or regional municipalities who still have to deal with the potential for pre-emption when creating rules and/or laws governing how and where drones can fly. With the 2018 reauthorization act approved, several important provisions have been made, especially as it pertains to recreational drone operation. For one, recreational drones are no longer considered to be model aircraft. This means that no matter the size, operator, or reason for use, all drones are considered unmanned aerial vehicles and must abide by existing rules governing where and when drones can be flown (FAA, 2018).

Prior to this new legislation, recreational drones operated under the designation of model aircraft. Under this designation they did not face the same severity of penalty if caught flying in violation of the safety guidelines. In fact, as a model aircraft, FAA rules and regulations were barely relevant for recreational drone operators and this was part of the reason why so many cities were struggling with how to regulate their use. Until recently, the only guidance the FAA had for recreational drone use was a set of recommended "safety guidelines". However, now the FAA provides increased guidance to states and cities that are considering local drone use ordinances. If cities and states follow these guidelines any enforcement that comes at the local level will not be preempted by federal law. Moreover, without these laws, cities have had no way of legally reprimand errant recreational drone

operators. That said, the suggested FAA guidelines still do not cover privacy or trespass laws, meaning that cities must develop alternative policy solutions if they wish to specifically address these conflicts. States are currently pursuing several policy options but most are extending existing laws to cover drone use. For example, New York Bill A 4642 amends existing civil rights law to make it an offense to use a drone for unwarranted surveillance of a neighbor (Curran, 2017). In Illinois, House Bill 3906 amended the criminal code to make it unlawful for any person to operate a drone within the confines of another person's private property while recording video or images or to invade another person's reasonable expectation of privacy (Moylan & Olsen, 2017).

Many cities have taken the approach of codifying FAA guidelines into a local ordinance. In doing so, local law enforcement has the means to enforce the rules that all drone operators must now follow. Without these local ordinances, the most a city can do is report the incident to the FAA and hope they follow up. It is then somewhat surprising that the current policy landscape in a region with some of the highest numbers of registered drone users is so fragmented. In Orange County (OC), CA, for example, the grand jury commissioned a report on drone use at the local level (OC, 2016) with two main intentions. First it gave the cities the information they needed to create enforceable ordinances at the local level while adhering to the federal level laws and preemption possibilities. Second, it also provided cities with recommendations on communicating drone use laws to their citizens. It has been three years since the report was published and the majority of cities in Orange County still do not have a local drone use ordinance (OC, 2016). Even more interesting, some cities in both Los Angeles and Orange County (for example Hermosa Beach) have retained their ordinances that go above and beyond the rules outlined by the

FAA. Why some cities choose to formally adopt drone use policies while others do not remains unclear.

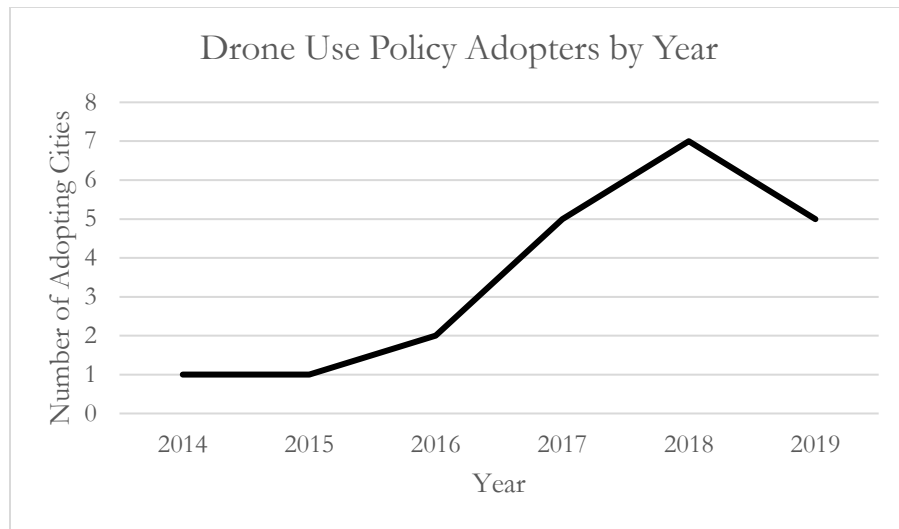


Figure 2. The number of drone use policy adopters by year in Los Angeles and Orange County.

Drone use policy adoption has generally followed the traditional innovation curve seen in other policy areas (Figure 2). When the earliest adopters formalized their drone use policies (2014) the policy landscape was rather uncertain with respect to jurisdiction, enforcement, and preemption possibilities. As time went on, there was still some policy uncertainty but the FAA starting to make clear some of the many areas causing the most uncertainty for cities. During that time there was a pointed increase in the number of cities with ordinance. Currently, there is a fairly reliable framework for cities to follow in addition to having numerous cities that have already navigated the policy process to observe. Yet some cities, particularly those in a region with high numbers of drone registrations and a relatively large number of adopting cities, are still without a drone use ordinance. Using the previously mentioned theory of policy innovation, this study will clarify which innovation mechanisms are the most salient for this policy area. It will make clear how the complex mix

of diffusion, internal determinants, and uncertainty in the policy landscape combine to cause policy adoption. The identification of these causal forces influencing emerging technology policy has implications for shaping and understanding local level approaches to future technologies with similar social implications.

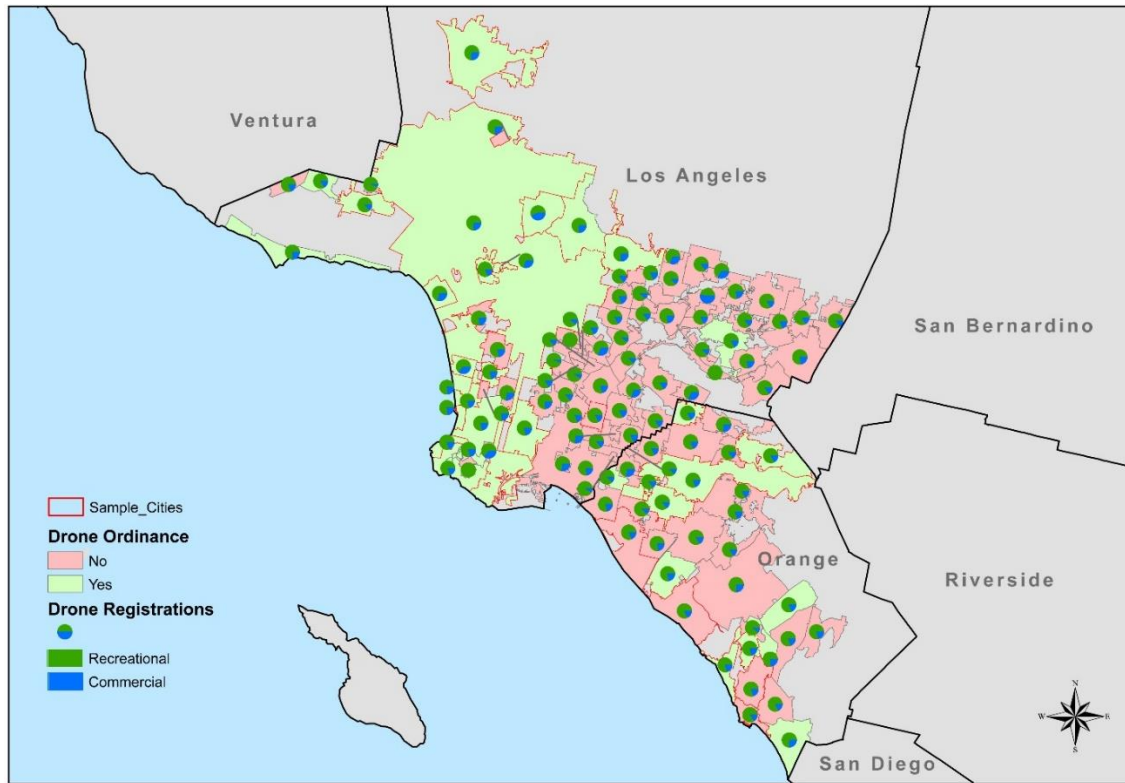


Figure 3. Study area and sample cities (red outline) for this study.

Data

The fact that some cities in Southern California have followed the Orange County Grand Jury recommendations while others have not is part of the reason why this dissertation considers all cities within Orange County as the sample frame (Figure 3). That some cities in Los Angeles County have adopted a drone use policy while others have not is the reason why all cities in Los Angeles County are considered. Additionally, this area was chosen due to the representative mix of city demographics and because it is a hotbed for

drone registrations (some of the largest numbers of registered users in the U.S.), drone policy activity, and drone operation. In fact, Beverly Hills and Los Angeles were two of the first cities in the entire U.S. to adopt drone use policies. The study sample was determined based on the availability of data but also selectively to include early, middle, and late adopters, from both Los Angeles and Orange Counties. Cities that had ordinances or had considered an ordinance as of December 2018 were first identified. A key part of this initial search was using the city council archives available on each of the city websites to determine whether they had discussed the possibility of a drone use ordinance. Of the initial list of 118 incorporated cities across the two counties, 24 were identified that had officially adopted a drone use ordinance or had some recorded documentation of the city council discussing the decision to regulate drone use (Table 2). In total there were 16 cities that had formally adopted a drone use ordinance and 8 that had not.

The primary data source for the analysis are the video recordings of city council discussions and interviews conducted with three city officials. These recorded city council discussions ranged in length from about 10 minutes to well over an hour and the interviews lasted about thirty minutes. Some cities had several discussions of the policies over the course of several months while other cities had a single, longer discussion in a one meeting.

Table 2. Data table listing the sample of cities used in the analysis

City	County	Ordinance	Date of Adoption	Data Type
Alsio Viejo	Orange	Yes	9/5/2018	Email Correspondence/Staff Report
Anaheim	Orange	Yes	8/14/2018	Interview/Email/Staff Report
Bellflower	LAC	No	none	Press Release/Email
Beverly Hills	LAC	Yes	10/21/2014	Media/Staff Report
Burbank	LAC	Yes	5/10/2016	Media/Staff Report
Calabasas	LAC	Yes	11/8/2017	Media/Staff Report
Carson	LAC	Yes	12/1/2015	Media/Staff Report
Dana Point	Orange	No	none	OCGJ response/Email/Staff Report
Garden Grove	Orange	Yes	4/11/2017	OCGJ response/Media/Staff Report
Hawthorne	LAC	No	11/8/2016	Media/Staff Report
Hermosa Beach	LAC	Yes	5/10/2016	Media/Staff Report
Huntington Beach	LAC	No	none	Media/Staff Report
La Habra	Orange	Yes	8/15/2016	OCGJ response/Media/Staff Report
Laguna Beach	Orange	Yes	3/23/2017	OCGJ response/Media/Staff Report
Laguna Niguel	Orange	No	none	OCGJ response/Media
Los Angeles	LAC	Yes	10/14/2015	Media/Ordinance/Staff Report
Manhattan Beach	LAC	Yes	2/2/2016	Media/Ordinance/Staff Report
Newport Beach	Orange	No	none	OCGJ response/Media/Ordinance
Palos Verdes Estates	LAC	No	none	Media
Pasadena	LAC	Yes	5/15/2017	Interview/Ordinance/Staff Report
Rancho Santa Margarita	Orange	No	none	OCFJ response/Email
Santa Clarita	LAC	No	none	Interview
West Hollywood	LAC	Yes	1/19/2016	Media/Ordinance/Staff Report
Yorba Linda	Orange	Yes	11/7/2017	OCGJ response/communications/Email

When possible, all of the video recordings of the city council drone use discussions were downloaded for each of the cities in the sample. If a video download was not available the audio was obtained using an external recording device. The media recordings for each city were transcribed using Temi, an online automated transcription service.² Following the automated transcription, each of the transcribed documents were reviewed while simultaneously listening to the audio/video, checking for accuracy and correcting any errors. Transcribed documents were then exported as a word file. There were 27 transcribed documents from the videos in total which came in at just over 12 hours of discussion. All of the ancillary data related to the city's decision to adopt a drone use ordinance was also downloaded. This included the ordinance, responses to the grand jury report, news articles, staff reports, and presentations (Table 2).

Semi-structured interviews were conducted with three city staff members who were familiar with the cities drone use policy discussions. Interviewees included a policy analyst from the city of Santa Margarita, a police sergeant from the City of Anaheim, and an assistant city attorney from the City of Pasadena (Table 2). Following Cohen-Vogel & Ingle (2007), the interview was performed in a way that would provide contextual information regarding the reasoning behind the decisions to regulate (or not) drone use in the city. Specifically, the interview protocol was structured to inquire about internal determinants and diffusion mechanisms but also allow for some flexibility in the responses (Appendix A). The interview protocol and recruitment process was approved by Arizona State University Institutional Review Board.

² www.temi.com

Additional data was collected via the U.S. census, city websites, and the FAA. This included data on income levels, law enforcement, median home value, and the number of commercially and recreationally registered drones for each city. All of these data were recorded and managed using excel. Rows corresponded to each city (case) and columns housed individual variables. Each was dichotomized based on the identification of its presence or absence, as well as the context in which it was being used in the qualitative data (covered in more detail in Chapter 6).

Analytic Approach

This dissertation is structured as a multiple case study with an embedded design (Yin, 2013). The context of this study is emerging technology policies, the case is drone use regulation, and the embedded units of analysis are the sample cities. Qualitative data was collected from interviews and documents related to each city's discussion of a possible drone use ordinance. As "the most powerful research designs are those that do not rely on just one tool but those that combine different qualitative techniques" (Starke, 2013, p. 577), this dissertation uses two methods to answer the research questions.

The first approach is content analysis. As discussed in the previous chapter, content analysis is one of several research methods that are applied to text-based data. Content analysis relies on the contextual meanings and interpretations through a classification and coding process guided by a protocol (Hsieh & Shannon, 2005). The coding and classification protocol acts as a blueprint for distilling the large amount of text data down to broader categories and codes that represent the phenomenon of interest. Thus, the first step in the analysis process was to develop a coding protocol to guide the categorization and coding of the data. The coding protocol was developed based on a mix of personal experience with the

data, direct content analysis, and inductive interpretive research. Key concepts identified in the literature review as well as the theories framed by prior research were used in the initial development of the protocol (detailed in the Conceptual Framework section). Some of the initial codes were derived from the investigator's personal knowledge about the research context and through the initial readings of the data. Given the novelty of this policy area the protocol was revised to incorporate additional codes and concepts as they were identified during the content analysis. The development of the definitions of the codes is elaborated on in Chapters 4 and 5 and the full coding protocol is detailed in Appendix B.

The content analysis was performed as a summative exercise (Hsieh & Shannon, 2005). Each of the codes were summed to get the total frequency of their occurrence across all of the data from the sample cities. The information gained by identifying the frequency of codes across the data provided the foundation for the second analytic strategy, QCA. QCA is limited by the total number of conditions that can be included in the model (Ragin et al., 2017; Schneider & Wagemann, 2012) and it is therefore advantageous to base the inclusion criteria off of theoretical or practical knowledge. By using the findings of the content analysis and subsequently selecting conditions based on the frequency of their appearance in the data, the selection and eventual inclusion is both theoretically and practically justified. The findings from the content analysis acted as a mechanism to support the exploration and inclusion of concepts as possible conditions for policy adoption to occur (detailed in Chapter 6).

A Note on Validity

Validity always come into question with qualitative research. This is interesting because most of the arguments about validity have to do with the subjectivity of qualitative

research findings. Consider, for a moment, other methodological approaches. It becomes strikingly clear that no matter what type of approach is taken there exists an interpretive element. Numbers, equations, words, and observations “are all abstract, symbolic representations of reality, but not reality itself” (Ratcliffe, 1983, p. 150). Any finding, regardless of the way it is obtained, requires interpretation and depends on the researcher’s ability to relate it back to the context in which it was captured. Furthermore, Merriam & Tisdell, (2015) make a strong case that qualitative analysis is perhaps more valid than quantitative research by itself. By observing the phenomenon directly and without a data collection instrument wedged between the phenomenon of interest and the researcher, qualitative research is closer to what is actually occurring in “reality”. That said, there remains the question of capturing an objective “truth” and this is non-trivial. Qualitative research, along with other research methods, depend on the researcher’s interpretation of the data so it is up to the researcher to ensure that what is being interpreted is in fact what is occurring.

Denzin & Lincoln (2008), Wolcott (2005), and many others have detailed strategies to increase the validity of the findings or, put another way, the correspondence between the interpretation of observations and what is happening in the real world. One of the most well-known approaches of achieving correspondence is triangulation. There are several approaches to triangulation, all of which are variations on the act of making sure what is interpreted from the data is what is actually happening. To that effort, this study relies on a number of pieces of evidence. This includes in-situ observations, multiple document types, and interviews to develop a complete picture of the processes supporting drone use policy adoption. Furthermore, the final analysis and interpretation is ultimately based multiple

methods, content analysis and QCA, which will be used to support a single interpretation of the mechanisms that result in drone use policy adoption. In line with a post-positivist worldview, this study aims at building a broad overview of the drone use policy process (Ryan, 2006). It begins by determining the individual level factors that spark the conversation about a drone use policy. Once this conversation has started, the study identifies the salient factors which are integral parts of the conversation about whether or not a drone use ordinance can/should be adopted. Finally, from the possible processes observed to be part of the drones use policy decisions, the study isolates the conditions which make up the causal path towards drone use policy adoption.

Conclusion

The theoretical framework guiding this study is derived from policy innovation and to a lesser extent, what is to be expected based on the findings from the emerging technology literature. There are several likely routes to policy adoption which are important to capture within the context of this study. Content analysis can be used to identify the individual innovation processes that are present and influential during the city council discussion of a drone use ordinance. Some of these processes are likely to be unique to a specific city while other may be more common across all the sampled cities. One of the beneficial characteristics of QCA is its ability to identify the most common set of conditions (configurations) that are necessary and sufficient towards a causal path(s) to drone use policy adoption. The results of this analysis should be generalizable to other cities. The use of embedded cases increases the variability in the characteristics of the city with respect to the socio-demographics and political environment and the number of registered drones does vary from city to city. Increasing our understanding of what supports drone use regulation

will provide important insight for how this new technology will be handled at the city level as it continues to rapidly make its way into the hands of recreational and commercial operators. The following chapters detail each of the analyses that together, identify the catalyst of drone use discussions, relevant diffusion mechanisms and internal determinants, and lastly the combination of these conditions that cause drone use policy adoption.

CHAPTER 4

CATALYSTS FOR CONCERN AS DRIVERS OF DISCUSSION

Trust as an ethical value in emerging technology governance: the case of drone regulation³

This chapter builds on discussions of ethical values for the good society by foregrounding the potential role of emerging technologies in realizing the good society. Specifically, it looks at the emergence of drones and the evolving regulation of their ownership and use. The study presents a qualitative, thematic analysis of city council meetings in 20 cities in Southern California where drone regulation was discussed from 2014 to 2017. These results show the ethical themes that were operative in such discussions: privacy, safety, enforceability, crime, nuisance and professionalism. Underlying most of these themes is trust. A discussion of trust with respect to the good society is discussed, and it is suggested that trust may be more critical to emerging technologies than technologies in general. That is, trust in an emerging technology is required for it to be accepted and more fully integrated in society. Without trust, it is difficult for society to accept the technology.

Introduction

Technology and society co-constitute each other in an evolutionary dance extended through time. This dance can move in any number of directions; though some would speak of this evolution as “progress,” the notion of progress is rarely defined and in any case should not be taken for granted. Rather, as Hans Jonas (Jonas, 1985) suggested, there is a

³ Nelson J., Gorichanaz, T., (2019) Trust as an ethical value in emerging technology governance: The case of drone regulation, *Technology in Society*, <https://doi.org/10.1016/j.techsoc.2019.04.007>

responsibility—one that cannot be shrugged off—to think critically about where society should go, and to build it in that direction.

This is a question of ethics. Broadly construed, ethics is the field of philosophy dedicated to investigating and systematizing what is good and bad, right and wrong, etc. Within ethics are the areas of: metaethics, exploring the foundations of ethical principles; normative ethics, establishing moral standards of good behavior; and applied ethics, examining specific controversial issues in particular realms of human concern, such as medicine and the natural environment.

Recent discussions in various fields of ethics have pointed toward the concept of the good society—a cosmopolitan analogue to the traditional Aristotelian concept of the good life. When the good society is considered, metaethical questions would include what “good” means, what makes a society good, how we know a society is good, and the relationship between the good life and the good society. Questions of normative ethics would engage theories such as virtue ethics, deontology and consequentialism to devise a coherent system for judging individuals’ behavior with respect to the good society. And questions of applied ethics would explore issues in society that are both controversial and morally charged, such as drug policy, gun control, homosexuality and immigration. In applied ethics, questions of social policy interact with questions of morality; for this reason, authors such as Paulo (Paulo, 2016) see applied ethics as the confluence of philosophy and law.

As will be discussed below, many authors have written on the role of technology in the good society (e.g., (Brey, 2018)). This paper discusses emerging technology from the perspective of applied ethics, examining how societies implement regulations for emerging technologies through moral arguments. It builds on Brey’s (Brey, 2018) conceptualization of

values for the good society by foregrounding the role of emerging technologies in moving toward (or away from) the good society. Specifically, the study looks at the emergence of drones and the nascent regulation around their ownership and use. The following study presents results from a qualitative study of city council meetings in Southern California where drone regulation was discussed. These results show the ethical concepts that are deemed operative in such discussions, and it is suggested that the establishment of trust underlies them.

The following section begins with an illustrative review of the literature on technology and the good society, as well as on the proliferation of emerging technologies generally and drones specifically.

Technology and the Good Society

For decades, scholars in science and technology studies, philosophy of technology, and other fields have been working to understand how technology and society co-constitute each other (MacKenzie & Wajcman, 1985; Mumford, 2010). *Technology* here is understood to be a way in which humans build order in the world, and *society* is a group of people who live together and feel themselves to form a distinct entity. Technology is what puts distance between a people and the natural course of events, and this distancing is what allows for society (Floridi, 2013, pp. 303–305).

Within the literature on technology and society, some discussions have entered the realm of ethics, exploring how technology relates to the good society. In a classic paper, Winner (Winner, 1980) examined the political qualities of technological artifacts—that is, the way particular technologies either require or are highly conducive to particular distributions of power, authority and privilege in a society. To recapitulate two of Winner’s examples,

nuclear power seems to require a centralized, authoritarian arrangement, while solar power could in principle be administered with authoritarianism but is more conducive to decentralization and democracy. For those technologies that *entail* a particular political arrangement, the decisive question is whether to adopt it at all; for those that merely *encourage* certain arrangements, the question is what form the technology should take.

Underlying how these questions are answered is an ethical vision for what a future society should be like, and the technologies in question are seen as contributing to that vision. So what *should* society be like? At first blush, one might suspect the question to be inscrutable, given that the different moral, legal and religious theories found throughout the world are incompatible in many ways. However, some convergences are inevitable. Take the case of the Universal Declaration of Human Rights, ratified by the United Nations in 1948. Maritain (Maritain & UNESCO, 1949, p. 9) recounts: “someone expressed astonishment that certain champions of violently opposed ideologies had agreed on a list of rights. ‘Yes’, they said, ‘we agree about the rights but on condition that no one asks us why.’ That ‘why’ is where the argument begins.” The UDHR has stood the test of time and today is the most universally accepted basis that society has for defining a good society. It defines and establishes basic ethical concepts such as dignity, liberty, equality, and brotherhood; it establishes rights of individuals and communities; and it specifies to some extent how these rights can be used and ensured.

Taking the spirit of the UDHR further, Brey (Brey, 2018) discusses the place of technology in constructing the good society. He focuses on the values inherent in and manifested by technological arrangements with an eye toward identifying the most critical

value to underlie the global information society. He begins by differentiating instrumental from intrinsic values, and he presents candidates of each.

- An instrumental value is a value for the sake of something else, such as another value. Some instrumental values are necessary, while others are merely contingent. Examples of instrumental values that Brey offers are equality, autonomy, friendship, community, trust, privacy, freedom, democracy, sustainability, physical excellence, wisdom and artistic expression.
- An intrinsic value is valuable for its own sake. Brey's examples include well-being and justice. These intrinsic values are supported by a number of instrumental values; according to Brey, among them are (from the above list) freedom, democracy, sustainability and privacy.

Brey (2018) contends that justice is the intrinsic value most worthy of grounding the good society with respect to technological development. However, he does not conceptualize justice in depth. Fortunately, such work has been carried out by Britz (2008). Britz argues that, given the globalizing force of modern information technologies, devising universal moral principles for a global society is increasingly urgent. He proposes the concept of social justice, and he proceeds to analyze that concept. According to Britz, social justice has three core principles: all people must be treated equitably and judged according to the same norms; a person ought to get that which is due to them; and unequal treatment is justifiable where differentiation between people is based on publicly accepted criteria representing all and so long as the information-poor and the marginalized are not disadvantaged. Britz also outlines seven categories of justice and their application in the global information society.

With this vision of the good society in place, scholars can evaluate the role of any given technology in moving toward that vision. Though technologists have begun some efforts to design for well-being on one hand and justice on the other, both agendas are in their infancy (Brey, 2018). Brey notes that “operationalizations will have to be developed for these values, along with methods of impact assessment to assess how technologies can positively or negatively impact their realization” (Brey, 2018, p. 44).

Particularly when it comes to emerging technology, also to be considered is the interaction between governance, regulation, and ethics (Floridi, 2018; Paulo, 2016). Governance is the creation and maintenance of policies, procedures and standards; it establishes what moves are possible in the game, so to speak. Regulation is the legislation enforced through social norms and government; it says what moves are legal and illegal. Finally, as discussed in the introduction, ethics is the examination of moral problems; it says what moves are good or best in a given context. In this framework, regulation shapes governance through legal compliance, while ethics, chiefly applied ethics, shapes both governance and regulation through moral evaluation (see Figure 4). All three of these aspects are necessary to move a society in the right direction. Moreover, governance, regulation and ethics each in turn involve a matter of coordination of a number of sub-elements. Therefore, as society works to move toward the good society, it faces a problem of coordination. The present paper shines some light on the dynamics at play as this research considers a case of this coordination unfolding today, in the context of an emerging technology.

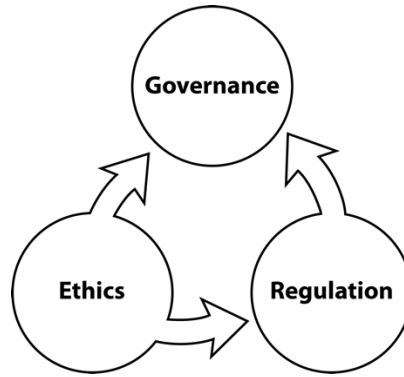


Figure 4. Interactions among ethics, regulation and governance of technology. Adapted from (Floridi, 2018).

Emerging Technologies

To examine a real-world case of moving toward the good society, this study focus on emerging technologies. Emerging technologies are defined by their radical novelty, relatively fast growth, coherence and conceptual autonomy, prominent impact and uncertainty, and ambiguity (Rotolo et al., 2015). That is, emerging technologies are shapers of society par excellence. With emerging technologies, the dynamics of ethics, regulation and governance are in flux.

Some common examples of emerging technologies today can be found in the fields of nanotechnology (Scheufele & Lewenstein, 2005), bio-technology (Martin & Kohli, 2003), genetic technology (Cashion, Driscoll, & Sabek, 2004), and neuro-technology (Giordano, 2012), as well as machine learning and other advances in computing (Yan et al., 2015). The ongoing and rapid development of these technologies implies some associated uncertainties, especially when it comes to the perception of risks and benefits posed to society and the role these technologies will have on shaping society. By definition, firsthand experiences and

interactions with emerging technology are minimal, and therefore the public must rely on personal anecdotes, media coverage, social networks, or cultural predispositions as sources of information (Gregory & Miller, 1998; Scheufele & Lewenstein, 2005). Unfortunately, biased information that supports or rejects the emerging technology can have a strong influence on opinions, which can divide the public into “for” and “against” camps, making the introduction of the technology into society particularly contentious (Lee, Scheufele, & Lewenstein, 2005). Furthermore, when divisions among individuals grow stronger, the technology’s potential contribution to the good society can become murky and harder to define.

As an emerging technology becomes more known throughout a society, individuals form opinions about its use, but research suggests that these opinions are likely based on very little (if any) information. Fiske and Taylor (2013) posit the concept of a *cognitive miser*, which occurs when an individual seeks out the simplest way of coming to a conclusion about a particular problem or subject. Similarly, *satisficing* has been used to describe the concept of bounded rationality, suggesting that individuals only gather enough information as minimally necessary to make a decision within a certain context (Simon, 1972). For the case of emerging technology, this means that when the time and effort required to gain a comprehensive understanding of an emerging technology is large, individuals will only gather as much information as necessary to contrive an opinion or confirm a previously held belief. Also referred to as cognitive shortcuts or heuristics, scholars have documented this process in relation to new or existing technologies (Scheufele et al., 2008; Scheufele & Lewenstein, 2005), while others have found that previously held feelings and attitudes significantly

moderate the overall opinion of emerging technologies (Lee, Scheufele, & Lewenstein 2005).

Trust in Emerging Technology

Recall in Brey's (2018) discussion of technology the instrumental value of trust. If the literature on emerging technology is any indication, it seems that trust is also particularly salient when it comes to emerging technologies, more so than for those technologies that are well established. Here *trust* is defined as a person's acceptance of the truth or beneficence of something to the extent that the person does not need to investigate the grounds for their belief. Trust entails at least two dimensions: trust in the information received about the emerging technology, and trust in the institutions or people developing the emerging technology.

The perception of risk versus benefit can play a strong role in whether individuals feel that an emerging technology, or those who use it, can be trusted. For example, studies have asked respondents about the trust they have in a nanotech business leader's ability to minimize risk to humans. A comparison between responses showed that less trust was related to respondents perceiving the risks of nanotechnology as larger than the benefits (Cobb & Macoubrie, 2004). Siegrist, Cvetkovich, and Roth (2000) investigate these implicit tradeoffs through a structural equation model demonstrating that the alignment of values (social, political, religious) between the public and an emerging technology business leader increases trust in the technology. Most interesting, however, was the confirmation that when trust is high, there is a higher perception of benefit and lower perception of risk for those technologies used as examples in the study. Thus, if individuals feel that the user or creator

of a technology can be trusted, it is more likely that the benefits of the technology will be perceived to outweigh the risks.

This process has been replicated for other emerging technologies as well as other users of the technologies. For example, in a study by Ho et al. (Ho, Brossard, & Scheufele, 2008), deference to scientific authority was one of the strongest (in both magnitude and significance) predictors of support for stem cell research. That is, if the information obtained about the technology was positive and came from a scientist, individuals reported higher support for the technology. Similarly, the study by Lee, Scheufele, & Lewenstein (2005) found the coefficient for “trust in science” to be positive and highly significant with respect to general support of nanotechnology. Further evidence is found by Alhakami and Slovic (1994), who report that risk and benefit perception may be tied to how favorable the technology is perceived, while Siegrist, Cvetkovich, and Roth (2000) found that value alignment and trust will also play a strong role in risk and benefit perception.

To reiterate, when the actual or perceived risks of the technology outweigh the benefits, a general distrust of the technology will follow. Conversely, if individuals view a technology as having more benefits than risks, then there will be higher levels of trust and acceptance of the technology. As opinions become more favorable towards the technology or the organization associated with the technology the risks will be perceived as lower than the benefits. In situations where favorability of the technology is high and the benefits outweigh the risks, the public will be more likely to have a general trust of the new technology (Siegrist, Cvetkovich, & Roth, 2000). But if the public views the technology as unfavorable, it is more likely that risks will be perceived as higher than the benefits and the public will have a general distrust of the technology.

This paper continues this line of work by investigating the confluence of emerging technologies, trust, and the good society in one example of an emerging technology: unmanned aerial vehicles, or, as they are more commonly known, drones.

Drones as an Example of an Emerging Technology

There are a number of emerging technologies at any one point in time. Unmanned aerial vehicles, or more commonly drones, are one example in the present. Drones are growing in popularity; and, as a technology, they can certainly be considered as emerging. As the name *unmanned aerial vehicles* implies, drones are remotely controlled by an operator on the ground or pre-programmed to fly specific routes. Making them stand apart from other emerging technologies is the easy access and ease of use by the general public. Other emerging technologies, such as nanotechnology, are either incorporated into other technologies or reserved for use by researchers and scientists. While there is a fair amount of work investigating social questions regarding emerging technologies which are similar to nanotechnology, research on the social acceptance and policy implications of widely available emerging technologies like drones is lacking.

Drawing on Moor's (2005) tripartite model of technical revolution, drones have clearly passed from the introductory stage to the permeation stage. During the introductory stage, technologies have a marginal social impact and few users, and the devices are esoteric. Up until quite recently this defined drone use, as they were predominately used for specialized military and mapping applications (Przybilla & Wester-Ebbinghaus, 1979). However, drone ownership and use have been on the rise, with registrations for recreational and commercial operators topping one million in the United States in 2018 (USDOT, 2018). Drones are becoming more noticeable, devices are being standardized, the cost of use is

decreasing, and they are beginning to be integrated into society, providing strong support for the move from the introductory stage to the permeation stage of Moor's (2005) model. This underpins the notion of drones becoming increasingly embedded in today's society.

To date, research on drones has taken a contextual approach with the goal of understanding individual feelings related to drones in society. Several studies have implemented surveys to provide a general understanding of drone perceptions. This includes a detailed survey on different types of drone users, perceived risks and benefits, and general knowledge (Herron, Jenkins Smith, & Silva, 2014). Other surveys have focused specifically on law enforcement use and privacy (Friedenzohn & Mirot, 2014). Scholars are also conducting smaller-scale qualitative research, whereby researchers familiarize study participants with drones before inquiring about their personal feelings regarding drones use (Wang, Xia, Yao, & Huang, 2016). Driving this line of inquiry is the fact that drones have a historical existence in the commercial and military markets, but are now obtainable and commonly used by the general public.

As one might expect, the characteristics of drones incite a multitude of feelings about their use. Many of these are public safety and privacy concerns which promote deeper questions related to the ethics of drone use. Luppicini & So (2016) approach this question from the commercial drone perspective. They perform a systematic review of the literature to identify several topics related to the ethical use of drones: public safety, privacy, legality, and information integrity. Interestingly, although these topics are indeed related to ethics, at least conceptually, the explicit exploration of ethics and drone use has the lowest coverage across the articles reviewed. In a similar article, Rao and colleagues (2016) explore perceptions of commercial drone use through a content analysis of documents capturing

public sentiment. Besides the constructs that largely align with other findings [e.g., Luppicini & So, 2016], Rao and colleagues (2016) focus on existing regulatory approaches to drone use—mostly at the federal level—noting the lack of clarity in regulation, policy lag, and misconceptions about what drones can do. Both articles highlight the recent proliferation of drones into markets beyond the military and mapping, focusing on commercial drone use and what that means with respect to privacy. The articles also allude to the lack of regulatory activity regarding the recreational use of drones when compared to commercial use. It is clear that most of the federal regulation is aimed at commercial drone use, yet studies suggest that it is the recreational users who pose the largest threat to both public privacy and safety (Finn & Wright, 2016). Because drones are small and used on the local level, most of the problems and ethical questions will be dealt with by local governments. Consequently, it is at this level that the balancing of ethics, governance, and regulation will likely play out.

Drone Policy Context

Over the past several years, drone regulation has evolved considerably. Still, as we discuss below, people are still ambivalent about drones as an emerging technology. To provide context for the ensuing discussion, a brief overview of drone policy to date is detailed.

Laws specific to drone operation exist at two levels. At the highest level, the Federal Aviation Administration (FAA) is responsible for creating commercial and recreational drone regulations which has been evolving slowly since the 2012 FAA modernization and reform act (FMRA) (FAA, 2012). In July 2016, the FAA modified the registration process under the FMRA that created a more streamlined process for drone users to register and fly a drone. Interestingly, there are no strict requirements for recreational drone operators other

than requiring that the operator register their drone with the FAA⁴, even though recreational drone operators far outnumber commercial operators in the United States (FAA, 2016).

The second level includes state and local drone regulations. The FAA allows some flexibility when it comes to creating and implementing drone regulation at this level, but at the same time caution states and cities not to stray too far into the operating environment of the FAA. For example, states cannot regulate airspace (e.g., restrict drones from flying in certain areas) and any attempts to do so are often met by federal preemption (Migala, 2017). Because the FAA does not enforce or regulate privacy or trespassing rules, many state and local drone policies are created with a focus on the protection of these individual liberties. Municipalities can restrict where drones can take off and land, as well as establish trespassing, stalking, and harassment ordinances specific to drones (Curran, 2017; Rhodes, 2016). As drone use continues to grow and more individuals become aware of their use, an increasing number of municipalities are enacting drone-specific regulations, especially in the urban centers with the highest number of drone registrations (Figure 2). Furthermore, although the FAA has now provided cities with a (fairly) clear path towards regulating drone use at the local level, some cities maintain their hardline no-drone approach. The reasons for this are still unclear. In the following sections, the study will attempt to elucidate these local policy decisions with an eye towards the interplay between ethics, regulation, and governance.

⁴ Although this registration process was removed for some time because it was challenged as unconstitutional, it has been restored as of December 2017: <https://www.zdnet.com/article/how-to-register-your-drone-its-the-law-again/>.

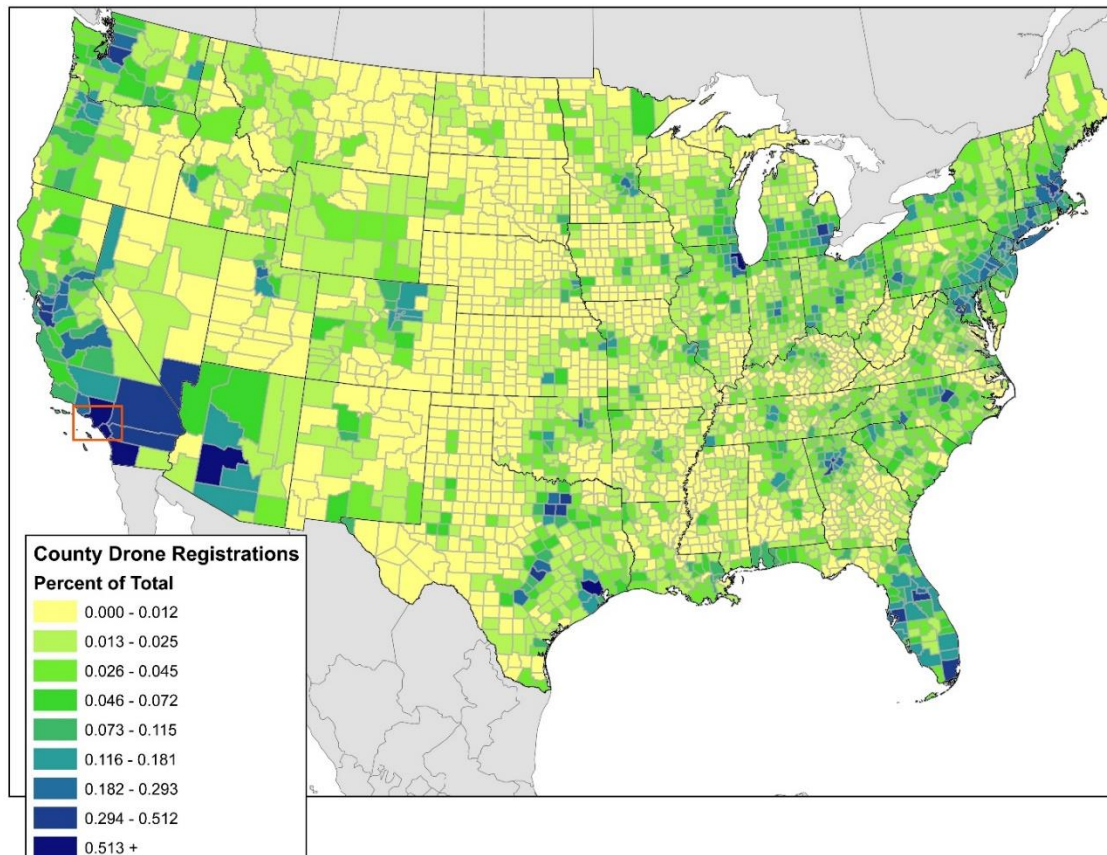


Figure 5. The percent of the total number of recreational and commercial drones registered by county with the FAA as of May 2016 (FAA, 2016).

Methods

This study sought to understand how the governance, ethics, and regulation of emerging technologies develops. It focused on drones as an example of an emerging technology using a qualitative thematic analysis of the proceedings of several city ordinance meetings discussing drone regulation.

It is geographically limited to Los Angeles County and Orange County, in Southern California. The counties were selected because they have some of the highest numbers of FAA drone registrations in the United States (see Figure 5). The study began with a list of all the incorporated cities within the two counties and searched through city ordinances to

establish whether or not the cities had drone-related ordinances enacted, as of February 2018. This list was narrowed to include only those cities that record their city council meetings and make them publicly accessible online. The final list included 20 cities, as listed in Table 1.

All the relevant recordings for each of these cities were reviewed, which spanned from 2014 to 2017. At these meetings, city council members deliberated drone regulation, often referencing concerns they had heard elsewhere; at some meetings, citizens were invited to speak. Notes were taken while reviewing these videos, sometimes recording extensive quotations and other times paraphrasing. The study sought to represent the drone-relevant portions of each meeting in a quickly accessible format, rather than transcribing the entirety of each meeting. The notes were subjected to thematic analysis using constant comparison (Braun & Clarke, 2006); and analyzed in the following way: The notes were first read several times. During the initial readings, we developed a tentative list of open codes based on recurring ideas throughout the notes. In subsequent readings, these codes were gradually refined, resulting in themes. The final list of themes includes only those invoked in at least three cities. This list reflects the breadth of the concepts that participants invoked during the deliberations captured in these meetings. The researchers recognize the interpretive element in deriving these themes, and there is no claim of exhaustiveness or statistical generalizability. Rather, the aim is to illustratively articulate the breadth of concepts invoked with an eye toward identifying the most salient ones in this context, with possible transferability to other contexts.

Table 3. List of cities which had publicly available city council meeting recordings of drone policy discussion

Number	City	Date of Meeting(s)	Date Ordinance Enacted
1	Palos Verdes	Mar 8th, 2017	No ordinance
2	Laguna Beach	Mar 7th 2017, Mar 23rd,	Mar. 23rd, 2017
3	Los Angeles	Oct 14th, 2015; April 6th, 2016	Oct 14, 2015
4	La Habra	July 18th, 2016; Aug 15th, 2016	Aug 15th, 2016
5	Hawthorne	Nov. 8th, 2016	No ordinance
6	Beverly Hills	June 17th, 2014; Oct. 7th, 2014; Oct 21st, 2014	Oct. 21st, 2014
7	Hermosa Beach	Oct 14th, 2014; April 12th, 2016; April 26th, 2016; May 10th, 2016	May 10th, 2016
8	Huntington Beach	Sep. 6th 2016;	Sep. 6th, 2016
9	Garden Grove	Mar. 14th 2017; Mar. 28th, 2017; April 11th, 2017	April 11th, 2017
10	Dana Point	Oct. 16th, 2016	No ordinance
11	Carson	Dec. 1st 2015	Dec. 1st, 2015
12	Calabasas	Nov. 8th, 2017;	Nov. 8th, 2017
13	Burbank	April 26th, 2016; May 10th, 2016;	May 10th, 2016
14	Redondo Beach	Sep. 20th, 2016	Sep. 20th, 2016
15	Manhattan Beach	Aug. 18th, 2015; Oct. 20th, 2015; Jan 5th, 2016; Jan. 19th 2016; Feb. 2nd, 2016; April 19th, 2016; May 3rd, 2016	Feb. 2nd 2016
16	Newport Beach	Oct. 10th, 2017;	No ordinance
17	Pasadena	Mar. 20th, 2017; May 15th, 2017	May 15th, 2017
18	San Clemente	April 18th, 2017; May 2nd, 2017	May 2nd, 2017
19	West Hollywood	Nov. 2nd, 2015; Dec. 21st, 2015; Jan. 19th, 2016	Jan. 19th, 2016
20	Yorba Linda	Oct. 17th, 2017; Nov. 7th, 2017	Nov. 7th, 2017

Findings

The key concepts of concern that were invoked in these meetings are summarized in Table 4, along with the number of cities in which they were invoked and a brief description. The

following paragraphs present these concepts in greater detail. The numbers refer to the cities as numbered in Table 3.

Table 4. Summary of themes derived from the city council meeting review

Theme	Freq.	Description
Privacy	15	Drones entering or viewing private spaces; concerns over privacy in public spaces, e.g., recording capabilities
Safety	14	Drones will be used recklessly and dangerously, particularly in crowded places such as beaches and special events
Enforceability	7	Question about officials' ability to enforce drone regulations
Crime	4	Drones being used to aid in theft/burglary and trespassing
Nuisance	4	Drones being used to harass or disrupt people in public spaces
Professionalism	3	Question about whether and how professional use should be regulated differently than recreational

Privacy

In 15 of the cities reviewed, privacy was discussed as a topic of concern. In many cases, city council members cited reports that they received from their publics, such as “drones hovering over people’s backyards” (1) or “outside a window” (7). In these discussions, most council members referred to how the idea of a “reasonable expectation of privacy” is changing with this emerging technology. In this regard, one particularly relevant feature of drones is their recording capability, which makes them more troubling than, say, binoculars or telescopes. An individual's right to privacy is being called into question as drones become more prevalent, as one resident described as the right to “not have a drone or camera peering into [our] bedrooms or into our private areas in our backyards” (16). Privacy was perhaps a more pronounced concern in the more affluent cities. For example,

(6) and (12) are two cities with the highest median home value. During the city council meetings in those cities, members routinely emphasized the cost of homes and the exclusiveness of their residential communities as strong reasons why drone use requires regulations. In these locals, paparazzi routinely follow and photograph high profile celebrities. City council members do not trust that this new medium for videography will be used in a manner that follows existing privacy laws. Instead, they will try to use drones to peer into backyards and even in windows.

Safety

Another major concern voiced in the city ordinance meetings was safety. In 12 of these cities' meetings, city council members mentioned ensuring safety as one of their duties and aims. In general, the meaning of safety was not discussed, nor were further specifics, but rather the safety issues of drones were assumed to be self-evident. Exceptions to this include: 7, in which one citizen relayed a story of a time when "this drone almost hits us, hits the house, completely combusts"; 8, in which drone interactions with police helicopters were cited as a safety concern; and 11, in which drone crashes around the country were mentioned. Additionally, in some cases, council members sought time-based regulations on drone use in the name of safety. Five cities brought up the issue of drone use during special events, either to specially prohibit it (7, 11, 17, 20) or to specially allow it (9).

Enforceability

In seven of the cities, the enforceability of prospective regulation was taken into account in designing that regulation. When discussing an issue that warranted regulation, others brought up difficulties in enforcing any such regulation. For instance, in 2, a citizen argued that the city was not ready to establish further regulations because already the police

were unable to enforce the current regulations. Others saw the local ordinances as a way to enforce the FAA rules, which had already been established in principle but were not directly enforceable in any particular jurisdiction. Enforceability is an instrumental value related to trust. Citizens are making clear that they do not trust their fellow citizens to use drones for good purposes automatically. Thus, they appeal to lawmakers to create regulations that modulate the necessity of trust: with regulations, citizens can trust their fellows' willingness to abide by the law rather than their inherent good intentions. However, citizens must then additionally place trust in the enforcement and enforceability of those regulations.

Crime

The unlawful use of drones was a concern among several citizens in four of the city council meetings. Unlawful use was not in reference to violating existing privacy or nuisance laws, or even violating new laws aimed specifically at regulating drones. Instead, citizens were concerned that drones could be used as a tool to break-in or burglarize residences. More specifically, individuals were concerned that drones would be used to “case” homes and yards (19)—individuals could possibly use drones to “check things out and say, ‘We looked at everything, not worth it, let’s go down to the next [house]’” (7). Much of this concern is fueled by a drone’s ability to venture into areas considered private without physically touching private property, and furthermore, the ability to utilize digital recording technology to relay back images and video to the drone operator. Trust is again the underlying factor as concerned citizens “do not know what their [the drone operators] intent is” with the recorded images and videos.

Nuisance

There were four instances of nuisance concerns/complaints brought up during the city council meetings. Keeping in mind that our study area has the highest number of drone registrations in the United States, both the residents and the city council members cited nuisance as a reason to regulate and restrict drones from flying in certain areas. The increased number of drones flying in neighborhoods and over residents' homes was cited as a particularly annoying problem in (3), while the noise that drones make while hovering overhead was brought up in several of the discussions around nuisance (2, 10, 16). During the public comment period of (2), one resident who opposed drone regulations acknowledged that drones can be loud, but in an effort to bolster support for no restrictions, assured the city council members that the technology is getting better and future drone models will be quieter. This was one of the few instances of public comment during the city council meetings where both sides of the debate were well represented. Those that opposed ordinances brought up the future potential of the technology while those that were for the ordinances emphasized the disruptive nature of the technology without regard for future potential. This highlights the process of satisficing and cognitive misers where each side is only relying on the information necessary to support their side of the argument.

Professionalism

As previously mentioned, there is a definitive regulatory line between recreational and commercial drone operators, the latter of which use drones as part of their profession. There are more stringent requirements for commercial operators, which are set by the FAA. Aside from registering a drone, recreational drone operators do not face the same set of requirements that commercial operators do. Thus, it is no surprise that this distinction between recreational drone operators and commercial drone operators was brought up

during city council discussions. The arguments against enacting local drone ordinances mostly came from commercial operators who noted that “commercial operators already have to follow [FAA] rules” and as such should at a minimum be exempt from further regulations (1, 2). City council members of 15 also recognized this distinction by making sure any new ordinances would not change regulations for commercial users who were “doing everything by the book.” Similarly, the city council in 20 was cognizant of not putting overly restrictive ordinances in place so as to completely stymie the commercial use of drone technology. Those that use drones professionally seem to view them as a technology that can contribute to the good society. Thus, they do not want overly restrictive ordinances keeping them from using drones. Because of their close contact with and passion for the technology, professionals outnumbered non-users at many of the city council meetings with public comment periods. In those cases, the meetings lasted longer, were not settled quickly, or resulted in no ordinance being created (1, 2, 19).

Discussion

As the findings show, meetings around drone regulation saw a number of concepts invoked, including privacy, safety, enforceability, crime, nuisance and professionalism. These are ethical concepts that made their way into governance and regulation, thus providing an example of the interplay between ethics, regulation and governance that Floridi (2018) discussed. The concepts invoked were concepts of applied ethics, setting the grounds for what is understood to be good or best among a set of possibilities. These concepts were meant to influence regulation, or legislation, i.e., moral enforcement through government action and social norms. Both ethics and regulation affect governance, which influences the development and proliferation of new technologies. Along the way, society advances,

hopefully becoming better and better. Brey (2018) presented a vision of how instrumental societal values can lead to (or not) the intrinsic societal values of well-being and justice, which must ground any conceptualization of the good society. As mentioned previously, one of these is trust.

It was suggested above that trust may be a salient instrumental value with respect to emerging technologies. Indeed, trust underpins several of the themes in the analysis. This suggests that, in Brey's terminology, trust is a *necessary* instrumental value and not just a contingent one, at least when it comes to emerging technologies.

By definition, emerging technologies are uncertain. In the introductory stages of the technology (Moor, 2005), uncertainties lie in not knowing where the technology will be incorporated, who will be using the technology, or how the technology will ultimately be used. When a technology has the potential to violate individual liberties (e.g., privacy), people will likely be more hesitant to trust that the technology will be used responsibly. Furthermore, when access to the technology is unrestricted, individuals are not only having to consider trust in the technology itself, but also trust in the different users of the technology.

Indeed, within the themes listed above, trust was mentioned in relation to the operator of the drones and the technology itself. Individuals did not trust that the drones would be used in a manner that aligns with their conceptions of good and just. Concerns were raised about the unknown intentions of the drone operators and who the operators are. Concerned citizens saw drone regulations as a way to increase their trust in the technology by ensuring that operators have a specific set of rules to follow regarding privacy, crime, and safety, and that if the regulations are violated, the authorities have a way to reprimand the

errant operators. Simply put, without a way to bolster trust in the technology, the risks posed to the society are easier to recognize than the potential benefits. This blurs the contribution that the technology may have towards the good society.

However, when individuals can trust that the governance of the technology ensures its ethical use, the benefits and contributions of the technology to the good society may be easier to recognize. This was apparent in the professionalism theme. Individuals who use drones in a commercial capacity see themselves as using it responsibly, and therefore trust that others will do the same. They contend that more restrictions will stymie the potential benefits of the technology.

In sum, the results suggest that trust at all levels of emerging technology is critical for its societal acceptance. Without trust, individuals have a hard time seeing past the risks, especially when the risks involve threats to individual liberties. As far as drones are concerned, regulations seem to be the next step in ensuring trust, but as the technology develops, software and hardware advances may help to ensure that privacy values are built into the design of the technology (Brey, 2018). If drone companies and drone advocates can ensure the ethical use of drones by making it a part of the drone itself, individuals and communities may find it much easier to accept the technology as a valued part of the good society.

Conclusion

This paper explored the governance of emerging technology through the example of drone regulation in Southern California. In meetings to discuss and establish drone regulations at city council meetings, several ethical concepts were invoked, such as privacy and safety, *inter alia*. The results suggest that the issue of trust underlies these concepts. That

is, trust in an emerging technology is required for it to be accepted and more fully integrated in society. Without trust, it is difficult for society to accept the technology. Drones are a fairly distinct emerging technology. Their characteristics and unrestricted public access may mean that more trust is required before it becomes seen as a trusted and valuable part of the good society. Based on the literature on emerging technologies, these findings are likely not limited to drones and may extend to other emerging technologies that share the unique characteristics of drones such as self-driving cars, virtual and augmented reality, and artificial intelligence.

On Brey's (2018) account, instrumental values help realize intrinsic values. When it comes to creating the good society, there are both instrumental and intrinsic values; moreover, instrumental values may either be necessary or contingent. The results of this study suggest that trust is a *necessary* instrumental value. This means it helps to realize the intrinsic values of the good society, which Brey and others (e.g., Maritain, 1949) suggest are well-being and justice. Thus, trust, if it is well-placed, contributes to these aims. The felicitous placement of trust, then, is a key issue. This paper offered a way to operationalize the evolving dynamic of the placement of trust by examining how drone regulations are discussed and enacted. Though trust was scantily mentioned directly, it was a guiding value in the discussions reviewed.

This indicates as well that the participants implicitly discussed drones with respect to some future ideal vision of society. To be sure, this vision was likely left unexplored. The study contends that this vision ought to be examined and duly considered, even (or especially) in such a nuts-and-bolts context as discussing limitations to drone use on Saturdays at the beach, lest the forest be lost for the trees.

CHAPTER 5

INFLUENTIAL FACTORS IN DRONE USE POLICY ADOPTION

The purpose of this chapter is to explore the relevant drivers associated with the decisions to adopt, and not adopt drone use regulation. The study is conducted by content analyzing a mix of documents and media related to drone use ordinance adoption decisions. The codes were generated through an open coding process that progressed iteratively for each piece of empirical evidence. Smaller codes were grouped and subsequently refined into broader categories and concepts as they emerged in the data. Several mechanisms related to policy innovation were identified as having an influence on the decisions related to a local drone use policy. In addition, the analysis identified several other factors unique to the drone use policy context which had an additional degree of influence on drone use regulation decisions. In particular, the role of uncertainty and the possibility of preemption. The end result are several broad categories present during city council drone use adoption decisions: Concerns, Diffusion, Enforcement, Internal Determinant, Preemption, and Uncertainty.

Introduction

The broad realm of policy innovation studies are mostly focused on the factors that contribute to the adoption of policies (Berry & Berry, 2018). A large majority focus on the geographic coincidence of policy adoption or how policies move from one jurisdiction to another with respect to their spatial arrangement. It is a process which is now more popularly referred to as regional diffusion (Mooney, 2001). The stockpile of evidence supporting this conjecture continues to mount as scholars apply regional diffusion frameworks to a variety of policy areas including taxes, educational reform, environmental, and the spread of social welfare programs, to name a few (Berry & Berry, 1992; Volden,

2006a; Wong & Langevin, 2007). Many of these studies are heavily focused on state level policies and some scholars attribute this research paucity to the federalism form of government in the United States and the low-salience of local policies (Koski, 2010).

To be clear, local level policies are studied but not nearly as heavily as state level policies. For example, scholars have investigated smoking bans in cities (Shipan & Volden, 2006; Skeer et al., 2004) as well as gun control and local climate policy initiatives (Godwin & Schroedel, 2000; Krause, 2011). The importance of studying local policies is captured by Koski (2010) who states, “of all the governments with jurisdictions over individual actions, local government is often the one with which we are most familiar.” Indeed, most of the rules and regulation’s governing everyday life take place at the local level making it increasingly important to understand how policies governing everyday life move from one government to another. In large multi-city metropolitan regions where the number of residents has ballooned in recent years (McGranahan & Satterthwaite, 2003), local laws and regulations will effect greater and greater numbers of people. The increase in the number of individuals that are directly impacted by these local policies underscores the need for continued research on the factors effecting local policy adoption.

With the boundaries between municipalities in multi-city metropolitan areas starting to coalesce, the movement of people and ideas is becoming increasingly fluid. This means that the problems arising in one city will likely emerge in another. The response of cities to the potential spillover of problems has been documented by scholars who study the transfer of the solution to a problem from one city to another (Bouché & Wittmer, 2015). The likelihood of adopting another jurisdictions policy is often assumed to be stronger with smaller distances between jurisdictions. Simply put, neighbors tend to have similar policies

yet, policy innovation scholars claim that the diffusion of policies cannot be fully described through the geographic clustering of jurisdictions (Shipan & Volden, 2012). The claim that there exists a multitude of factors underpinning the movement of policies from one jurisdiction to another is supported by a mix of both qualitative and quantitative research (Cohen-Vogel & Ingle, 2007; Shipan & Volden, 2008).

For example, jurisdictions in the same region may *compete* via policy to attract businesses or to keep unwanted activities from taking (Bouché & Wittmer, 2015) or jurisdictions can *emulate* policy leaders as a normative/symbolic policy gesture (Berry & Baybeck, 2005; Grupp & Richards, 1975b). Where a good majority of the research lies, and indeed where many qualitative studies excel, is identifying policy *learning*. Learning can take several forms but mostly consists of active information gathering to identify potential policy options and how they can be shaped to fit the needs of the adopting jurisdiction (Mossberger, 1999). What's more, there is also the possibility of *vertical* influences where policy activity at different levels of government influence policy adoption decisions of other government levels (Karch, 2012). Many times the vertical influence is facilitated by intergovernmental networks of communication via professional organizations, national conferences, or policy entrepreneurs (Mintrom, 1997; Mossberger, 2000).

When faced with policy uncertainty or situations where information about policy success is low the primary mechanisms of policy movement can change. In low information situations there are limited numbers of similar policies to draw information from and limited numbers of adopters to observe whether a policy has been successful. One developing policy area where this low information context is playing out is the introduction of emerging technologies. An emerging technology is characterized by its novelty, newness, ability to be

applied broadly, and capability to change the status quo (Rotolo et al., 2015). The difficulty of regulating emerging technologies comes from an inability to anticipate how they will be used, who will be using them, and where they will be used. In attempting to regulate, policy makers must also balance the potential for both positive and negative economic and social changes that the technologies may bring (Mandel, 2009). One area where these decisions are actively being made is in local drone use ordinances which share many of the characteristics of an emerging technology. Cities are having to contend with the economic potential of drones, the inherent privacy and safety concerns of the residents, and on top of everything else, having to navigate an environment of low information about the policies themselves and the technology.

In an effort to develop a better understanding of the policy adoption process in a low information environment, this study takes a qualitative methodological approach of content analyzing documents and media related to drone use policy decisions in Southern California. In particular, this study uses the video and audio recordings of city council discussions, written documents explaining the policy, the resulting ordinances, and interview and email correspondence with city employees to answer two main research questions. First, *what are the main policy innovation processes that influence drone use policy adoption decisions?* Second, *what is the role of uncertainty in drone use policy adoption?*

Unlike traditional approaches to policy innovation, this approach allows for the assessment of policy innovation with respect to the context in which it takes place. This study is also unique in that it investigates policy adopters alongside non-adopters to identify the differences in policy innovation with respect to the factors that influence the policy outcome. Furthermore, as this area of policy innovation is new, the method allows for the

documentation of novel differences that may arise. Specific mechanisms can be identified and subsequently verified using multiple sources of contextual data. The implications for this work lie in emerging technology policy, decision making under uncertainty, and policy innovation broadly.

Literature Review

Early efforts towards a better understanding of the policy adoption process proceeded with the analysis of internal characteristics thought to be influential in making policy adoption choices (Dawson & Robinson, 1963). The assumed role that internal characteristics have on policy decisions is fairly straight forward; the characteristics are hypothesized to enable or inhibit the adoption of a policy. Some of the earliest scholarly work focused on the socioeconomic environment, the demographics, or the political factors (Hofferbert, 1966). More recently scholars have broadened the focus to also include measures of fiscal and resource capacity in the form of professionalism (McLendon et al., 2006), a jurisdictions revenue per capita (Tolbert et al., 2008), and the existence of a problem that requires regulation (Matisoff & Edwards, 2014).

Along with the internal characteristics, scholars also investigated the influence that policy decisions in one jurisdiction had on the policy choices in another jurisdiction. In other words, scholars were interested in how policies move from one jurisdiction to another through formal or informal communications (Graham et al., 2013). One early example published by Crain (1966) detailed the decision to adopt fluoridation policies for drinking water at the state level. In addition to several internal determinants, he considered two sub-models of diffusion to explain adoption: regional influences and the leader-laggard model. Through some fairly rudimentary correlation analyses and investigation of the percentage of

adopter's overtime, Crain found support for both regional effects and the leader-laggard model. He noted that state policies regarding the fluoridation of drinking water clustered in space and speculated that some states preferred to wait until the early adopters (leaders) worked out the policy kinks and then adopt a policy themselves later on (laggards).

In more recent policy innovation scholarship there are only a few articles that investigate internal determinants without consideration for diffusion mechanisms. This is because the two are linked on several levels and usually work in conjunction with one another. For example, when jurisdictions align on socio-demographic characteristics it has been found to be more likely that a policy choice by one will influence the other (Volden, 2006b). Scholars have also found that similarities in political characteristics influence the type of policies that are adopted (Collier & Messick, 1975). For example, the policies of a state with a strong Republican base would diffuse more readily with a neighboring state that shares a similar political makeup. Further still, some internal determinants, such as the existence of a problem, can be so influential that it forces a jurisdiction to consider the policies of the surrounding jurisdictions (regional diffusion) regardless of what the political or ideological belief may be (LaVenita et al., 2015; Matisoff & Edwards, 2014). Thus, when investigating the forces that drive policy adoption it is critical to understand the degree that both internal determinants and diffusion mechanisms effect the policy innovation process.

Several models have been proposed to control for internal characteristics and diffusion processes simultaneously. The most notable is the event history analysis (EHA) model by Berry & Berry (1990) which is also known as the unified model of state policy adoption. EHA has been the go-to model for policy innovation studies since the 1990s and continues to be applied broadly to help explain policy innovation (Butz et al., 2015). The

central claim for the use of EHA is that neither internal determinants nor diffusion models by themselves will adequately explain policy innovation. In order to fully understand policy innovation it is necessary to combine the two models. The approach of controlling for both models with a single method has emanated broadly in the policy innovation literature. EHA, along with other quantitative methods are heavily relied upon when determining the factors involved in the processes leading up to policy adoption.

However, various limitations of EHA and other quantitative policy innovation analysis have been pointed out over the years. For example, Mooney (2001) detailed how the EHA model introduces significant positive bias due to the nature of the hazard term which is tied to the number of previously adopting jurisdictions. As the number of adopters increase in a region the hazard term will also increase, resulting in a positive slope for the presence of a regional effect. Graham, Shipan, & Volden (2013) point out, there doesn't seem to be much movement towards a general understanding of how diffusion works, partly due to variation in the significant policy adoption variables for similar policy settings. Furthermore, while regional diffusion is almost always hypothesized to be a significant predictor in policy innovation studies it is routinely not (see Shipan & Volden (2008) for significant effects and Wong & Langevin (2007) for non-significant regional effects). As previously mentioned, many scholars no longer accept that regional diffusion alone is enough to explain the movement of policy across regions. The concept can be broken down into more precise processes such as emulation, learning, and competition (Shipan & Volden, 2008). But perhaps the reason why many scholars have commonly lumped several of the processes into a larger regional diffusion variable is the difficulty in being able to accurately detect the presence of the other variables.

A more nuanced understanding of the policy innovation process requires an alternative methodological approach for analysis. One way to achieve this is through qualitative methods using cross-case or within-case comparisons (Starke, 2013). Although case studies are (generally) smaller in sample size, they provide the much needed contextual support to understand the role that different diffusion mechanisms and internal characteristics have on the decision to adopt a policy.

Ingle et al. (2007) state that “well-planned qualitative studies can integrate the internal determinants and regional diffusion models and avoid the pitfalls of conventional techniques typically employed by innovation diffusion scholars.” Qualitative studies within policy innovation are growing but still somewhat limited with respect to the contexts they have been applied (see Mossberger, 1998; Mintrom, 1997; and Horowitz, 2010 for a few different applications areas. As one example, Cohen-Vogel et al. (2007) conducted interviews with policy makers in six states in the southern U.S. to understand the role of regional diffusion in the adoption of merit aid programs for higher education. The researchers transcribed and content analyzed the interviews to code for central constructs related to policy innovation, finding evidence for two diffusion mechanisms and several internal determinants. Using the same policy context, Ingle et al. (2007) interviewed policy makers in eight southern states in the U.S. to characterize the nuances of policy diffusion. Their contextual evidence provided support for interstate influence on policy adoption decisions and went a step further to explain why it occurred as it did. Economic concerns and competition between states were found to play a very influential role in policy adoption decisions.

Policy Innovation in a Low Information Environment

Drones are becoming increasingly prevalent in the urban environment and in response cities are having to determine whether to regulate their use and if so, how to do it. The adoption of ordinances has not been uniform across cities within the same region and a great deal of this is due to the lack of clarity between local government jurisdiction and the Federal Aviation Administration (FAA). The most perplexing aspect of this is the lack of FAA rules specifically governing the use of drone by recreational operators. Although recreational operators are by far the largest drone user group, the FAA is more concerned with the regulation of commercial drone operations. With the exception of a few guidelines, all trespass and privacy rules regarding drones are left to local municipalities to manage. The problem cities face is how to best do that. For example, a city cannot restrict where drones can fly beyond the flight restrictions that the FAA has already imposed. Cities are also not able to add any additional registration requirements or require operators to take classes. For now, the only options cities have is saying where a drone can take off and land from or codify the guidelines that the FAA has created. That said, a handful of cities have risked federal preemption by formally adopting no fly rules or requiring local registrations (HB, 2016). Other cities have codified the FAA flight guidelines but hold-out cities with no ordinances remain, often within the same region as those with drone use policies.

The novelty of drone use in major urban areas places cities in a low information policy environment. Combined with the lack of guidance by the FAA on what and how drones can be regulated, cities must consider policy decisions with uncertain outcomes. There is the possibility of state/federal preemption and a limited understanding about how this technology will be applied in the future and what regulation might do to that.

Complicating matters further, many policy makers and the general public are not familiar with what the technology can actually do (Herron et al., 2014), creating an additional information gap that is difficult to fill without a concerted information seeking effort.

Where emerging technologies are concerned, the ideal approach to deal with uncertainty is to anticipate how the technology will be used (Barben et al., 2008) given what other people/cities/municipalities have communicated and create policies to avoid those situations. It is suggested and observed that cities taking an anticipatory approach rely on experts to guide and inform policy decisions (Sabatier, 1988). The opinion of experts is particularly salient in the policy process because their opinion also influences public opinion (Zhao et al., 2011). Acceptance of a technology (i.e. the integration of the technology into society) is strongly tied to the *perception* of risk and benefit by the public, policy experts, and policy makers (Siegrist et al., 2007). Policies seeking to address the risks and benefits of an emerging technology are strongly influenced by expert and public opinion which will change how strict a policy ultimately is (Anderson et al., 2011; Brossard & Nisbet, 2007; Ho et al., 2011; Scheufele et al., 2007).

However, in reality the more common route to policy creation is reactionary. Having limited information about an emerging technology, policy makers wait until something happens that prompts the need for a regulation (Mandel, 2009). Regardless of whether the approach to policy making is anticipatory or reactive both can result in regulation that is unyielding to evolution and overly restrictive. When it comes to creating emerging technology regulation, it is often expected that the more a city or policy maker hears about how bad a problem is, or how bad it is expected to be, the more likely it is that they will adopt a policy to regulate its use.

Over the course of the policy adoption process policy makers will take steps to learn about what works and what does not work. This process is generally referred to as “lesson drawing” and depends on the policy maker’s ability to observe both the positive and negative sides of a policy elsewhere in order to make a decision about what aspects of the policy to adopt. But in situations where the topic of the policy is new, there are limited opportunities to observe policies elsewhere.

Facing a lack of time and resources to conduct a formal technology/policy assessment, smaller local governments may choose to defer regulation until they have a chance to observe how the policies work in early adopting areas (Butler et al., 2015). This situation is detailed in Mossberger’s (2000) qualitative analysis on the creation of enterprise zones in the U.S. Using a carefully selected sample of five states, she demonstrates how differences in when a policy is adopted changes how states learn about the policies and subsequently adapt them to their situation. Early adopters operating in a low information environment tend to learn in a more bounded form but in a way that is more rational than later adopters. With fewer opportunities to observe policies in other states, these early adopters take part in a more extensive learning process where they “identified some general goals, searched for information about enterprise zones, developed alternatives, and evaluated them against general goals” (p. 165). However, with the absence of opportunities to see how these policies played out elsewhere, they relied heavily on the policy expertise of the staff. On the other hand, the later adopters had the opportunity to observe how the policies in the early adopting states played out. Rather than apply a systematic process of achieving goals, later adopters had the opportunity to observe the policies in the early adopting states and assess what would work, what wouldn’t, and what else could be added. As Mossberger

(2000) describes it, learning by later adopters can be characterized as opportunistic and based on the availability of a solution. That said, low information policy situations, such as drone use policy, may result in different policy adoption strategies via learning. Some cities may be more willing to expend their resources crafting a policy while others may wait until they can observe how these policies play out in other cities.

These findings suggest that low information within the policy environment prompts variation in the diffusion mechanisms, but specifically in how learning takes place. As was just described, some policy makers will take the initiative to actively search for possible policy options while others may wait until there are opportunities to observe how those policies come to fruition elsewhere. Furthermore, Walker (1968) suggests that uncertainty may halt the policy making process until policy makers feel that they can make adequate decisions given the information that they have gained. In order to fully understand the processes that prompt cities to respond to drone use in different ways, the following study uses content analysis to compare the policy innovation process of cities that have formally adopted a drone use ordinance with the cities that have not. The results allow for a comparison between these two decisions and the policy innovation mechanisms associated with each.

Method

With evidence to suggest that cities within the same region interact when it comes to policies, this study focused on two regions within Southern California to understand policy innovation for emerging technology. This studies sample consisted of all of the incorporated cities within Los Angeles County (LAC) and Orange County (OC). Fortunately, the incorporated cities in LAC and OC keep thorough records of city council meetings and

archive them on each of the city websites. The archives are organized by date and are searchable by key words which appear in the titles of the city council agenda items.

The archives for each of the city council discussions were searched to identify if cities had drone use policies on the council agenda and when. Occurring in tandem was a search through each city's municipal code to identify those that had officially adopted a local drone use policy. These two searches resulted in a list of cities that had an ordinance but also identified cities that had drone use policy on the agenda but did not result in the adoption of a policy. This information was recorded and stored in an excel file. Several cities were identified that had a drone use policy on the agenda but never publicly discussed the decision to adopt the policy during the recorded city council discussions. For three of those cities—Pasadena, Santa Clarita, and Anaheim—phone interviews were conducted to gain additional insight into the drone use policy adoption process. In other cities there were a few gaps in information regarding specific decisions about the policy adoption process after reviewing the recorded media. Personal emails were sent to city officials in those cities in order to fill the gaps in information about the adoption process. At the conclusion of the data gathering process the sample included a mix of 24 cities—16 had an official drone use policy and 8 did not (Table 5).

When searching through the archived city council meetings, and upon identifying the meetings where a drone use policy was discussed, all of the associated data for the meetings were downloaded. This included the video recording of the meeting and all supporting material which included any published response to regional professional groups, the ordinances when available, documents (email and interviews) from personal communications with city staff members, meeting minutes, and staff reports. If the video was not available

for direct download an external recording device was used to play the video on the website and record the audio.

All of the media was uploaded to an online transcription service and transcribed verbatim.⁵ After the initial automatic transcription, each of the resulting documents were reviewed a second time. The second review involved listening to the recorded media (video or audio) while reading through the transcribed document. Any spelling errors were corrected, clarifications of difficult to interpret phrases were made, and the speakers were identified. This also served as an initial reading of the transcribed data which helped in formulating the starting coding protocol for the content analysis. As the study progressed the data collection and analysis occurred simultaneously (Straus & Corbin, 1998). All of the corrected and transcribed audio and video documents along with the ancillary data was imported into the ATLAS.ti qualitative analysis software⁶. The list of cities and the data source(s) obtained for each city is detailed in Table 5.

⁵ <https://www.temi.com/>

⁶ <https://atlasti.com/>

Table 5. List of cities, the data type, analysis and whether the city has an ordinance.

City	County	Ordinance	Data Type
Aliso Viejo	Orange	Yes	Email Correspondence/Staff Report
Anaheim	Orange	Yes	Interview/Email/Staff Report
Bellflower	LAC	No	Press Release/Email
Beverly Hills	LAC	Yes	Media/Staff Report
Burbank	LAC	Yes	Media/Staff Report
Calabasas	LAC	Yes	Media/Staff Report
Carson	LAC	Yes	Media/Staff Report
Dana Point	Orange	No	OCGJ response/Email/Staff Report
Garden Grove	Orange	Yes	OCGJ response/Media/Staff Report
Hawthorne	LAC	Yes	Media/Staff Report
Hermosa Beach	LAC	Yes	Media/Staff Report
Huntington Beach	LAC	No	Media/Staff Report
La Habra	Orange	Yes	OCGJ response/Media/Staff Report
Laguna Beach	Orange	Yes	OCGJ response/Media/Staff Report
Laguna Niguel	Orange	No	OCGJ response/Media
Los Angeles	LAC	Yes	Media/Ordinance/Staff Report
Manhattan Beach	LAC	Yes	Media/Ordinance/Staff Report
Newport Beach	Orange	No	OCGJ response/Media/Ordinance
Palos Verdes	LAC	No	Media
Pasadena	LAC	Yes	Interview/Ordinance/Staff Report
Rancho Santa Margarita	Orange	No	OCFJ response/Email
Santa Clarita	LAC	No	Interview
West Hollywood	LAC	Yes	Media/Ordinance/Staff Report
Yorba Linda	Orange	Yes	OCGJ response/communications/Email

The content analysis was a theory driven open-coding approach. It was guided by an initial coding protocol developed from the researchers previous knowledge of the context, the literature on policy innovation and emerging technologies, and the initial readings of the transcribed media (Chapters 2 and 3). Using previously established theories in policy innovation, coding began under the initial categories of diffusion and internal determinant.

As the content analysis progressed, several other categories emerged. These were classified as uncertainty, concerns of use, and enforcement. The categories reflected any acknowledgement of uncertainty, specific concerns that the city council or citizens had about drone use, and any reference to enforcing drone policies by law enforcement, respectively. There were also references to problems with drones that fell outside the scope of these categories which were categorized as miscellaneous problems. Only two codes emerged under this last category. All codes falling into the identified categories were created and organized in a way that reflected the researcher's interpretation of what they were related to. As the content analysis was directed and also inductive, some of the codes emerged after the initial protocol was outlined. As the protocol developed and finalized, the entirety of the data was coded for the presence of the codes and grouped into one of the categories previously mentioned (Appendix B).

Several of these codes were not mutually exclusive. More than one code could be assigned to a single piece of data. For example, a code for privacy concern could be in reference to something that happened in a neighboring city. If this seemed to be influential in a city's policy decisions, it would be coded as both privacy and regional influence. Some of the codes within the protocol appeared more than others and some were unique to a single document for a single city. The intent of developing the coding scheme was to determine the individual factors that were influential in the city discussions of drone use policy, and which codes, if any, were unique to cities that adopted policies and which were unique to cities that did not adopt policies. The most influential and/or frequently identified codes are listed in Table 6.

Results

The most prevalent diffusion mechanism associated with adopting cities was regional influence, learning, and emulation. Regional diffusion was identified when there was sufficient evidence to suggest that a city was basing their decision to adopt a drone use policy off of a neighboring city's decision to adopt a policy. Learning, often times identified in conjunction with regional diffusion, can be difficult to isolate when the success of a policy cannot be observed. Yet in several of the cities, in particular the non-adopters (detailed later), there was reference to the desire to learn about drone use policy by observing policy success. This was considered as an attempt towards learning. For the adopting cities an additional type of learning was observed. Following the work of Mossberger (1999) and others (Rose, 1991) learning was coded when there was evidence to suggest that cities were actively searching for drone policy solutions elsewhere in the region and without explicit regard to policy "success". As a result of both types of learning, emulation can also take place. However, in this case emulation is defined as the copying of another city's policy in order to conform to a normative environment. That is, there is no evidence to suggest an active information search or that the adoption decision was made rationally. This was difficult to identify, however, several instances became apparent when analyzing the data (detailed below).

Following the discussion on the policy innovation mechanisms is an explanation of the role that uncertainty had on the policy adoption process. Uncertainty surrounding drone use and associated policies was significant throughout the entire study. Cities were uncertain about how drones would be used, where they would be used, how to enforce policies, and

which policies could be enforced. All of this played a role on the process of policy innovation.

Table 6. Details on the most frequently mentioned internal determinants and diffusion mechanisms identified by adopting and non-adopting cities.

Diffusion	Adopter Diffusion	Non-adopt Diffusion	Internal Determinants	Adopter ID	Non-adopt ID
regional	11	4	problem	10	5
emulation	4	2	problem anticipation	9	2
learning	9	4	economics	2	0
group membership	5	1	land features	4	0
leader	5	1	socio-demographics	2	0
competition	1	1	policy expert	0	3
			municipal resources	3	3

Diffusion among Policy Adopters

Regional diffusion was the most referenced diffusion mechanism and was not mutually exclusive. It was often observed as facilitating the influence of other diffusion mechanisms, especially learning. In Garden Grove one city council member acknowledged that neighboring cities would be adopting some sort of drone use ordinance because of an Orange County Grand Jury Report (OCGJ) released to the OC cities detailing the current state of drone use with policy recommendations. The report recommended that all OC cities formally adopt an ordinance. However, although the report by itself was influential in getting the topic of drones on the policy agenda, the decision to adopt a drone use ordinance was influenced by the fact that neighboring cities were also considering policy adoption:

I might add that, you know, this is a model ordinance that's been shared with all the cities in Orange County. It's very possible, you know, who knows what the city of Westminster is going to do, but they're probably looking at something similar themselves and they're probably likely to adopt something similar to what we're doing.

The OCGJ report was a major reason a drone use ordinance was placed on the policy agenda for the OC cities but the final decision to adopt reflected other factors like what neighboring jurisdictions were doing or whether or not a policy was needed given the current drone situation in the city. In Los Angeles County, the addition of drones to the policy agenda was influenced by the policy activity of the early adopters in that region. When speaking with the Assistant City Attorney in Pasadena, he discussed their ordinance as “its own thing” but acknowledged the drone use policy activity in the cities of Beverly Hills, Los Angeles city, and West Hollywood—all of which are within LAC and were early adopters of a drone use policy.

In other cities, the policy activity at the federal level combined with an increase in drone use moved the topic of local drone regulation to the city council policy agenda. The policy process progressed further in the cities that determined the federal policies were inadequate to deter errant drone use from occurring in their cities. Many cities pointed out the noticeable gap in drone policy at the state and/or federal level which, as previously mentioned, was almost exclusively focused on commercial drone operations. This prompted the search for local policy solutions.

Many cities in this region shared in the opinion that federal policies were not good enough to protect their residents. Although this was certainly part of the reason the topic of drones was on the council agenda, it was also a major factor in the decision to adopt a policy. For example, in Huntington Beach, the police chief was explaining how the FAA had really dropped the ball with respect to regulating and enforcing local drone use which was the reason why a local ordinance was necessary:

The other need for an ordinance is the FAA rules are evolving and there is little enforcement of the FAA rules away from the airport, so there are not FAA inspectors or police

officers going around enforcing drone ordinances. And with the numbers of drones that we have in our community, we want to give our officers the tool that they have to help enhance public safety (emphasis added).

After realizing the inability of the FAA to enforce policies along with the recognition that local law enforcement could not regulate drone use, cities began their active information search. For most of the cities, staff members including the city attorneys, city managers, police, and policy analysts were responsible for doing the majority of the information search. It was clear that many of the later adopters were looking to the early adopting cities to gain information on how and what could be regulated (Los Angeles and Beverly Hills in particular) while the earlier adopters were doing the best they could with the limited information provided by the FAA. The city attorney from Hermosa Beach, a later adopter, encapsulated their search for information as well as the lack of information about the policy environment when explaining the crafting of their ordinance:

What we did in preparing the ordinance was we took a look at some of the ordinances that were prepared and adopted in other cities...I just want to make it clear that the law in this area, if I haven't made it clear already, inferentially, the law in this area is fluid and uncertain. And we enter into some uncertain waters here.

Although Hermosa Beach had other cities to look to when creating a policy, they still recognized the presence of uncertainty in the policy decisions. Along with the policies of other cities, they were actively seeking information from the often confusing FAA guidelines, as well as the policy frameworks that several professional organizations outlined. Some cities were then taking that information and deciding what needed to be changed in order to meet the specifications of the city in a form of active adaptation. Laguna Beach was one city that conducted an extensive amount of research for their drone use ordinance which was described by the police chief heading the policy development:

We've received guidance from the four entities you see there, the national league of city, the FAA, league of California cities, and Orange County Grand Jury. And the purpose for the guidance, they know all cities are struggling with this. They know there's a proliferation of drones....So the purpose of the guidance was to provide a foundation for an integrated regulatory framework for.

As would be expected given the different information seeking strategies in low information environments (Mossberger, 2000), using other city policies as a blueprint to model an ordinance is an alternative to being able to observed policy “success”. Some diffusion scholars (mostly in the quantitative literature) have defined learning as “a process where policies in one unit are influenced by the consequences of similar policies in other units” (Gilardi, 2016) and adoption is prefaced on the *success* of the policy elsewhere. In a low information situation, that definition does not suffice. Drone use policy was so new that there was limited (if any) chances to observe the “success” of the policy—broadly defined. Thus, most cities were doing their best to craft an ordinance that would protect their citizen’s privacy and safety while also avoiding the possibility of preemption by borrowing from cities elsewhere that already had a policy.

The Manhattan Beach data revealed an additional concept related to success that was shared across a several of the cities. In these discussions of drone policy adoption, the city council was interested in observing success and defined success as the policy being approved by the FAA. In particular, the city council in Manhattan Beach was interested in whether Los Angeles’s ordinance had been approved by the FAA because several parts of the Manhattan Beach ordinance was modeled after Los Angeles’s. One council member clarified that “They are in fact the FAA regulations...on page 244, it says examples of state and local laws for which consultation with the FAA is recommended and none of those are included in our ordinance.”

This alternative notion of success was apparent in several other cities as well. Perhaps due to both the possibility of preemption (particularly salient for local municipalities) and the lack of observational success as traditionally defined, many cities viewed a successful policy—at least in part—as one that wouldn’t be preempted by state or federal law. They could therefore learn from those policies that had the FAA stamp of approval.

As alluded to previously, professional organizations were partly responsible for moving drone policy to the agenda but they also were influential in facilitating learning. The influence of and learning by group membership was determined based on cities reporting that their membership within a regional or national group helped them to formulate their local drone use policy. The Association of California Cities – Orange County (ACC OC) and the California League of Cities (CLOC) were both identified as sources of information about a drone use ordinance for a few of the cities. Yorba Linda, Garden Grove, Anaheim, and Lake Forest all mentioned that the ACC OC model drone ordinance was approved by the group in 2016 and used as an outline to create their local policies.

Although evidence of group influence was noticeable in several cities, there was a noticeable lack of influence from professional organizations or regional/national group membership across all of the cities in the sample. Some of it might be attributed to group influence taking place behind the scenes, perhaps at regional or national conferences as some scholars have suggested (Mintrom, 1997; Mintrom & Vergari, 1998). In fact, one city council member in Calabasas did allude to this when describing the information he received at a CLOC convention: “I think it was the 2016 League of Cities convention and (I) attended a

seminar on the unmanned aircraft and brought back the model ordinance that is the basis for our ordinance.”

While many cities were actively formulating a drone use policy using a framework provided by professional organizations or the FAA, other cities were adopting an ordinance as a symbolic gesture. As previously mentioned, the OCGJ report released to all OC cities brought cities attention to drone use. Part of the reason the OCGJ commissioned the report was because of a pointed increase in drone use in the region. Some cities were experiencing this increase while others were not. In those cities that were not experiencing any drone use their adoption of an ordinance was done as a symbolic gesture to appease the OCGJ but importantly, occurred without an active information search. Among other things, the report outlined key findings related to drone use and recommended that each city adopt a drone use policy. Recommendation #2 stated: “Each City should adopt a recreational drone ownership and operation ordinance with regulations similar to those found in Los Angeles City ordinance #318392, by March 31, 2017.” Several of the OC cities adopted the ordinance from Los Angeles nearly word for word (i.e. Anaheim, Aliso Viejo), and did so without a specific need for the ordinance (not experiencing a drone problem, no reported incidents). They also did it in a process that was noticeably absent of learning. In fact, the absence of active learning by cities in the region was expressed by a policy expert in his discussions with the Palos Verdes City Council:

There's no question that that's happening (copying) and what I see is one city, I think primarily the city of Los Angeles passed their ordinance and now what you're seeing is a lot of other cities sort of cutting and pasting from the city of Los Angeles ordinance and nobody's really paying much attention to, hey, are, are all these prohibitions really valid or are we going to get stuck fighting this in court

After comparing the recorded city council discussions to each of the OC city responses to the OCGJ report it became clear that many were adopting policies without any active information seeking. The extent of the information search was, as the OCGJ suggested, finding the Los Angeles ordinance and copying it. Admittedly, some of the later adopters including Aliso Viejo and Anaheim were in a position where several professional organizations as well as the FAA had laid out specific guidelines for these cities to adopt. At this point there is little if any active learning that *needs* to take place if a city is merely looking to have some form of a local drone policy.

One of the more unique, but effective, arguments for a drone policy was competing with neighboring cities to have more strict policies in order to keep operators from spilling over into cities with less strict regulation (Bouché & Wittmer, 2015). This was reflective of diffusion as a form of competition and was only found in Beverly Hills. The solution in Beverly Hills was to enact a complete moratorium on all drone use so that if anyone were to fly in Beverly Hills they could take legal action. The city council member explained it this way:

...that we put a moratorium on any drones until we've actually worked through the process of understanding the state and federal implications, police, fire, public safety, et Cetera, because I also don't want another jurisdiction that may, could be very nearby the city using drones to monitor activities in our city from their city.

Somewhat surprisingly, especially in an area chalk full of celebrities, competition did not play an overtly influential role. Although it wasn't explicitly acknowledge, there may have been some of this implicitly acknowledge through the recognition of problems occurring in neighboring cities which consequently required a local ordinance.

Internal Determinants – Adopters

In addition to the diffusion mechanisms noted previously, the data was also coded for internal determinants. Again, the initial coding protocol guided the analysis but there were several internal determinant codes that were not already specified in the protocol. Furthermore, many of these codes were general, but were specified further to match the context in which they were referred to.

Severity of Problem/Problem Anticipation - Several prominent internal determinants came up during city council discussions but none were more prevalent than references to how big of a problem drones already were or how big of a problem they might be. Although it was not clear that these references to a problem supported the addition of drone policy as an agenda item, it can be inferred that complaints or knowledge of problems elsewhere was a major reason that drones were added to the agenda. This was especially true when city council members had first-hand experience with drones, as one city council member from Hermosa Beach explained:

So after our last meeting I've had to talk to some people that have raised some concerns about that (drones) and I've actually seen them outside of my house, more than half a dozen drones in one night. There just kind of roaming all over the place. I didn't realize it was that many of them.

The police chief from Laguna Beach shared a similar story where the first-hand experience of seeing drones operating over people in a very public area had them concerned and supported their push for a city ordinance

I think there's a lot of people (drone users) out there. I mean, just recently, this past summer, when we had our nice art sculptures out on Main Beach, I was out there enjoying it myself and there was probably five or six drones out there that night hovering over everybody, um buzzing around everybody.

Some city council members referenced the growing number of drone owners nationwide and used that as part of the support for why an ordinance was necessary. This was more preemptive. In Los Angeles one city council member said “Just to give you an idea, there are over 2 million drones that were sold just last year alone. In fact, the leading drone manufacturer sells about 30,000, just them alone a month.” Another council member would support this claim in saying “It's also, I gotta say, in my district a huge nuisance in neighborhoods. We have lots of drones in my district, particularly in Mar Vista.” Many of the adopter cities recognized the growing popularity of drones locally and broadly and 10 of the cities with an ordinance explicitly mentioned drones as a problem.

It wasn't only the direct observation of drones that was seen as a problem though. Nine cities recognized the potential for problems in the future and were adopting regulations in anticipation of having a problem later on. Beverly Hills was the first city to adopt a drone policy in the region and one city council member remarked:

I can see more problems coming out of letting people do this (fly drones) then not letting them do it and I know that I'm always a little ahead of the curve on stuff like this, but I see problems that will ensue because of this.

The City Council of Calabasas shared a similar sentiment “We haven't had a lot of complaints, but the Public Safety Commission just wanted to be proactive and say as these become more common and more popular that we'd like to have something in place ahead of time.” And again, in the city of Carson the council members cited the potential for future problems and the need to get ahead of it “So this ordinance tonight is really to help us as a community get a better handle on drones before they actually become a problem.” Some cities were much more concerned with the potential for future problems which, given the emerging technology status of drones, is something that was expected.

Economics – Cities did recognize the economic potential of drones. In the adopter cities economic considerations were brought up but did not have much influence on whether the city adopted the ordinance. To this extent, most cities were cognizant of not stymieing the commercial potential of drones and as a result, the regulations were almost always geared towards regulating recreational drone users. One city council member from Laguna Beach exemplified this perfectly when explaining why regulations were needed:

‘They as professionals, they’re not the ones we’re concerned about. They’re getting licensed. They’re doing things by the book. They’re not the ones we’re worried about. We’re worried about bad actors and unfortunately those actors are always the ones that are driving the need to have regulation and ordinances.

While at least four of the adopter cities brought up economic considerations it was often over shadowed by the potential for recreational and hobbyist operators to break the rules.

Land Features – The existence of sensitive or attractive land features within a city was referenced by Hermosa Beach, Pasadena, and Laguna Beach as one of the reasons why an ordinance was necessary. In the case of Hermosa and Laguna Beach, the coast was seen as an attractive area for drone operators. This was viewed as a safety hazard and prompted these cities to consider an ordinance. As the city attorney explained, their ordinance was “taking a stab at how to deal with the complex problem of the beach being a popular, you know, the beach and the ocean being popular areas for hobbyists to use the drones and, um, perhaps even there being a preference for them.” Laguna Beach contains similar features.

The police chief described one complaint by a resident in this way:

A resident came down and she was very upset and she lives near table rock right on the cliffs and she is in her shower that has full glass with a drone right next to her window that has a camera affixed to it... she has gone out there and ask people to stop it, but they wanted to get that perspective of the ocean from a high vantage point that happens to be right next to her residence. So that's just a minor example.

The attractive land features, such as a beach or rocky coastline, was attractive for hobbyists drone operators to take photos of, but for those who lived near those areas drones flying so close to their homes made them uncomfortable. Other land features mentioned as the reason why an ordinance was needed also included the built environment. For example, in Pasadena the assistant city attorney described the need to restrict drones from flying over or near the football stadium as well as the Rose Parade.

Socio-demographics – There were only two references to the socio-demographics of the community. This was somewhat surprising given the high value properties and people throughout these counties. Beverly Hills was one city where the city council was highly concerned about the privacy of their residents, specifically because they are home to many high net worth individuals: “This is a community where the new homes going up are 35 to 40 million dollars, these are people that value their privacy and want it and they don't need a drone in their backyard.” Calabasas was another city that made some reference to their resident’s socio-economic status noting that the ordinance needed to be adopted to protect the privacy of their “gated communities,” keeping in mind that Calabasas is almost exclusively made up of gated communities with high net worth individuals including Justin Bieber, Drake, and the Kardashian’s.

Diffusion of Information among Non-adopters

Several similarities in diffusion mechanisms between adopters and non-adopters were clear. It appeared that non-adopters were more concerned by the low information policy environment. That is, the lack of clarity within this policy context created enough uncertainty to support the decision to not adopt a drone use policy. Like the adopting cities,

however, the non-adopters were still interested in what neighboring cities were doing it just had much smaller influence.

In the City of Newport Beach the police chief pointed out that two of their closest neighbors, Laguna Beach and the City of Irvine, had drone use policies. As these discussions about a potential policy progressed it became clear that the regional effect was dwarfed by the city councils focus on the unclear understanding of whether or not a policy would be preempted by the FAA:

I'll say that this is a complete mess of a legal situation and it's the second week study session in a row where we're dealing with the FAA possibly preempting our decisions and the ability to make a, uh, you know, illegal what is essentially virtual peeping toms, and that's not okay.

Although the topic of drones had reached the agenda in Newport Beach it was not adopted due to the possibility of preemption. Like the adopting cities, the lack of clarity from the FAA guidelines was still a major concern and certainly fueled the conversation about adopting a drone use ordinance. The city manager from Palos Verdes Estates expressed this dissatisfaction with the lack of clarity while at the same time demonstrating his awareness of the policy activity taking place in other cities:

Um, so it's been a real struggle to try to define how best to regulate or not regulate or even if we have the opportunity to regulate drones. Um, up until December, a lot of cities were struggling because the FAA, had not really established something that was distinct.

While Palos Verdes Estates did not end up adopting a drone use ordinance it was clear that at least some level of information seeking was taking place to understand what was going on in the region. One of the city council members in Palos Verdes Estates expressed an interest in coordinating with other cities in the area, recognizing that the ability of drones to fly unfettered across administrative boundaries required coordination between

neighboring cities; operators and the technology will not necessarily abide by jurisdictional boundaries:

And this also seems to me to be something that it would be helpful to coordinate our four cities on because I think it was maybe council member Peterson who said it's very easy to cross city lines with this. So this might be, it might be helpful if we all had some type of comprehensive ordinance or, or at least identical ordinances in all the cities.

This highlights that regional diffusion was an influential factor and that cities were interested in learning. Although the council member showed a desire to not only have a policy but also coordinate with other cities, they ultimately decided not to adopt a policy. Palos Verdes Estates, Rolling Hills Estates, Rancho Palos Verdes, and Rolling Hills all come together in a small coastal area but only two of those cities have some form of a drone use policy. This underpins the early claim that the regional diffusion among non-adopting cities was less influential in the decision to adopt a drone use policy. To a certain extent it also indicates, at least in part, the possibility of confounding factors that are perhaps more influential for cities that chose not to adopt a policy. Even though active information seeking was taking place, the deciding factor was clearly something that goes beyond diffusion of policies or is perhaps taking place in tandem.

In contrast to the information seeking in the adopting cities, non-adopting cities were expressing a desire to learn about policy through observations of policy success. This was made clear in four of the cities that did not have any regulation. These cities were willing to wait until there was evidence to suggest that these policies would be successful before deciding to formally adopt them. That is, their definition of success was not just about implementation, but evidence that they would work. In Huntington Beach the city council discussion ended with one official saying “let’s continue in this (discussion) and move it to a

date uncertain so we can work through the issues identified here and all see what's happening countywide.” The council discussion in Palos Verdes Estates was where the policy expert (previously discussed) pointed out that many cities were simply copying the ordinance of Los Angeles rather than take the time to learn what would work and what would not. The expert was stressing the importance of actively learning about what works and what does not before making policy decisions. The expert advice combined with the desire to observe success placed several non-adopting cities in a policy stalemate likely because there were so few opportunities to observe success.

A few of the non-adopting cities brought up group membership, being a leader, and competition related to drone use but they simply did not have as much influence for the non-adopting cities. For example, Laguna Niguel acknowledged the OCGJ report when discussing a possible drone use regulation. Again, the report not only placed the topic of drones on the agenda also suggested that cities adopt an ordinance. Laguna Niguel determined that the drone problem within their city was non-existent and therefore they did not need an ordinance. As one council member explain, there was no reason to have a policy when there is nothing to suggest that it was necessary: “We're not getting complaints today and it's not a problem today. And I really don't like creating regulations for regulation sake. I like limited government, I like government to stay out of, you know, activities such as this one.” Along with the lack of influence that policy leaders like Los Angeles had on the decision to adopt an ordinance, the data suggested that non-adopters were more influenced by the internal characteristics of their city when making policy decisions. In particular, non-adopting cities were focused on whether or not they had a problem and if they did, whether it could successfully be reduced by adopting an ordinance.

Internal Determinants among Non-Adopters

Severity of problem/problem anticipation – For the non-adopters there was a certain amount of back and forth between council members regarding whether or not to adopt an ordinance. Most of this was based on whether there was a real problem, however it was clear that the final decision was much more complex. Any reference to a problem or the potential for a problem was often based on whether the police had received any drone-related complaints. One city council member in Laguna Niguel illustrated this when he remarked:

And uh, again, the old see something, say something. If there was some public outcry then I would agree we should take action, but there is none. So with that, I disagree with you, I don't think we should take any action today.

But in other non-adopting cities there was a more explicit acknowledgment of a problem through personal anecdotes. Such was the case in Huntington Beach when the police chief explained to the city council the need for the ordinance due to “multiple close calls with aircraft, including the Huntington Beach helicopters and our pilots. We have encountered several dangerous drone crashes, one of which I witnessed personally during the U.S. Open of surfing two years ago”. In Palos Verdes Estates the Police Chief explained “I can tell you that I am, I'm aware of several drone calls this past year. One was involving a disturbance at a school during the weekend.” And finally, in Newport Beach, a similar conversation took place after the city council member asked the Police Chief how many drone incidents they have had, to which he replied “85 cat events involving drones, 85 cat events that have basically been entered into the computer and been dispatched with the police department.” While there seemed to be a problem in some of the non-adopting cities, there was no problem in others, suggesting that the existence of a problem may not be the only reason why a city would make the decision to not go ahead with a drone use policy.

Policy Expert – The recorded city council discussions made it easy to identify the participation of policy experts. Their participation was certainly not the most prevalent of the internal determinants but it did seem to be highly influential. Across the three cities mentioned above (Palos Verdes, Newport Beach, and Huntington Beach) a policy expert—defined as someone outside the city staff offering policy advice during city council discussions—appeared to have strong influence on the council decisions. The same policy expert was present in two different city discussions, Palos Verdes and Huntington Beach. He was a lawyer specializing in drone policy for a semi-local law firm and during both discussions he cautioned these cities against creating regulations that go above and beyond the FAA, also suggesting that:

The council can and should consider regulations under which it has authority as such as limitations on public property from which drones can be operated. In the meantime, the council should delay any immediate action on new or amended drone ordinances in light of these significant legal issues.

In Newport Beach the ACC OC policy manager suggested to the city council that they review their existing common laws and determine how applicable it would be to drones:

So that would definitely be our recommendation. Whatever generally applicable neutral privacy laws, noise ordinance laws that you have on the books or at the state level that you can simply educate your officers and your residents on how to apply those at the local level.

With the input from the policy experts the city's decision to adopt a policy was put on hold. Those three cities still do not have a formal drone use ordinance. Whether this was in direct response to the policy opinion of the experts was not made clear since several other internal determinants were also present. However, the opinion of a policy expert was expected to be influential given the uncertainty surrounding this policy area and what is known about the influence of policy experts in other policy areas (Mintrom, 1997).

Municipal Resources – The resources that a city had to put towards monitoring and enforcing a new drone use policy came up in three of the non-adopter cities. This ranged from not having enough municipal resources, not being able to effectively enforce an ordinance, or law enforcement contracts with the OC Sheriff's Department. Where the latter is concerned, several of the OC cities noted that their contract with the Sheriff's Department provided adequate protection and knowledge of the rules and regulations. Furthermore, these cities did not mention any existing problems with drones. Of the non-adopters, cities referencing the OC Sheriffs department included the cities of Santa Margarita, Laguna Niguel and Lake Forest. On the other hand, Huntington Beach referenced the already stretched local police department and explained that another ordinance would add an unnecessary burden "Hardy said there's the enforcement part too. I, I don't want, we're talking tonight about police not having enough time and everything. I don't want them running around chasing drones too." This feeling was echoed in Newport Beach who also have a local police force.

Land Features – A major driver for not needing an ordinance for Newport Beach was the fact that they were within the 5-mile no-fly radius of an airport. The council members were swayed by the possibility that the airport would be able to address errant drone operators by reporting them to the FAA. They were also confident that the federal restriction on drone flights in this area would deter operators from flying in the city:

Almost all of the city of Newport Beach falls under that class E airspace, about 50 percent of Irvine falls under that class E airspace and none of Laguna Beach falls under that class E airspace. So in a way we are more restrictive under the FAA regulations here in Newport beach because we do fall under that second most restrictive layer of airspace.

Palos Verdes Estates recognized the “Bluff” where people like to fly but in the end, it seemed that the influence of the policy expert who participated in their discussions combined with a feeling that the ordinance would stretch their enforcement resources too thin outweighed the adoption of a drone use ordinance, at least for the time being.

The Influence of Uncertainty

The status of drones as an emerging technology manifest itself in several ways during city council discussions but most prominently through the presence of uncertainty. Uncertainty in this study is defined as not having enough information to be confident in the outcome of the policy decision. There were two areas where information about drone use policy was low. The first was limited information about drones in an operational sense and the second was how to regulate them with respect to jurisdictional roles between governments. In addition to not fully understanding how drones would be used in the future or what they were operationally capable of the local policy landscape added an additional area of information uncertainty. More specifically, cities were uncertain about the types of policies they could create and what the role of the FAA and cities were with respect to regulating drone use. However, there were key difference between adopting and non-adopting cities in their approach to uncertainty. For one, the adopting cities acknowledged their ability to deal with uncertainty as an iterative policy process and were willing to come back and revise the policy as more information from the FAA was made available. In Hermosa Beach, for example, the city attorney recognized the lack of clarity of FAA jurisdiction and noted the uncertainty that it brings to the policy process:

The FAA regulations are not surprisingly not clear as to whether or not local regulation is completely preempted and thus creating an area of some uncertainty.... the law in this area is fluid and uncertain and we enter into some uncertain waters

here. If you go ahead and adopt either this ordinance or some version of this ordinance, it wouldn't be surprising to me if we had to come back to you at some point in the future to make some adjustments.

The lack of information was certainly recognized, but the possibility of revisiting their drone policy after the FAA decided how cities could regulate drones reassured the council that they could go forward with a policy. The City Attorney in La Habra communicated a similar flexibility to the city council when acknowledging the uncertainty in FAA regulations:

What we're doing with the drone ordinance is relatively new, similar to kind of what cities went through with the marijuana ordinances five years ago as a laws and rules become more refined, cities come back and tweak the ordinance and make adjustments to implement newer regulations or if the court process is taken. Its uncharted waters, we're doing the best we can.

And this ability to revisit the ordinance was also apparent in West Hollywood when the City Attorney was discussing the ordinance with the city council and the FAA jurisdiction was brought up:

This is a rapidly changing fluid environment. Just recently, the FAA, um, decided to have a mandatory registration requirement for all drones and, um, I expect there to be other changes as well. So whatever you do tonight, and in terms of this ordinance, figure that at some point we may be back with some amendments because of the changing laws.

The discussions in West Hollywood and some of the other early adopters had the most easily recognizable references to uncertainty as a potential problem. Without the ability to observe other policies, cities had to come up with possible policy options by looking to the states and federal government, professional organizations such as the ACC OC and CLOC, and when possible other cities in the area. However, unlike other policy areas where there is some clear guidance about what can and cannot be done with respect to governmental jurisdictions (Mossberger, 2000), the cities in this study were clearly

recognizing that they did not know what their role was in regulation. This meant that adapting the available policy frameworks to meet the requirements of the cities remained questionable. In response, many cities actively sought information through their city attorney or city manager but even then the lack of reliable information due to the ambiguity at the federal level made these policy decisions difficult. The policy decision in response to this uncertainty differed substantially between adopters and non-adopters. In Beverly Hills which was the earliest adopter of a drone policy with arguably no cities to turn to for advice, used the uncertainty as a reason to propose one of the strictest approaches to drone regulation in the region:

It's still uncertain at this point, um, what local authority and municipality has to regulate, what the state is going to do, and where the federal regulation is going to fit in...I think we put a moratorium on the drones until we get more information about it.

Beverly Hills did go on to adopt a drone use ordinance and eventually scaled back their initial no-drone approach. On top of the unclear jurisdictional boundaries between the governments, cities also noted the lack of familiarity with the operational aspects of drones, adding an additional level of uncertainty. As would be expected with an emerging technology, the city council and general public were generally unfamiliar with their operation. Claims of not knowing what a drone can do or how it would be used were present in seven of the cities that formally adopted regulations. In Beverly Hills there were two different occasions where uncertainties regarding drone operation were brought up in support of regulation. The first concerned safety and in another meeting a different council member referenced the uncertainty around the ability of the cameras to take pictures:

We have no idea when these things run out of juice and fall from the sky or don't run into juice and run into a power line or distract drivers or bicycle. I mean, you know, the potential is huge.

...and we don't know how good they are, how resolute they are, whether they're taking pictures, whether they get heat, thermal, thermal type of responses to that. I'd be more aggressive rather than less aggressive, always be able to lax it.

City council members in Calabasas and Carson also expressed concern with drone operations in the form of not knowing where a drone is operated from and the purpose it is being operated for. In these instances it wasn't necessarily that the city council was uncertain about the drone technology but that there was uncertainty inherent to the operation of a drone. When discussing the option of putting a limit on the number of drones that could be registered within the city one City Council member asked about air congestion, stating that "I don't know when we would be too congested. I just don't know enough about these operations."

On the other hand, the cities without regulation discussed uncertainty as the reason why they *should not* adopt a drone use policy. In both of these cases the city council members expressed frustration with the lack of clarity about FAA jurisdiction and the uncertainty that it created for them. In Newport Beach, a City Council member complained that the FAA did not know its own role and was frustrated with the FAA telling cities what they can and can't do with respect to drone use:

...so the FAA doesn't understand what its role is in this, but it's coming in and telling people that it controls it (airspace). Then the state comes in and says, well, we control the airspace as well, and then now cities are left with land use issues, which is barely code enforcement at that point. And so I'm just going to say I'm really sorry for the residents that are getting harassed by this and until Congress and the FAA figure out exactly what their roles are, the best we can do is send out our police officers to try to enforce what is essentially, you know, pre-technological penal codes.

From the onset of the Newport Beach discussion the city attorney and police department liaison highlighted how existing laws could be applied to drone use but never mentioned the potential to revisit a policy specific to drone use later on. This is very much in contrast to what the same personnel during adopting city council discussions were communicating to council members.

In this context the lack of information regarding drones and their regulation had a differential effect on cities. Uncertainty was clearly acknowledged during the drone use policy discussions in adopting and non-adopting cities. However, the acknowledgement of uncertainty supported different policy choices by the different city councils. This finding offers some support for the possibility that uncertainty combines with other mechanisms of policy innovation to cause a specific policy decision to be made. One of the benefits of evaluating cities that made the decision to adopt a policy alongside cities that made the decision to not adopt makes this differential effect clear. Thus, if the goal of policy innovation studies is to identify the factors involved in the decisions to adopt a policy, then the role that uncertainty has on those decisions should be explicitly acknowledged.

The low information environment brought by the novelty of drones forced many adopting and non-adopting cities to actively gather information about what they could do to regulate drones. However, as one policy expert described it there were some cities basically copying and pasting the Los Angeles ordinance into their own municipal code without taking the time to learn about the policy. Several cities in OC were given these instructions along with a copy of the ordinance to follow such that no active information seeking was required. Whether this act of emulation was in reaction to the uncertain policy environment or an attempt to conform to what the OCGJ recommended for all cities in OC is not

precisely clear given the data. What is clear is the distinction between emulation and learning in drone policy context.

Discussion

The primary purpose of this analysis was to determine what the important influencers of drone use policy innovation are in Southern California. This study also aimed to understand whether the uncertainty inherent to emerging technologies played a role in influencing policy adoption decisions.

When explicitly or implicitly acknowledged during city council discussions, the uncertainty of the policy environment was associated with two different outcomes. As an example, in Beverly Hills the uncertainty of the FAA policies was reason to adopt a policy while in places like Newport Beach the uncertainty was reason to not adopt a drone use policy. This differential effect played out across several cities including Laguna Niguel, Hermosa Beach, and Manhattan Beach. Although it was clear that uncertainty was a factor in the policy adoption decisions it was not clear why it affected these cities differently when focusing on uncertainty alone. However, there was some indication that non-adopting cities were more focused on their internal characteristics. Specifically, in more non-adopting cities evidence pointed to them wanting to see evidence that drones were a problem before adopting a policy. However, there were exceptions and what can ultimately be determined is that uncertainty alone cannot adequately explain the decision to adopt.

Throughout this analysis it was clear that cities were working to minimize the amount of uncertainty they faced by actively seeking information from several different sources. There were two areas that policy makers had particularly low levels of information about. First, there was a lack of clarity about what aspects of drones could be regulated by

cities. Second, cities were unfamiliar with how drones were operated which made it difficult to determine whether the policies that were being crafted would work as intended. In order to gain information about these areas cities were learning from the policies of other cities, the FAA, and professional organizations where at least part of this process was facilitated by spatial proximity. In this context, the role of geography makes sense given that drones and their operators are both highly mobile. An operator using a drone on the border isn't necessarily going to be stopped by a jurisdictional boundary. Consequently some cities expressed a desire to maintain some policy coherence across regions but that rarely resulted in a strong cluster of policy adopters. When discussing whether an ordinance should be adopted, cities such as Garden Grove and Palos Verdes Estates pointed to the possibility that neighboring jurisdictions would also be formulating some sort of policy yet these regional influences didn't necessarily result in policy adoption. Again, this points to the possibility of confounding factors that configure to influence these policy decisions.

Some learning was facilitated by membership in regional or national professional organizations. The ACC OC was influential in moving the policies to the agenda of the city council. In addition the OCGJ report that was sent to all cities in OC was responsible for not only placing the topic of drones on the policy agenda, but also supported the adoption of drone policies in a handful of the cities. As far as intergovernmental networks influencing the movement of policy ideas go, data limitation prevented a deep dive into what happens behind the scenes. However, there was reference to drone policy information gained during a regional conference which was brought up by a member of Calabasas City Council. Yet, other than this one reference no other evidence for intergovernmental networks were found. This does not necessarily mean that these intergovernmental networks supported through

alternative communication channels were not influential. It simply means that the evidence available for this dissertation cannot definitively say what their role was.

Regardless, there was plenty of evidence to suggest that cities were interested in learning about policy success. This analysis showed that there were two main approaches to defining policy success and this differed between adopting and non-adopting cities. For non-adopting cities success was defined as the policy doing what it was intended to do. Not having many (any) examples of success under this definition supported the decision by non-adopting cities to hold off on policy decisions until success could be observed. In contrast, adopting cities were more interested in policies that could be implemented and fit the needs of the city. They were not interested in waiting to see whether the policy did what it was supposed to do. In many ways they had more faith in law enforcement's ability to apply these new policies to deter errant operators but that is not to say the adopting cities did not care about whether the policy would be successful if challenged in court. Rather, they were more willing to amend the policies at a later date rather than proceeding with no policy at all. Both the adopters and non-adopters were actively learning but the information that cities were seeking to learn differed and was part of the reason that cities differed in the final decision about a drone use policy.

That being said, for those cities without a drone use policy the role of diffusion was not as prevalent. As mentioned, the data revealed some discussion occurring between neighboring non-adopting cities, but most of these non-adopters preferred to wait to observe policy success. In some cases, non-adopting cities were waiting so as to not act to preemptively. In other cities there was a feeling that there was not a large enough problem to

merit an ordinance. But like uncertainty, the existence (or non-existence) of a problem had a complicated and differential role for cities.

The existence of a problem was indeed the most frequently cited reason why adopters needed an ordinance and furthermore, was one of the reasons why a drone policy was on the policy agenda. Some cities, such as Pasadena, had a significant event occur involving a drone⁷. These events helped to move the topic of drones up the policy agenda but also acted as examples of why an ordinance was needed. Other cities had a high number of incidents reported to the police or directly to the city council during the meetings and other cities were taking preemptive measures to problems they anticipated might occur later on based on the rise in drone use beyond the city. However, the outcome of acknowledging a problem did not always result in a policy adoption decision. Between problem anticipation and actual problem, every city in the sample acknowledged a problem yet not every city adopted an ordinance. It would certainly be convenient to be able to point to a single factor as the reason why a city adopted an ordinance, but the process of innovation is clearly more complicated. Some cities without a problem had an ordinance and other cities with a problem did not.

As some scholars note, cities will borrow policies or parts of policies of other (generally larger) cities due to an inability to conduct their own research or expectation that the larger city has conducted a substantial amount of research prior to creating the policy. After reviewing the ordinance from each city, there was very little amount of variation in policy from the later adopters. This is to be expected given what we know about policy leaders and laggards (Walker, 1969). However, as the policies at the state and federal levels of

⁷ <https://losangeles.cbslocal.com/2015/09/15/drone-crashes-injuring-baby-in-pasadena/>

government matured, there were increased limitations placed on cities. This is important to keep in mind. Since the first adoptions in 2014, the FAA has gotten increasingly specific with what cities can regulate. This study found that the highest variation in the approach to local drone regulation is observed in the earliest adopters, while the later adopter's policies are beginning to converge. This is interesting given the early push by regional organizations like OCGJ to emulate the policy leaders in the region rather than use the early frameworks provided by the FAA.

Where policy experts are concerned, the emerging technology literature suggests that they can have a strong influence on policy outcomes. This was apparent in the present study but only explicitly in three cities. In this study a policy expert was someone who was not directly affiliated with the city, had specific drone knowledge, and offered suggestions to the city council during their discussions. In the three instances where a policy expert was clearly identified the policy expert warned against an ordinance due to the possibility of preemption. They suggested alternative policy options which did not include a formal drone ordinance. Although there was an explicit recognition of drone incidents within two of these cities all three cities do not have a drone use ordinance. While an explicit link to the policy expert's advice cannot be drawn to the city council decision from this data, the influence of the expert can be partly implied given this evidence.

Conclusion

The results of this study are unique in that they speak to the process of local policy adoption for both the adopters and non-adopters of emerging technology policy. In general, diffusion plays a stronger role for the policy adopters whereas the internal characteristics are more influential for non-adopters. For most cities in the sample, drone policy was placed on

the agenda following a focusing event such as a drone crash, influx of reported drone incidents, or interest by a larger governing body such as the OCGJ. These served to begin the discussions on drone use policy as well as support (or detract) from the need for a policy once the discussions were taking place. To some extent, this underscores a reactionary approach to emerging technology policy where nothing is done until something happens that forces policy makers to consider regulating. Reactionary policies, as opposed to anticipatory ones, tend to over correct by being more restrictive than necessary. The policies, once in place, are difficult to change and risk stymieing the development and use of the technology. Anticipatory policies can begin a little less restrictive and then be gradually increased as needed. It is the anticipatory approach that many emerging technology scholars point to as the correct way to regulate emerging technologies.

There are a several limitations from this study that the reader should be aware of. First, the study relied on recorded video of city council discussions as the data source along with other ancillary supporting documents. These discussions are likely only a portion of the policy process picture as there is likely off-camera discussions that occur along with communications that are not ever recorded. While this study attempts to triangulate using multiple data sources it does not claim exhaustiveness. Second, the content analysis implies some subjectivity during the coding process. This depends on the researcher's interpretation of the data. Relatedly, the codes need to be interpreted with respect to the context in which they were created. While some of the evidence could be interpreted differently the results of this study were presented in an effort to maintain transparency in the coding process. All the data is also freely available for other curious researchers to review.

Limitations aside, this study demonstrates that the qualitative approach to policy innovation is a fruitful avenue for isolating diffusion mechanisms and internal determinants that influence policy innovation. This is especially so with new policy areas such as emerging technologies where the uncertainty within the policy process can play an important role. Capturing the role of uncertainty could not easily be done with traditional quantitative methods. The qualitative approach also highlighted a more nuanced view of the innovation process. Specifically, it helped with identifying two different approaches to learning between the adopters and non-adopters which would otherwise not be observable. As emerging technologies like drones begin to be used more broadly policy conversations will continue. This work provides an important step towards understanding the uniqueness of what contributes to these policy decisions so that the emerging technologies of the future can be shared across cities equally, while also ensuring that the public's best interest is kept in mind.

CHAPTER 6

QUALITATIVE COMPARATIVE ANALYSIS APPLIED TO POLICY INNOVATION

The previous chapter highlighted several important variables which were present across the cities that chose to adopt and not adopt drone use policies. The role that these variables played was not immediately clear, nor was it clear whether certain variables were interacting to support or detract from the decision to adopt a drone use policy. In some cities, certain variables seemed to support drone use policy adoption and in others they did not. Two variables in particular were perplexing, uncertainty and the existence of a problem. Uncertainty was embedded throughout the analysis in two main forms. There was uncertainty in the policy environment and uncertainty with how drones operate. Both of these factors were observed to influence policy but when considered in isolation led to two different outcomes. A similar finding was uncovered with respect to the existence of a problem. In some cases a problem was associated with policy adoption, other times it was not. A key focus of the following study is the explicit account for the role uncertainty and a problem have within the policy innovation process. That is, how these two factors, when combined with other aspects of the policy innovation process, lead to policy adoption. The approach to address the combinatory effect of factors is through qualitative comparative analysis (QCA). This method uses the idea of necessity and sufficiency to identify a configuration of conditions that lead to an outcome of interest. It is applied in the present study to identify which configuration of conditions result in a local drone use ordinance.

Introduction

The introduction of emerging technologies into society underpins questions of when and how policies regulating their use should be adopted. When it comes to emerging

technologies, regulation is difficult due to the balancing act between potential and unrealized risks and benefit of the technology. This balancing is made more difficult by the dichotomy between intentional function and actual use of the technology (Carlsen et al., 2010).

Intentional functions are the built-in characteristics of a technology that define how it is supposed to be used. For example, a screwdriver is designed to work with a screw and a hammer is designed to drive nails into a board. These are the intended uses of those technologies (Hansson, 2006). Actual use is trickier to pinpoint because it tends to materialize after the technology has become more widely available (Carlsen et al., 2010).

These are the unintended uses which are difficult to predict and prepare for in advance (Tozzi & Hopkins, 2017) because the risks and benefits of the actual use are uncertain (Kaebrick et al., 2016). Generally speaking, the lack of consumer-grade easy-access emerging technologies means that wide-spread use and familiarity is usually low (Cobb & Macoubrie, 2004), presenting significant difficulties when trying to plan for the wider dissemination of the technology.

Uncertainty in this study is defined as not having enough information to be confident in the outcome of the policy decision. Policy makers and the general public rely on cognitive misers, informational shortcuts, and heuristics to inform their opinion about the uncertainties associated with new technologies (Fiske & Taylor, 2013; Ho et al., 2008; Scheufele & Lewenstein, 2005). That is to say, very few people—including policy makers—are fully informed about the risks and benefits of emerging technologies. As a result, they must rely on previously held beliefs, value predispositions, or the actions and opinions of others to make decisions regarding the use of emerging technologies. With respect to policy development, much of the same apply. The amount of available policy information changes

the approach to information gathering. For example, later adopters with arguably more policy examples to observe will require less active learning and at the same time have the ability to pick and choose what parts of existing policies they want to emulate. They are able to observe the positives and negatives in a process of lesson drawing (Rose, 1991). Early adopters face lower levels of information and consequently must conduct more extensive searches for information about a policy (Mossberger, 2000). The early adopters have less flexibility to adapt existing policy frameworks offered by professional organizations or other levels of government and rely heavily on city staff members and experts for policy information (Radil, Dezzani, & McAden, 2017; Rose, 1991; Shipan & Volden, 2008). In order to gain a better understanding of how these learning strategies support policy adoption decisions can be evaluated alongside other factors through theories of policy innovation. The theories embedded within policy innovation explain the adoption of new policies by a government entity (Berry & Berry, 2018). However, these existing approaches may not be fully equipped to handle the presence of uncertainty and its unique influence on policy innovation.

Policy innovation is defined as the process that jurisdictions go through when adopting a new policy (Allen & Clark, 1981b). Subsumed within the innovation literature are models of diffusion and internal determinants. The former focuses on the effect and mechanisms that support how the choices of one government influence the choices of other governments (Shipan & Volden, 2012). The latter is focused on the characteristics of governments and polity that influence policy decisions (McLendon et al., 2006). When combined, these two areas of research offer theoretical and methodological insights that help to answer questions about policy adoption across a variety of policy topics.

The previous chapter was guided by a policy innovation framework and a coding protocol to identify the presence and influence of diffusion and internal determinants along with uncertainty in the drone use policy adoption process for Southern California cities. The identified how the existence of low information effected the process of information gathering which, in turn, influenced the final policy adoption decision. There was a mix of internal determinants and diffusion mechanisms present for both the adopting and non-adopting cities but the way they interacted differed. The presence of uncertainty was found to be influential for adopters and non-adopters, but it was unclear why it led to different adoption outcomes. The presence of a problem had a similar differential effect. With very little research on the combinatory effect of variables in policy adoption decisions there have been few systematic studies done to investigate how policy innovation mechanisms combine to get a policy adoption decision. Furthermore, even less has been done to investigate the factors that result in a non-adoption decision despite the policy being on the agenda. This study, with its unique policy context and factors with differential effects provides one avenue for addressing this gap in knowledge.

The active area of drone regulation provides a unique setting for this study due to the evolving policy landscape with localized problems and related decisions on whether to regulate drones at the city level. From a theoretical point of view this study is guided by a policy innovation framework where diffusion mechanisms and internal determinants are used to explain policy adoption decisions. Practically speaking, this study builds on the findings from the previous chapter that identified influential diffusion mechanisms and internal determinants during city council discussions of drone use policy. Taken together, this approach to research is advantageous because it minimizes the need for theoretical

assumptions about the factors hypothesized to play an influential role in policy adoption. Instead, it takes advantage of the specific observations embedded in the policy adoption context and uses them to support the analysis of necessary and sufficient conditions for drone use policy adoption. With that in mind, the research question this study seeks to address is: *How does the existence of uncertainty in the policy process combine with diffusion and internal determinants to support or detract from the adoption of an emerging technology policy?*

The Complex Process of Drone Use Technology Policy

A technology, broadly speaking, is defined by an established body of scientific knowledge applied for practical purposes in industry and engineering (Carlsen et al. 2010; Stevenson 2010). Occasionally, contestation of new technologies occurs when the technology has the potential to directly affect individual rights or change the way in which something is done. Depending on the area of study, these “status-quo overthrowing” technologies are referred to as disruptive, radical, discontinuous, or revolutionary (Avila-Robinson & Miyazaki 2011). More commonly, however, these types of technologies are referred to as “emerging” and are defined by their fast rate of growth, potential for economic and social change, expanding knowledge base, broad areas of application, and uncertainty (Cozzens et al. 2010).

Drones display many of the qualities of an emerging technology. First, drones have expanded rapidly in production and ownership. As of January 10, 2018 the number of drone registrations in the United States topped one million (USDOT, 2018) with that number expected to continue increasing into the foreseeable future. Second, the number of application areas for drones is also expanding. Chabot (2018) recognizes over a dozen research areas within academia that have publications which involve the use of drones.

Third, companies like the UPS, Amazon, and Google are all researching ways that drones can be used for goods and services delivery (Divis, 2015; Mogg, 2016). Lastly, drones for recreational use continues to expand at a rate that is faster than all of the commercial sectors combined. In 2016, recreational drone sales grew to 2.2 million units, up from the 1.1 million reported in 2015 (Glaser, 2017). Put simply, drones have a fast rate of growth, potential to change the economy of goods and services delivery, and a broadening knowledge base through academic research of drones.

For those reasons and the documented uncertainty noted in the previous chapter, drone use regulation is inherently complex. The majority of drones are already operating in dense urban environments (Atherton, 2016) where there exist complex socio-economic considerations. This is an important consideration given the very real privacy and safety concerns already being communicated to policy makers during city council meetings (Nelson & Gorichanaz, 2019) which arguably places drone use regulation on the agenda in many of these cities. Moreover, the perceived risks associated with drone use can change based on the type of drone operator (Nelson, Grubestic, Wallace, & Chamberlain, 2019). Recreational users are seen as the most risky when it comes to the potential for privacy violation followed by government operators, and commercial users (Finn & Wright, 2016; Nelson et al., 2019). Indeed, Chapter 4 found that it was a lack of trust in recreational operators that many residents were concerned about. Hence, the situation is forcing drone use policy decisions to be made while the technology is essentially still being developed. Among other things, policy makers must determine with who is using the drone, the unique capabilities of the drone, and whether they can realistically (and effectively) regulate their use, all without knowing what their capabilities will be in the future.

Uncertainty is injected into this complex mix of social and economic factors in the policy environment itself. Cities are unsure of their role in drone regulation and when identified as being a cause for concern, the uncertainty resulted in differential policy outcomes. Some cities are adopting a drone use policy in response to the noted uncertainty while other cities are not. To put these decisions into context it is worth noting the current drone regulatory landscape.

The Federal Aviation Administration (FAA) is the organization tasked with the safe integration of drones into U.S. airspace (Marshall, 2016). In particular, the FAA's responsibilities include the establishment of safe altitudes for navigating and protecting aircraft, protecting individuals and property on the ground, managing the navigable airspace, and preventing collision between aircraft. This equates to drone policies designed to designate types of airspace, creating general operating and flight rules, and air traffic rules (Raley, 2017). Until quite recently, the FAA did not operate outside this scope. Trespass, privacy, and other unlawful drone operation was left to the states and local governments to manage. However, new legislation by the FAA in the 2018 reauthorization act acknowledges privacy concerns by specifying that drone use "shall be carried out in a manner that respects and protects personal privacy consistent with the United States Constitution and Federal, State, and local law" (FAA, 2018). Although local issues are acknowledged, the FAA still controls when, where, and how drones are operated while in the air. This is where the additional regulatory complexity is added.

Even with the added language recognizing the local privacy laws, regulation of drone use across cities can be significantly different. As was identified in the previous chapters, some cities are doing their best to restrict all drone flight in the city, effectively risking the

possibility of preemption. Other cities avoid regulation altogether. When considering factors like uncertainty in the policy process or the existence of a problem in isolation, the decision about whether to adopt a drone policy is not at all consistent. Cities such as Santa Clarita rely on existing model aircraft rules which may or may not cover drones (to be determined) while others, such as Bellflower, are currently without any drone use ordinance. These cities all exist within a small geographic region and are all subject to the same regulatory challenges yet the decision to regulate is not consistent. This implies the possibility that these conditions are interacting in ways that influence policy adoption decisions differently. One way to determine which are necessary to result in a policy adoption decision and which variables are sufficient is through a configuration method known as QCA.

Addressing Drone Use Policy Using QCA

QCA refers to a group of methods used to explore the sets of common conditions across multiple cases which are associated with some outcome of interest. Sets are constructed in terms of necessity and sufficiency such that some conditions will be necessary for an outcome and some will be sufficient (Schneider & Wagemann, 2012). The configuration of conditions related to the policy outcome of interest is identified through Boolean operation and logical minimization to reach the most parsimonious explanation possible (Ragin & Rihoux, 2004). The approach as a whole is rooted in the notion of causal complexity. Within QCA causal complexity is defined by three unique attributes: equifinality, conjunctural causation, and asymmetrical causation. Respectively, these refer to the potential for multiple combinations of conditions to imply the outcome, that conditions do not exert their influence in isolation, and the occurrence and non-occurrence of an outcome must be evaluated as conceptually different (Schneider & Wagemann, 2012). Conditions are necessary

if the outcome cannot exist without the condition and sufficient if the condition can produce the outcome (Ragin & Rihoux, 2004). The causal complexity of QCA supports the notion that conditions are often combined. A condition that occurs in combination with another is referred to as INUS—an insufficient but necessary part of an unnecessary but sufficient condition (Ragin, 1987). The unique causal complexity inherent to QCA has aided in its growth over the past several years. It has been applied to a number of diverse research questions and contexts (Fischer, 2015; Mitar, 2010).

The approach is perfectly suited for addressing policy innovation in the context of drone use policy adoption. As detailed above, there is a considerable amount of complexity involved in the decision to adopt a drone use policy. Yet, it would seem that there is only one QCA study that addresses policy innovation. Gran & Aliberti (2003) seek to explain the adoption of social policy at the country level using children's rights and the formation of a national children's ombudsperson as focus. The conditions of the study are informed by several models posited to influence the existence of social rights. These include access to individual resources such as education, ability to pay for legal counsel, participation in international conventions, and level of industrialization. The study implicitly recognizes theories of policy innovation but never explicitly acknowledges the associated models of diffusion or internal determinants. In the study they use a total of five conditions which are structured as a crisp set QCA (csQCA).

In another policy oriented QCA study, Kim & Verweij (2016) explore the configuration of conditions which are associated with the adoption of state level environmental justice (EJ) policies. The conditions they explore are expertly based on a general theory for why states might have an EJ policy (Ringquist & Clark, 2002). There are

several parallels that can be drawn from their theoretical framework to what is posited within the policy innovation literature. For example, the researchers suggest that EJ policy is related to external political factors, internal political factors, and policy specific factors. These are somewhat akin to internal determinants and diffusion mechanisms. Unlike the previously detailed QCA example by Gran & Aliberti (2003), Kim & Verweij (2016) strengthen their argument for using QCA by illustrating the lack of consistency in the variables that are thought to influence the existence of EJ policy. In this way, they demonstrate the potential for a configuration of factors leading to the policy outcome and also allude to complexity. In addition, the authors question the independent effects that many quantitative approaches must assume. They also use five conditions derived from the general model of EJ policy adoption in a fuzzy set QCA (fsQCA) to identify two possible causal paths towards different levels of state EJ policy.

This study builds on these two examples of policy adoption analysis using QCA. It follows the work by Verweij & Gerrits (2015) of identifying conditions that contribute to an outcome of interest through qualitative analysis of text and media. More specifically, the choice of conditions in this study are based on a content analysis of the policy adoption process detailed in the previous chapter (Chapter 5). Data analysis was conducted in an iterative semi-open coding procedure and guided by expectations from the policy innovation literature and emerging technologies. The associated coding protocol was theoretically based in policy innovation literature and practically based on the researcher's knowledge of the context. Any mention of uncertainty was also identified and coded as such (Appendix B). After several iterations of coding, the most frequent and influential were included as possible causal conditions in the QCA (Table 7).

Analysis

The first step in the analysis was to evaluate each one of the identified conditions in a manner that made theoretical and logical sense in light of the research question. After determining the presence and absence of each condition across all the cases they were compared using crisp set QCA (csQCA). The outcome condition is the existence of a local drone use ordinance coded as present (1) or absent (0), as determined by the city's municipal code. The analysis was performed using the same sample of cities used in the content analysis and analyzed with the fsQCA software.⁸

Drone use Policy Innovation Conditions

The content analysis of city council media and documents was used to build a coding protocol and identify the frequency of their appearance across the sample cities (Appendix B). The conditions were subsequently used in the QCA by determining their presence or absence in each of the 24 cases considered in the sample. Each of the codes were tallied to get an estimated total frequency (Table 7). In addition, the most influential conditions identified during the content analysis in Chapter 5 were also considered. With respect to diffusion mechanisms, the most frequently identified was regional but this was not mutually exclusive. It became clear through the content analysis that the regional influence, while important, was facilitating learning. That is, cities were most often learning from the cities that they were closest to. Other influential diffusion mechanisms were emulation, group membership, leader, and competition. As for internal determinants, the most referenced was some reference to having a problem which was defined as city council members or the general public referencing a crash, privacy violation, visual or auditory nuisance, a noticeable

⁸ <http://www.socsci.uci.edu/~cragin/fsQCA/>

increase in the use of drones, or other incident at the city council meetings or in the interviews. This was followed in frequency by problem anticipation, land features, economics, municipal resources, the presence of a policy expert, and socio-demographics. Throughout the content analysis were references to uncertainty. Uncertainty played a major influential role in city decision about drone use policy adoption. Because uncertainty was found to play such a major and differential role between adopters and non-adopters it was included as a possible condition in the QCA (Table 7). The conditions with the highest frequency and/or importance were considered as the conditions in a casual path leading to a drone policy adoption decision.

Table 7. Frequency of diffusion mechanisms and internal determinants based on the content analysis.

Diffusion	Adopter	Non-adopt	Total	Internal Determinants	Adopter	Non-adopt	Total
regional	11	4	15	problem	10	5	15
learning	9	4	13	problem anticipation	9	2	11
Emulation	4	2	6	municipal resources	3	3	6
group membership	5	1	6	land features	4	0	4
leader	5	1	6	policy expert	0	3	3
competition	1	1	2	economics	2	0	2
				socio-demographics	2	0	2
Uncertainty							
Uncertain (operation)	7	0	7				
Uncertain (policies)	9	4	13				

The structure of QCA limits the number of conditions that can be considered in the model. This limitation is due to the pairwise comparison of all possible conditions in the model. The total number of possible solutions increases by a function of 2^k where k is the

number of conditions. In theory it is certainly possible to include a large number of conditions, but this is not advised. Too many conditions increases the number of, and possibility for, logical remainders. Logical remainders are combinations of conditions that are logically possible, but are not observed in the data set due to a lack of empirical evidence (Grofman & Schneider, 2009). Fortunately it can partly be avoided by choosing a number of conditions where the total number of combinations is less than the number of cases in the model. With large-N data sets this is less of a problem but as Table 7 indicates, the 14 identified conditions could not all be included and had to be reduced.

Table 8. Coding protocol for influential and frequently identified codes.

Diffusion			Internal Determinant			Uncertainty	
Code 1: Learning (11)	Code 2: Emulation (9)	Code 3: Regional Influence (15)	Code 4: Problem (24)	Code 5: Resources (6)	Code 6: Policy Expert (3)	Code 7: Policy Uncertainty (13)	Code 8: Operation Uncertainty (7)
1) Delay till success is observed 2) active information seeking	Evidence to suggest normative copying. No active learning	Reference to neighboring jurisdictions policy adoption	Reference to an event or number of drones seen	Availability of resources effect policy	Participation by someone other than city staff with knowledge of drones	Uncertain how local policies interact with state or federal policies	Uncertainty about drone operation creates difficulty
“So based on what you just said, you're not aware of any challenges that were made to Beverly Hills ordinance since it was enacted in October 2014?”	“We adopted a virtually identical version of this ordinance in West Hollywood”	“who knows what the city of Westminster is going to do, but they're probably looking at something similar themselves and they're probably likely to adopt something similar to what we're doing”	“I've actually seen outside of my house more than half a dozen drones at one night. There's just kind of roaming all over the place. I didn't realize it was that many of them”	“that we may end up having a time suck for our police department and having to talk about, um, you know, whether they're being, we're drawing resources away to, to manage this problem”	“I think that when you have a group of experts like that, we ought to solicit their input and we'll come up with a better product in the end. I don't have any doubt that we need regulations”	“I cannot tell you whether or not they will pass through the legislature and slashed or be signed by the governor. So that's the uncertain legal landscape in which we find ourselves”	“We have no idea when these things run out of juice and fall from the sky or run into a power line or distract drivers or bicycles. I mean, you know, the potential is huge”

Amenta & Poulsen (1994) suggest several strategies for reducing the number of conditions in a QCA. One approach is to create higher order constructs (Ragin, 2000) and another is to base the reduction on theoretical and empirical evidence gathered over the course of the research process (Schneider & Rohlfing, 2013). These two reduction strategies were used to reduce the number of conditions for the present study. It should be noted that the final conditions were chosen after several iterations of calibration⁹. It should also be noted that QCA is an iterative process (see chapter 3 for an in-depth discussion of QCA analysis or Thomann & Maggetti, 2017). Iterating between conditions, outcomes, and cases is an accepted part of comparative methods but must be done in a manner that is both logically and theoretically sound. With that in mind, information regarding the use and reasoning for each of the conditions used in the model are described below. These final conditions were selected from the most frequently identified and influential conditions found during the content analysis. The final set of possible conditions considered in the QCA model is detailed in Table 8. The table also details the protocol used to identify the conditions when coding the data in the content analysis. Three main categories were identified: internal determinants, diffusion, and uncertainty. The category, code, definition, and an example of each is provided for reference. Through an iterative process guided by practical and theoretical knowledge this list of possible causal conditions was refined further to those four that are detailed in Table 9, where the calibration details are described.

⁹ While learning is the second most frequently identified diffusion mechanism it had very low consistency across cases so was not included in the analysis. However, it is not uncommon to include learning as a regional variable. It is thought that learning is done most often by observing the policies and practices of those who are closest in proximity since problems and communication tend to be somewhat local.

Condition Details

Regional Effects: The data in Table 7 indicates the importance of a regional effect being identified most frequently during the content analysis for both adopters and non-adopters. Again, regional influence was not mutually exclusive and tended to facilitate learning or other diffusion mechanisms. In this way, the presence of a regional influence could also serve as a proxy for the learning variable. Because learning did not result in good coverage or consistency it was left out of this analysis. In order to get a more objective measure of regional influence this condition was determined based on the actual topological relationships of cities. Furthermore, Mooney (2001) correctly suggested that as the proportion of cities around a non-adopter jurisdiction increases the chance of adopting a policy increases for the non-adopter. The presence of a regional influence was determined by identifying the cities that had at least two neighbors with a drone use policy where neighbors were defined as having a shared border. The entire set of incorporated cities (n=118) was used when calculating this condition. It is expected that a city will have a drone use policy if it has at least two neighbors who also have a drone use policy.

Emulation: Emulation in this case is in reference to a city adopting an ordinance without actively searching for information to decrease uncertainty but also doing so in order to conform to a normative environment. There were several instances of this behavior following the recommendations by the Orange County Grand Jury to adopt a drone policy that reflected Los Angeles. Some cities did while others did not. For some of the cities that did, there was very little if any active information gathering. The final policy reflects word for word the policy adopted in Los Angeles. The Orange County Grand Jury required that cities send a written response stating what they had done with respect to a drone use policy. When

there was evidence to suggest that cities adopted a policy as a symbolic/normative gesture towards the Grand Jury it was taken as a sign of emulation.

Cross referencing the drafted ordinance of cities along with the responses to the Grand Jury identified several instances where city staff had crafted an ordinance to conform to the Grand Jury's recommendations (by copying the Los Angeles ordinance) but ultimately the city decided against formally adopting it. A positive value for the emulation condition indicates that it was identified for that city. The presence of emulation is expected to result in a drone use ordinance.

Problem: One of the most consistent variables in policy innovation studies is an indication that a problem exists and requires a policy solution. Following previous policy innovation studies and further informed by the results of the content analysis, this study includes a measure of the problem as possible causal condition. After content analyzing all of the media and documents, a drone problem and potential future problem were the most frequently referenced internal determinant for adopters and non-adopters. However, rather than make the assumption that reference to a problem by the city council members or the public was objectively true, this study used a proxy indicator that was based on the number of registered drone users in each city (Appendix C). The FAA website provides almost-recent data on the current numbers of recreational (section 336) and commercial users (part 107) by zip code and city¹⁰. The data for this study is current as of November, 2018. The reasoning for using this information to construct the proxy variable is twofold. First, with more drone use comes a higher potential for drone-bystander interactions and with that, more potential for residents to call in and complain about drone use. Second, drones can be

¹⁰ https://www.faa.gov/foia/electronic_reading_room/

seen, heard, and often used in popular areas such as public parks, beaches, or open spaces. A city with higher numbers of registered drones will likely have more users operating in these highly visited areas.

The median value for drone use registrations was used to define the cut point between presence and absence of a problem. The median was used as the cut point due to the presence of a few cities (Los Angeles in particular) with significantly large number of drone registrations compared to other cities. The smallish sample size equated to outliers having a large influence on the mean (Table 8), hence the median value was a better indication of problem.¹¹ The expectation is that cities with drone registrations above the median value will also have a drone use ordinance.

Uncertainty: Uncertainty was documented in the city council discussions and was related to two categories of low information: not knowing enough about the operation of drones and not knowing enough about how cities policies would interact with state and federal policies. The operation of drones comes with a handful of unknowns surrounding their operating capabilities (how far they can fly, how big they are, the type of camera they have) as well as the operation of the drone itself (who is operating it, where the operator is located, the type of operator). In addition, the policy environment for drone use was highly uncertain at the time that the city councils were discussing the possibility of a drone use ordinance. There were unknowns regarding jurisdiction (federal, state, local), FAA policies, and the proper level of enforcement. Both categories were coded during the content analysis

¹¹ The median and mean value were used in the data matrix and truth table separately to determine the appropriateness of using one over the other. In the end, the median was chosen because it made more sense given the distribution of drone registration across the sample and across the entire region as a whole.

separately and recorded as either being present or absent. Following the suggested strategies for reducing conditions, they were combined into a larger “uncertainty” condition which was used for the analysis. How uncertainty figures into the causal path is not clear, nor is how (if at all) it will combine with the diffusion and internal determinants.

Table 9. Descriptive statistics and calibration for the conditions used in causal path.

Condition	Mean	Median	Min	Max	Calibration
Regional	2.5	2	0	4	absence (0), presence (1)
Emulation	n/a	n/a	0	1	absence (0), presence (1)
Problem	546	223	71	5,402	<median (0), >median (1)
Uncertainty	n/a	n/a	0	1	absence (0), presence (1)

Case Configuration and Comparison

To reiterate, each condition was coded for presence or absence (Appendix C). For regional diffusion, a positive case was defined by a shared border with at least two jurisdictions that had a local ordinance. This was calculated within a Geographic Information System. Emulation/mimic was derived from the findings of the content analysis and recreational registration was determined based on FAA data detailing the number of registrations in each city. Uncertainty data was taken from the content analysis.

Following the construction of the data table, all of the possible configurations were organized into a truth table and each case containing the configuration was assigned to the corresponding row. Recall that each row represents only one possible configuration of conditions. With 4 conditions there were 16 possible configurations (2^4). Of those 16, eight

were logical remainders and 2 configurations only had one case. The majority of the cases (16) were associated with five different configurations (Table 10). There were no prime implicants that tied and only two contradictory cases. The frequency cutoff was 3 and the consistency cutoff was .75 following the suggestion by Ragin et al. (2017). The cutoff points are used in csQCA to determine which configurations are considered as a subset of the outcome. That is, they are used to determine which configurations to include for tests of sufficiency. In Table 10 the “Ordinance” column is labeled with a 1 where the configuration meets the cutoff point criteria and 0 where the configuration does not. The conditions marked as 1 are those which are considered to be subsets of the outcome. All the cases in those rows have positive outcomes.

Table 10. Truth table for the causal conditions

Uncertain	Regional	Emulation	Problem	Ordinance	Cases	Raw consist.
1	1	0	1	1	Pasadena, Aliso Viejo, Beverly Hills, Burbank, West Hollywood, Yorba Linda	1
0	1	1	1	1	Anaheim, Garden Grove, Manhattan Beach	1
0	1	0	1	1	Carson, Hawthorne, Laguna Niguel (C), Los Angeles	0.75
1	1	1	0	0	Calabasas, Hermosa Beach, Palos Verdes Estates	0.66
1	0	0	1	0	Laguna Beach, Newport Beach, Rancho Santa Margarita, Santa Clarita	0.25

Results

Minimization of the truth table using the fsQCA software provides three sets of results: complex, parsimonious, and intermediate. As detailed by Kim & Verweij (2016), the complex and parsimonious solution do not handle logical remainders well. The complex

solution takes positive cases as True and all other cases (negative, don't care, and remainders) as false, limiting the simplifying assumptions of the model. The parsimonious solution takes positive cases as True, negative cases as False, and remainders as Don't Care. This approach does allow for simplifying assumptions but handles remainders without respect for theoretical arguments (Legewie, 2013). As there were several logical remainders in this analysis the intermediate solution was chosen as best for interpretation. However, it should be noted that the intermediate solution and the complex solution were identical. The intermediate solution resulted in two possible causal paths detailed in Table 11. For the sake of completeness, the parsimonious solution is also presented below. Additionally, the negation of a drone use ordinance was explored using the same conditions. This is presented in Appendix D as the results were not definitive but nevertheless interesting.

Table 11. Intermediate and parsimonious causal paths with descriptive measures for evaluating strength of support.

Intermediate Solution	
Path 1	Path 2
Regional*~Emulation*Problem	~Uncertain*Regional*Problem
Raw Coverage: .562	Raw Coverage: .375
Unique Coverage: .375	Unique Coverage: .187
Consistency: .9	Consistency: .857
Carson, Hawthorne, Los Angeles, Pasadena, Aliso Viejo, Beverly Hills, Burbank, West Hollywood, Yorba Linda, Laguna Niguel (C)	Anaheim, Carson, Garden Grove, Hawthorne, Los Angeles, Manhattan Beach, Laguna Niguel (C)
Solution Coverage: .75	
Solution Consistency: .92	
Parsimonious Solution	
Regional*Problem	
Raw Coverage: .75, Unique Coverage: .75, Consistency: .92	
Anaheim, Carson, Garden Grove, Hawthorne, Laguna Niguel, Los Angeles, Manhattan Beach, Pasadena, Aliso Viejo, Beverly Hills, Burbank, West Hollywood, Yorba Linda	
Solution Coverage: .75	
Solution Consistency: .92	

The truth table rows marked with a 1 in the occurrence column represent the sufficient conditions for policy adoption (Table 10). Those rows with a consistency score of 1 indicate that all cases with that condition also have the outcome of interest—a drone use policy. The third row meets the cut off criteria to indicate a positive outcome, but it also indicates a mixed outcome with a consistency score of .75. This is referred to as a contradictory configuration because Laguna Niguel, although it has the configuration, contains a negative outcome while all the others have a positive outcome. This set of conditions is not sufficient for either a positive outcome or a negative outcome. This is not detrimental to the analysis as the consistency is still relatively high and the final minimization process does take this into account when performing the test of sufficiency.

The first row of the truth table indicates that the presence of uncertainty combined with having neighbors with a drone use policy and a large number of drone registrations is sufficient for the adoption of a drone use policy. The cities of Pasadena, Aliso Viejo, Beverly Hills, Burbank, West Hollywood, and Yorba Linda represent this configuration. The second configuration which also has a consistency value of 1 indicates that the absence of uncertainty, presence of neighbors with a drone policy, presence of emulation, and a large number of drone registrations is sufficient for drone use policy. Anaheim, Garden Grove, and Manhattan Beach represent this condition. The first three rows of configurations in the truth table were considered in the minimization process to get causal paths.

Causal Paths

This study began with three explicit expectations for causal paths. The presence of regional influence, emulation, and problem would all contribute to the adoption of a drone use policy. Only two aligned with the expectations. Causal path 1 indicates that the presence

of regional effects, a problem, and the absence of emulation is sufficient for drone use policy adoption. Causal path 2 (the logical OR) indicates the presence of regional effects, a problem, and no uncertainty is sufficient for policy adoption. The two conditions found to be sufficient for the outcome also indicate the presence of two INUS conditions. Regional effect and problem were present in both paths but the existence of the additional conditions—a lack of uncertainty and emulation—means that regional effect and problem are not sufficient by themselves to produce the outcome. They are insufficient on their own but necessary for a sufficient path. This finding underscores the strong influence of having large number of drones registered in the city (the measure of the problem) and having more than one neighbor with a drone use policy as mechanisms that support the adoption of a drone use ordinance. The full solution to drone use policy adoption is represented as follows.

Regional*~Emulation *Problem + ~Uncertain*Regional*Problem

The reader is reminded that a * indicates the AND operator, a + indicates OR, and a ~ indicates NOT. Both of the identified causal paths are highly consistent (Table 11). Path 1 has a consistency score of .9 and path 2 has a consistency score of .857. There were 11 cities that represented this path of sufficiency with Laguna Niguel included as the only contradictory case. From a policy innovation perspective, regional effects and severity of the problem both play a strong role. The absence of emulation/mimicry suggests that regional effects may influence the decision to adopt a policy, but that cities may be crafting them to meet the specific needs of their city. Causal path 2 tells the same story but has a slightly lower consistency and fewer cities are covered (7), indicating that path 1 may be better able to explain drone use policy adoption. However, path 2 is interesting because it includes the

absence of uncertainty condition. It indicates that the absence of uncertainty is sufficient for policy adoption when combined with the presence of a problem and neighbors with a policy, suggesting that being surrounded by neighbors with a policy may reduce the uncertainty in the drone use policy process.

The parsimonious causal path is $\text{Regional} * \text{Problem}$. Cities surrounded by other cities with a drone policy and those that also have a large number of drone registrations is sufficient for adopting a drone use policy. This makes logical sense but misses some of the policy nuances that the intermediate solution provides. Still, the parsimonious solution has great consistency and decent coverage. 13 cities cover the parsimonious solution.

Finally, the map in Figure 6 illustrates several aspects of this analysis. First, the outline color corresponds to the causal path. Cities with a red outline are aligned with causal path 1. Cities outlined in orange are aligned with causal path 2. Cities that are cross-hatched show up in both causal paths. The pinkish colored cities are those without a drone use ordinance and the cities filled with green have a drone use ordinance. There doesn't appear to be a spatial pattern associated with the causal path. In terms of drone use policy adoption across the entire region (including those cities not included in this analysis), it does seem that there are two clusters of policy adoption in Los Angeles county and in the southern middle portion of Orange county.



Figure 6. The study area and the cities that are associated with the two main causal paths

Discussion

This study set out to answer the question: what is the role of uncertainty in drone use policy adoption and does it influence how diffusion mechanisms and internal determinants combine to support the adoption of drone use policy? To answer simply, the absence of uncertainty supports policy adoption for some cities which may be due, at least in part, to their geographical proximity to cities with a drone use policy and a significant number of drones in the city. The answer came by considering a configurational approach to policy adoption, implicitly acknowledging the possible existence of multiple causal paths that could lead to a positive outcome. The intermediate solution with its two causal paths supports the arguments made for this conjecture. Taken together, the causal paths have sufficiently high coverage and consistency. In addition, both point to the importance of having neighbors

with a policy *and* having a sufficiently large problem. That is, they support the idea that both diffusion and internal determinants are part of the sufficient condition for policy adoption to occur. The two causal paths differ on the absence of conditions that are sufficient for policy adoption. Path 1 indicates that the absence of mimicry/emulation is sufficient to produce a drone use policy when combined with regional effects and problem. Path 2 indicates that the absence of uncertainty combined with regional effects and a problem is sufficient to produce a drone use policy. This solution offers several important insights about policy innovation generally, as well as emerging technology policy adoption more specifically. Both merit further elaboration.

First, the absence of uncertainty and emulation both suggest that policy adopters are actively searching for information and applying it to their policy decisions. As one might expect with uncertainty surrounding emerging technologies, the absence means that adopting cities have at least enough information about the drone use landscape to come to a conclusion on regulation. Consider the city of Los Angeles. It is the second largest city in the United States and has a drone use policy. With the size of Los Angeles comes a myriad of resources which, for example, can be used to hire policy experts, designate staff members to research, and enforce the policies once they are created. All of this works to increase the information gathering strategies for new and uncertain topics. If a city also has neighbors who have a policy learning can be even easier. Being close proximity to an adopter who has already dealt with a problem can support further investigation into regulation, easier observation, and ultimately increase what the non-adopting neighbors know about strategies to implement and enforce a drone use policy.

With an emerging technology such as drones the unique characteristics of a city will change how they want/need to regulate drones. Beverly Hills has a drastically different resident than the city of Carson. What may work for the City of Carson won't necessarily work for the City of Beverly Hills because there are different assurances that need to be covered by the policy. As cities learn what they need with a drone use policy they will spend more time adapting existing policies that they observe elsewhere. Because the presence of a regional influence was found to be a necessary condition and learning can be facilitated by regional diffusion, it may be the case that cities are learning from their neighbors to reduce this uncertainty. Indeed, the content analysis in Chapter 5 indicated that some cities actively discussing the possibility of a drone use regulation are also turning to their neighbors for information. Occasionally this is in an attempt to maintain policy coherence across region but what is more likely is that it is a way to gain information about what type of policy will work for the city's needs. Learning from a neighbor is easier than trying to learn from someone in a different region so it is not too surprising that the absence of uncertainty in the presence of regional influence is sufficient to cause a policy adoption decision.

That said, the absence of emulation as part of the causal path suggests that policy adoption for drones is coming from need rather than normative pressure. It is only when there is a problem and regional effects that emulation is not required. Consider a situation where a city does not have any neighbors with a drone policy nor a drone problem. Realistically the only reason that city would adopt a policy would be through some sort of normative pressure. Because the sufficient path

The presence of a large number of drone registrations in a city is a sufficient part of both causal paths. This finding is reinforced by the data from the content analysis that

indicates problem as the most frequently referenced internal determinant involved in the policy adoption process (Table 7). In the present study, the QCA condition representing severity of problem is the number of federally registered drones in a city. Because drones have a strong visual and auditory presence, and because they tend to be operated in areas where people generally like to congregate (beaches, cliffs, bluffs, parks), even a city with only a couple hundred registered drones will likely be noticeable. Furthermore, an analysis of necessity for this single condition resulted in a consistency of .81 and coverage of .722—it is a decent indicator of whether a city has a drone use policy by itself. On top of all that, research suggests the individuals have a marked aversion to drone use (Yao, Xia, Huang, & Wang, 2017). Regardless of whether an actual incident has occurred in the city, any increase in the use of a drones will likely be noticed and reported to local authorities. As more recreational drones are operated in cities their use, as well as the sightings, will increase. This would support the adoption of a drone use ordinance.

Another useful way of deciphering QCA solutions is through thought experiments about the counterfactuals. The counterfactual to the absence of uncertainty is of course the presence of it. From a purely theoretical lens prefaced on the findings from this analysis, one would expect that a city who is dealing with the presence of uncertainty would not have a drone use policy. Some evidence for this counterfactual is found by analyzing the negation of an ordinance (Appendix E). Both the parsimonious solution and intermediate solution found the presence of uncertainty to be sufficient for the *absence* of a drone use policy adoption. However, with the low coverage and consistency of these findings they do not hold too much weight, yet are nevertheless interesting to consider in light of the studies main findings.

Lastly, reconsider the complexity of the drone policy environment. Drones are a novel emerging technology where information regarding their use and regulation is low. It is not clear how drones will develop with respect to what they can carry, where they can fly, their maneuverability, or what their size will be. Furthermore, it is unclear how they will be used by different user groups. Commercial operators are turning their attention toward goods and services delivery, the government is entertaining the idea of surveillance for law enforcement, and recreational users are building their own drones to carry bigger and better cameras to fly faster for longer. On top of all of that, cities must contend with the possibility of preemption and the reality of whether these policies can realistically be enforced. That said, the sufficient ingredients for drone use policy adoption are having a problem, having neighbors that have a drone use policy, and having enough information to remove the uncertainty in the policy making process. It doesn't make much sense for a city to navigate this regulatory complexity without having a problem to deal with in the first place, but if the situation arises, the presence of neighbors who have already dealt with drone use regulation can take some of the guess work out of it.

Limitations

Generally speaking, limitations of QCA research come from the choice of conditions. Because of the way QCA is performed conditions must be chosen carefully and done so with a keen sense of theoretical and practical support. In this study, the content analysis provided the support for the use of specific conditions. Regional effects were found the most frequently with respect to diffusion mechanisms, and severity of the problem was the most frequently identified internal determinant. Rather than use the data from the content analysis, the decision was made to use a proxy for both of these variables; the spatial

relationship to neighbors with a drone use policy and the number of currently registered recreational drone users in a city. For the former, it is not without doubt that neighbors have the strongest influence. Yet, many studies in the diffusion literature suggest that proximity does matter (Emmert & Traut, 2003; Godwin & Schroedel, 2000; Mooney, 2001). Although some argue that geography is a crude measure of diffusion when used by itself (Gilardi, 2016), it is nevertheless a necessary part of the drone use policy outcome.

As far as the measurement of the problem is goes, it could easily be argued that data on the number of actual incidents in each city would have been a better proxy, especially if used in conjunction with the registration data. Unfortunately, that data does not yet exist, partly due to the newness of drones and partly because law enforcement have taken the approach of considering a drone complaint as a “disturbance” without further classification. As drone use becomes more common place this data will likely become available. At that time it would behoove researchers to address measures of the problem using incident data alongside other data, such as the number of registrations. Until then, the studies will be limited by the data that is available.

Ragin (2006) notes “perfectly consistent set relations are relatively rare in social science research...there are almost always exceptions.” The two causal paths identified in this study have relatively good consistency and coverage, but only account for the outcome of 13 out of the 24 cases. This is decent with respect to the agreed up on standards in the QCA literature but still leaves questions of whether or not other influential conditions exist. The limitation of QCA is that additional conditions cannot be added without incorporating additional cases. It would be a large endeavor to expand the data set without a massive data collection effort to capture the possible existence of different diffusion processes. It is

possible, but would take far longer than this dissertation would allow. Furthermore, some of these diffusion mechanisms would not exist simply due to the fact that a drone use policy does not exist in a city. Many cities without an ordinance do not discuss it and have no plans for an ordinance in the future. For now, we are left with counterfactual arguments operationalized with thought experiments.

One final note. While no direct comparison (1:1) to other metrics of model performance in the quantitative methods can be drawn, a crude analogy to an R^2 can be made. About half the variance in the data set was accounted for with the intermediate QCA solution found here. No matter the methodological approach, a model that accounts for at least half the variance is pretty good in the social sciences.

Conclusion

This study investigated the emerging technology of drones and the decision to adopt a drone use policy with a new methodological approach. The policy environment for emerging technologies like drones is complex and rife with uncertainty. The complexity must be met with an approach that can take the complexity into account. QCA fit the bill and uncovered two causal paths to drone use policy adoption. Cities with a large number of registered drone users and neighbors with a policy were necessary for policy adoption. When these necessary conditions were combined with either the absence of uncertainty or absence of mimicry, it was sufficient for policy adoption to occur. This work suggests that uncertainty plays a significant role in drone use policy. More importantly, as drones contain many of the same characteristics of emerging technologies in general, these findings provide insight into the possible causal paths for emerging technology policy adoption in the future.

CHAPTER 7

CONCLUSIONS AND DISCUSSION

Understanding the factors that affect the design and implementation of an emerging technology are important to understand. From a policy standpoint, less restriction equates to an increased potential for experiencing those risks, but a higher possibility of technological and scientific breakthroughs. More restrictions will decrease the chance of experiencing risks but at the cost of slowing down or completely stopping important advances attributed to emerging technology research. This particular conundrum is at the heart of the emerging technology debate. It is in many ways a question of ethics, where policy makers must contend with what is good or bad, or right and wrong. There is no easy way to approach these policy questions and there is no simple answer to emerging technology governance. Mandel (2009) characterized this quandary well when stating “the development and governance of such (emerging) technologies are inevitably intertwined...the challenge is how to simultaneously leverage a promising technology’s anticipated benefits while guarding against its potential risks.”

Mandel goes on to describe one of the primary motivations for this study; to document how policy makers deal with the low amount of information when determining how emerging technologies should be regulated. Generally speaking, this study identified two main areas of uncertainty. The first was an inability to accurately determine how a technology will be used, where it will be applied, and who will be using it. The second was not having enough information about what steps could be taken by cities to regulate the use of drones and how to enforce regulation once they were in place. Drones, which are often referred to in the traditional emerging technology sense (Rao, Gopi, & Maione, 2016), are

now at the point where many policy makers are having to grapple with these questions of uncertainty. Their use continues to increase and as it does the potential for incidents also increases. Furthermore, they are increasing most rapidly in heavily in dense urban areas although it seems that for now, even though the number of registered drones has increased dramatically over the past 5 years it is still relatively uncommon to see them hovering overhead. But that is not to say they are absent. As more individuals become aware of drones, any interaction will have a strong impact on the perceived risks and benefits of their wider use. Thus, the study of drones is a timely opportunity to observe how the uncertainty surrounding their use impacts the decision to regulate.

At the beginning of this dissertation was an outline of the research questions and the approaches taken to answer them. To that extent, this dissertation has succeed in answering and at the same time, provides some useful insights to local policy innovation for a highly salient policy topic. To reiterate, the main question of interest was: *what leads to drone use policy adoption?* In order to answer this question this dissertation began be determining what it was about drones that not only ignited local policy discussion to begin, but also what the tentative policies needed to address. Having identified these concerns there was a question of why, given all these concerns that seemed to be widely shared across cities within the same region, did some cities choose to adopt policies while others did not.

To address the second part, this dissertation leveraged theories of policy innovation which suggest that a mix of policy diffusion processes and characteristics internal to a city are influential. With the low information environment that cities were working in they had to gain a better understanding of drones and the proper way to regulate them. For this, cities took different approaches to information gathering which differentiated the policy adopters

from the non-adopters. Adopters looked to other cities to gain information about the form that the policies should take. They were less concerned about whether or not the policy would be preempted because there was an understanding that the policy could be revisited as the FAA clarified their policy guidelines. Non-adopters were more concerned about gaining evidence about the success of the policy. That is, several of the non-adopters chose to defer any policy decision until there were concrete examples of a policy being successful.

Interestingly, when discussing success there seemed to be two different types. There was success in that the policy would do what it was intended to do by limiting drone use in the city and then there was a second definition of success that was based on whether the policy would not be preempted if it was challenged in court. Non-adopters were more interested in observing success while adopters were more willing to adopt and subsequently change it as needed.

Given the documented association between uncertainty and emerging technologies the explicit reference to uncertainty was expected, especially in terms of uncertainty regarding the operation of drones. There was one area of uncertainty that was not expected when first starting the analysis—the uncertainty about the role cities played in the regulation of drone use. It was the *most* frequently referenced area of uncertainty in the data and came from the policy environment itself. Having performed the analysis and now knowing the policy situation, this aspect of uncertainty is understandable. The adopters and non-adopters responded to uncertainty differently. That is, uncertainty was explicitly recognized in at least half of the cities reviewed and supported two different policy responses. It was either a reason to adopt a policy (Beverly Hills) or not adopt a policy (Newport Beach). Another interesting finding was that the role that the problem had on the ultimate decision to adopt.

Across the non-adopting cities, half noted the existence of a problem while the other half did not and a similar result was identified for the adopting cities. Thus, the acknowledgement of uncertainty, the existence (or absence) of a problem, and active information gathering were not by themselves able to explain the patterns of adopting and non-adopting across these cities.

It was the complex mix of uncertainty, internal determinants, and diffusion mechanisms that supported the third approach to analysis taken in this dissertation—determining what configuration of factors combine to cause a city to adopt a drone use policy. More specifically, this study used qualitative comparative methods to determine the configuration of uncertainty, diffusion, and internal determinants cause policy adoption to occur. The results showed that having a large number of registered drones in a city, combined with having neighbors that have a policy, are necessary for drone use policy adoption. However, when these are combined with the absence of uncertainty or the absence of emulation/mimicry it forms a sufficient causal path to policy adoption. This finding suggests that uncertainty is an important piece of the policy puzzle. It also confirms what we might expect in this situation and is reassuring since it also suggests that cities with a drone use policy are gathering information to educate themselves on how to adequately regulate drones use. However, the existence of problem as a necessary part of the causal path may indicate that cities are responding to drones in a reactionary manner. Cities are waiting until drones are problem before any policy action is taken.

In order to avoid overly restrictive reactionary policies, policy makers should attempt to create regulations in anticipation of how a technology will be used in the future. But what should be the approach to policy when not enough is known about the future uses of an

emerging technology? This analysis showed that there are a few strategies already taking place but differ depending on four key factors. As society inches closer to a future where cars drive themselves, digital assistants control our houses, and drones deliver our Amazon packages, it is important to consider these conditions that promote policy adoption. In doing so we can work to address the ethical and practical concerns while minimizing regulation that is “tenaciously resistant to change, even as scientific information and the technology advances” (Mandel, 2009, p. 3).

This study analyzed theories of policy innovation using an approach that has yet to be explicitly used in this area of research and for a policy context that has not been addressed in the literature. Drones are an increasingly common technology with an active regulatory environment. Since the 2012 FAA reauthorization act, the regulation of drones has changed at least three times. The amorphous policy situation creates a rather uncertain policy situation for a technology that many are unfamiliar with (Nelson et al., 2019). Despite the lack of clear guidance until very recently, cities all over the country have been crafting policy to deal with their use. The findings from this study have implications for understanding how these policies may develop in the future.

An Approach to Drone Governance

Along with theoretically and practically derived diffusion mechanisms and internal determinants, the absence of uncertainty was part of a sufficient condition for drone use policy adoption. More specifically, this study identified two causal paths to drone use policy adoption. The first was the absence of uncertainty, a large number of registered drones in the city, and the existence of bordering cities with drone use policies. The second was the

absence of emulation, a large number of registered drones, and neighbors with a drone use policy.

But before any policy decision are made there is usually some sort of catalyst that begins the policy debate. The report by the Orange County Grand Jury, focusing events like a harmful crash in Pasadena, or a noticeable increase in the number of drones being used placed the topic of drone use policy on the agenda. Once on the agenda, cities needed to identify what any sort of drone policy would need to cover. This dissertation identified trust as the ethical concern that both the city council and the public saw as needing to increase through a potential policy. Trust was implicitly mentioned through several of the identified concerns. The content analysis confirmed that many of the concerns regarding drone use match what other research in different parts of the country have also found. Privacy and safety concerns topped the list of concerns followed by enforceability, the use of drones to aide in committing crime, nuisance, and professionalism. Privacy and safety concerns are not surprising as they have been discussed *ad nauseam* for decades (Reiman, 1976; Westin, 1968). Yet, it seems to always reemerge with the development of new technologies that force us to reconsider what privacy actually means. Drones have re-ignited this debate where we must now determine what constitutes a reasonable expectation of privacy.

The results of this dissertations have at least two policy implications for drone use policy going forward. First, it has documented what individuals are most concerned about in regards to broader drone use for recreation and commercial uses. These concerns are likely to be transferable to other cities and can help guide future policy frameworks. The biggest concern underlying these discussions was trust. The public needs to feel like they can trust that policies will deter errant drone operators and if not, that they can trust the policies to be

enforceable. An important consideration is that policy makers can address the identified concerns using extant ethical policies. For example, local privacy and trespass laws can be extended to include the use of drones, crimes such as burglary or spying, can be dealt with through criminal law, and nuisance ordinances (auditory, sight, etc.) can be modified to also include the use of drones. Of course, there will still be exceptions, especially as it relates to critical infrastructure, interfering with emergency services, or specific time and place restrictions, but the majority of drone use related to ethical concerns should be able to be addressed with existing policies.

Second, the results of this study indicate that cities are not creating drone use policy in anticipation of future consequences. Instead, they are waiting until there is a significant enough problem (measured as number of registered drones) before policy is created. This leaves open the possibility of overly restrictive reactionary regulations. Reactionary policies are generally less flexible after they have been adopted and can limit the future potential of drone technology development. Many scholars have stressed the importance of avoiding this approach. As an alternative, cities should begin by addressing drone use through existing ethical policies and do so in anticipation of increased drone use. Many would agree that it is better to begin with less restrictive policies and then make them more restrictive if need be, rather than starting with the most restrictive and trying to work backwards.

What Drives the Spread of Emerging Technology Policy Adoption?

This study used theories from policy innovation to guide the analysis of how drone use policy transfers from one city to another within the study region. Although recent literature tends to downplay the role of spatial proximity in policy adoption, it was the most frequently identified diffusion mechanism in the data. However it was not mutually

exclusive. Most often, spatial proximity acted as a facilitator for policy learning. Cities were learning from one another and doing so by looking to those cities around them that had already adopted a policy. Both the content analysis and the QCA identified regional influence as an important part of the causal path towards drone use policy adoption. Other data suggested that cities were cognizant of creating a heterogeneous policy landscape. Because of a neighbor's policy activity several cities felt they should adopt a drone use ordinance to avoid a "patchwork" of regulation in the region. This makes sense when considering the novelty and wide applicability of emerging technologies that are easily obtained by the general public. One implication of this findings is that cities within the same region may indeed try to achieve some consistency by adopting a policy if their neighbors have also adopted a policy. As far as emerging technologies are concerned, the spread of policies may be partly explained through geographic coincidence rather than other diffusion mechanisms. This is one avenue for potential future research that can strengthen theories of policy innovation for future emerging technologies.

One of the important contributions of this dissertation was the analysis of both adopters and non-adopters, thus avoiding the pro-innovation bias that often plagues policy innovation studies. By considering both, this dissertation was able to investigate what factors contributed to adoption or non-adoption of a drone policy after it was placed on the policy agenda. There was evidence that both adopters and non-adopters were actively learning about drone use policies, but the desire to learn about potential policies by observing success was more apparent in the non-adopting cities. As a consequence of the novelty of drone use there were limited examples of success and therefore those cities decided to defer policy decisions until after success could be observed. Success, broadly defined, is important for

these cities to consider and was defined in two distinct ways. There was the success of a policy in being able to achieve what it was designed to do and success as being able to be upheld if challenged in court. The latter is likely unique to local municipalities who face more possibilities of preemption. Adopting cities were less concerned about seeing policy success and were more willing to adopt a policy with the understanding that it could be modified at a later date. This understanding supported many of the adopting cities decisions to go ahead with a policy.

Adopting a policy as a symbolic gesture was referred to as emulation in this analysis. It was another diffusion mechanism identified in the QCA but it was its absence that was part of the sufficient causal path to emerging technology policy. The expectation at the onset was that the presence of emulation would be common due to the lack of information that cities had regarding the policy environment and operation of drones. It is interesting that the sufficient causal path to policy adoption included the *absence* of emulation when combined with the presence of neighbors with a policy and a large number of registered drone users. What this alludes to is that those cities who are adopting a drone ordinance are doing so in response to a need for it and when the cities can learn from their neighbors. The active information gathering from neighboring cities may mean that the drone use policies are similar between cities but that they are actively adapting them to fit the needs of their city. The absence of emulation also makes sense in light of the findings from the content analysis. Emulation as a form of symbolic adoption was identified when cities responded to the OCGJ report by adopting the Los Angeles policy without any indication that learning was taking place. It was a symbolic gesture to appease the request of the OCGJ and was not necessarily in response to a city having a problem. Therefore, if a city had a problem it was

more likely that they would make a concerted effort to learn about what could be done, rather than simply copy some other cities policy without regard for what it needed to achieve.

In the future, as the FAA continues to clear up the guidelines for how drones should be regulated, it would not be surprising to see emulation increase. There will of course be some amount of information seeking by those interested in adopting a policy. However, if a clear policy has already been written by the FAA with the added possibility of preemption lurking in the background, cities may feel that their hands are tied when it comes to local regulation and thus adopt the provided policy frameworks as is.

An indication that drones were a problem was the most frequently identified reason why a drone policy needed to be adopted, but the presence of a problem did not always result in policy adoption. Some of the non-adopters were discussing the severity of the problem or anticipating a problem to exist in the future. As it turns out, severity of the problem needs to be realized in an environment of low uncertainty for a policy to result. Other notable internal determinants from the content analysis were the existence of prominent land features, economic considerations, and socio-demographics of the residents but were not found nearly as frequently as having a problem. As previously mentioned, this finding points to the possibility that cities are waiting until they experienced a problem before they choose to regulate, but the absence of both uncertainty and emulation in the causal paths indicates that adopting cities are actively seeking out information to reduce their uncertainty. Vertical (state to city) and horizontal (city to city) coordination of governments for policy on emerging technologies should help remove some of the uncertainty in the policy process and support a more homogeneous regional policy landscape.

The Role of Uncertainty in Policy Adoption Decisions

Uncertainty was a main focus and finding in this research. Uncertainty was defined as not having enough information about drones to make a definitive decision about their regulation. The methodological approach explicitly considered uncertainty as part of the policy adoption decision because it was found to be an influential factor in the policy decision process. The study measured uncertainty by identifying when it was explicitly referenced during the city council discussions and subsequently included it as part of the causal chain. Its influence was measured through qualitative comparative analysis.

The finding underscores the importance of having a clear policy framework for emerging technologies at all levels of government but also that uncertainty surrounding a policy topic is associated with different policy outcomes. Many of the cities reviewed here responded to uncertainty by conducting an active information search. Both adopters and non-adopters described actively seeking out information to improve their understanding of drones and what could be done to regulate their use. However, the combination of uncertainty with other factors changed the final policy adoption decision. The content analysis revealed that non-adopting cities were more concerned about the lack of information regarding the possibility of preemption. When this type of uncertainty was combined with minimal evidence of a drone problem the non-adopting cities chose to wait until more information could be gathered regarding drones which led to a final non-adopting decision. On the other hand, adopting cities also acknowledged the unclear regulatory environments but given the existence of a problem and willingness to continue to revise the policy as necessary, decided to adopt regulations.

Both the content analysis and the QCA revealed the importance of regional influences. The content analysis showed that regional influence was often combined with learning. The QCA determined that having neighbors with a policy is necessary for a city to adopt a drone use policy. Together this underscores the importance of regional diffusion for the movement of policies across a region. It enhances learning which will help increase a cities confidence in their policy adoption decision.

The hyper local nature of drones combined with a lack of clarity in how they can be regulated and the possibility of preemption was a major deterrent for non-adoption cities. To reduce this in the future, the FAA (or any federal regulatory body) should recognize where the use of emerging technologies will have the most impact. Policies for emerging technologies those that have a strongly localized presence should come with clearly defined roles that each level of government plays in the regulatory process. As far as drones are concerned, some of this has already been done since this data was collected. Yet the damage may already be done, as the uncertainty of the policy environment early on fueled the development of a highly fragmented regional policy landscape.

Somewhat ironically, the FAA has routinely communicated the want to avoid a patchwork of regulation across regions (Huerta, 2017). In performing this study it became strikingly apparent that a patchwork of regulation is exactly what is happening in Southern California. The results highlight several ways to avoid perpetuating this going forward. First, while the number of drone users varies drastically from city to city, a drone use policy at the county level will reduce the burden and remove some of the uncertainty of local drone use policies. Second, the findings from this study suggest that cities are creating policies that are tailored to their specific needs. That is, there is an absence of emulation/mimicry among

those cities who have adopted drone use policies. To this extent, it is recommended that cities begin the policy process by exploring the adequacy of applying existing local policies to drone use. As most of the ethical concerns regarding drone use are not necessarily unique, the ethical policies that already exist can likely be extended to cover the use of drones. By including drones use in existing policies it will be easier for operators to understand what is and is not permitted as they travel to different locations to use their drones. Many cities that have adopted specific drone use policies have made their violations a misdemeanor. It would be unfortunate if a youth received a Christmas present and unknowingly flew their drone in an unfamiliar area which resulted in a ticket or a fine. Clear guidelines across all cities could help avoid this situation.

An Alternative Approach to Policy Innovation Research

In an effort to address the complexity involved in the policy process this dissertation applied a method that is designed specifically for such a situation. QCA has increased in use over the past decade to address questions in comparative politics and case based research. The approach is well suited for a topic like policy innovation where several theoretical models are brought together and the effects of each are difficult to isolate. As demonstrated here, the QCA approach identified the presence of possible interactions across different sets of conditions. The findings identified two causal paths to emerging technology policy adoption as well as theoretical support for theories of policy innovation. More generally, these findings and the approach serve as a starting point for research on emerging technology policy innovation in the future. By identifying the factors that are associated with an outcome of interest across many cases, future researchers can achieve better support for theoretical arguments in other models. Combining the results of QCA with regression based

research allows researchers to qualitatively address how these factors combine while also determining the independent effects that each of them have on policy adoption decisions.

The majority of previous policy innovation studies have been conducted at the state level while the focus of this dissertation has been on the local level. It sought to explain the adoption of drone use policy using theories of policy innovation as a conceptual guide. The data was derived *in situ* through media of city council meetings. The content analysis uncovered a considerable amount of complexity as well as the presence of multiple types of diffusion and internal determinants that were found to be influential for policy adoption decisions. The complexity was addressed using QCA which, after several iterations of analysis, found two sufficient causal paths and two INUS conditions. They suggest that uncertainty plays a role in policy decisions. More specifically, it is a lack of uncertainty that supports policy adoption when combined with having a problem, and having neighbors to learn from. For a topic as uncertain as emerging technologies this is important to consider going forward. Not regulating emerging technologies leaves open the door to unforeseen consequences and a reactionary response that results in overly restrictive policies. Thus, as we move towards a future where more emerging technologies like drones are disseminated widely into local urban environments, it is critical to take steps to limit uncertainty in the policy process. This will help create a more homogeneous policy landscape across regions and decrease the potential for knee-jerk reactions to the deleterious effects of increased emerging technology use.

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APPENDIX A
INTERVIEW PROTOCOL

1. What was your role (if any) in the development of the drone ordinance in your city?
2. Why was a drone ordinance brought to the attention of the city council? Why did the city council feel that a drone ordinance was necessary?
3. Why do you believe that the idea for a drone ordinance emerged in your city when it did?
4. Can you tell me about the first time you heard about the idea of a drone ordinance from your own city council or elsewhere?
5. Are you familiar with the drone ordinances in surrounding cities? If so, how did you find out about them?
6. In your opinion, did the information about the ordinances in other cities influence your thinking about an ordinance in your city? In what ways?
7. Was there a specific working group tasked with researching how to create and implement a drone ordinance?
8. Did the state or federal level drone rules and regulations play a role in the development and decision to adopt a drone ordinance?
9. Who were the proponents of the drone ordinance prior to and during its adoption? Why do you think s/he/they supported the ordinance at the time? In what ways did they build support for the ordinance's adoption?
10. Did any city council members oppose the ordinance and why? Did they change their mind during discussion and if so, what was the reasoning for them to change their mind?

APPENDIX B

CODING PROTOCOL USE FOR THE CONTENT ANALYSIS

Category	Code	Definition
Diffusion	competition	Policy to reduce the potential for drone use spillover
	emulation	Copying as a symbolic gesture towards regional leaders. No evidence of active information search
	group membership	Regional professional organization or regional member provided information on policy options
	leader	1)Reference to a leader 2)reference as being a leader
	learning	1) Reference to active information gathering for policy 2) delay policy until observation of success is obtained
	non-regional communication	Reference to drone policy of cities outside of the region
	regional communication	Communication between cities within the same county
	regional influence	Reference to neighbors or proximity to adopters as source of policy information or policy decision support
Internal Determinant	council support	No objection to having a policy by any council member
	economics	Reference to economic potential of drones
	land features	Sensitive features that need protection from drone use
	municipal resources	City time/cost/personnel as a factor in adoption
	policy expert - in support of regulation	Non city employee supports regulation
	policy expert-against ordinance	Non city employee opposes regulation
	drone prevalence	Large number of drones observed
	public support	Public comment shows support
	problem	Anecdotes for crashes/incidents/police report
	socio-demographics	Population characteristics require regulating drones
Uncertainty	operation	Unfamiliar with how drones operate
	polices (oppose regulation)	Unsure of jurisdiction between governments
	policies (in support)	Unsure of jurisdiction between governments
Concerns of Use	nuisance	Visual/auditory burden
	privacy	Reference to privacy violation
	safety	Reference to safety violation
	crime	Use of drone to commit crime
	enforcement	Concerned about ability to enforce
	professionalism	Regulation spillover to commercial users
Problem Misc.	problem Anticipation	Increase in drones presents future problem
	significance of problem: not a problem	Not a problem in cities
Enforcement	compliance	Reference to getting compliance through enforcement

	federal rules conflict	Enforcement of policy would conflict with federal rules
	mechanism	Type of enforcement to adopt
	of policy (against regulation)	Enforcement of policy would be difficult operationally
	of policy (in support)	Policies that law enforcement could enforcement without difficulty
	of policy (uncertainty)	Unsure if enforcement would hold up in court

APPENDIX C

THE NUMBER OF RECREATIONAL (PART 107) AND COMMERCIAL DRONE
OPERATORS (SECTION 336) IN EACH INCORPORATED CITY IN LOS ANGELES
AND ORANGE COUNTY.

City	Section 336	Part 107	City	Section 336	Part 107	City	Section 336	Part 107
Agoura Hills	136	26	Hawaiian Gardens	11	1	Palmdale	413	127
Alhambra	212	55	Hawthorne	222	58	Palos Verdes Estates	71	18
Aliso Viejo	302	77	Hermosa Beach	155	46	Paramount	56	12
Anaheim	992	242	Hidden Hills	17	1	Pasadena	545	186
Arcadia	261	41	Huntington Beach	1042	233	Pico Rivera	102	14
Artesia	40	15	Huntington Park	55	3	Placentia	178	32
Azusa	121	34	Industry	3	0	Pomona	212	61
Baldwin Park	88	19	Inglewood	142	39	Rancho Palos Verdes	190	45
Bell	29	6	Irvine	1421	449	Rancho Santa Margarita	223	57
Bell Gardens	30	5	Irwindale	11	12	Redondo Beach	450	116
Bellflower	158	31	La Habra	159	33	Rolling Hills	15	0
Beverly Hills	187	42	La Habra Heights	22	10	Rolling Hills Estates	52	14
Bradbury	4	2	La Mirada	165	32	Rosemead	115	19
Brawley	40	0	La Palma	66	9	San Clemente	377	127
Brea	159	55	La Puente	158	21	San Dimas	145	33
Buena Park	253	52	La Verne	126	24	San Fernando	39	13
Burbank	554	429	Laguna Beach	164	40	San Gabriel	176	24
Calabasas	149	24	Laguna Hills	168	51	San Juan Capistrano	139	30
Carson	213	61	Laguna Niguel	405	101	San Marino	61	11
Cerritos	182	41	Laguna Woods	25	3	Santa Ana	677	124

Claremont	136	23	Lake Forest	325	74	Santa Clarita	324	113
Commerce	18	8	Lakewood	298	50	Santa Fe Springs	32	13
Compton	109	33	Lancaster	447	85	Santa Monica	486	204
Costa Mesa	528	152	Lawndale	68	21	Seal Beach	98	26
Covina	209	35	Lomita	81	45	Sierra Madre	48	22
Cudahy	16	3	Long Beach	1238	347	Signal Hill	43	16
Culver City	201	58	Los Alamitos	90	12	South Gate	92	9
Cypress	200	74	Los Angeles	5402	1818	Stanton	75	12
Dana Point	144	26	Lynwood	63	9	Temple City	107	24
Diamond Bar	206	34	Malibu	126	40	Torrance	677	189
Downey	217	56	Manhattan Beach	215	63	Tustin	337	61
El Monte	150	45	Maywood	21	3	Vernon	5	0
El Segundo	99	56	Mission Viejo	472	114	Villa Park	29	6
Fountain Valley	270	76	Monrovia	158	27	Walnut	185	50
Fullerton	462	102	Montebello	88	9	West Covina	261	52
Garden Grove	519	87	Monterey Park	167	33	West Hollywood	169	71
Gardena	172	62	Newport Beach	491	107	Westlake Village	135	31
Glendale	611	204	Norwalk	184	41	Westminster	295	38
Glendora	212	41	Orange	560	148	Whittier	413	80
						Yorba Linda	321	68

APPENDIX D

DATA TABLE FOR THE SAMPLE OF CITIES USED IN THE QCA.

City	Regional	Emulation	Rec. Registrations	Uncertainty	Ordinance
Aliso Viejo	1	0	1	1	1
Anaheim	1	1	1	0	1
Bellflower	0	0	0	0	0
Beverly Hills	1	0	1	1	1
Burbank	1	0	1	1	1
Calabasas	1	1	0	1	1
Carson	1	0	1	0	1
Dana Point	0	1	0	0	0
Garden Grove	1	0	1	0	1
Hawthorne	1	0	1	0	1
Hermosa Beach	1	0	0	1	1
Huntington Beach	0	0	1	0	0
La Habra	0	1	0	1	1
Laguna Beach	0	0	1	1	1
Laguna Niguel	1	0	1	0	0
Los Angeles	1	0	1	0	1
Manhattan Beach	1	0	1	0	1
Newport Beach	0	0	1	1	0
Palos Verdes Estates	1	1	0	1	1
Pasadena	1	0	1	0	1
Rancho Santa Margarita	0	1	1	1	0
Santa Clarita	0	0	1	1	1
West Hollywood	1	0	1	1	1
Yorba Linda	1	0	1	1	1

APPENDIX E

THE INTERMEDIATE SOLUTION FOR THE NEGATION OF AN ORDINANCE
USING THE SAME CONDITIONS THAT WERE USED IN THE ORIGINAL
ANALYSIS.

Intermediate Solution – Ordinance Negation
Uncertainty*~Regional*~Emulation/Mimicry*Problem
Raw Coverage: .375, Unique Coverage: .375, Consistency: .75
Laguna Beach, Newport Beach, Rancho Santa Margarita, Santa Clarita
Solution Coverage: .375
Solution Consistency: .75