MODELING A DECADE OF ORGANIZATIONAL CHANGE IN MUNICIPAL POLICE DEPARTMENTS: A LONGITUDINAL ANALYSIS OF TECHNICAL, ADMINISTRATIVE, AND PROGRAMMATIC INNOVATIONS

By

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Abstract

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In efforts to facilitate reforms in American Law Enforcement agencies, there has been an increasing interest among practitioners and scholars alike to better understand the causes and conditions of police organization innovation and change. There are a number of gaps in the organizational innovation research literature and existing studies have produced inconsistent and mixed findings. Most studies of police organizational change are limited due to their cross-sectional designs, and longitudinal analysis of change is lacking.

This study endeavors to contribute to our understanding of police organizational change using a panel of data compiled from several principle data sources which include the 1997, 2000, 2003, and 2007 Law Enforcement Management and Administrative Statistics surveys, the Federal Bureau of Investigation’s (FBI) 1996, 1999, 2002, and 2006 Uniform Crime reports, and the RAND Center for Population Health and Health Disparities (CPHHD) Data Core Series.
These principal data sources are used in a longitudinal research design (panel-data analysis) to test how well a variety of hypothesized factors explain three important dimensions of police organization change: technical, administrative, and programmatic innovations. These data sources are also used to test two competing perspectives of police organization innovation and change; contingency theory and organizational design theory. Contingency theory predicts that the external environment is the principal driving force behind organizational change, whereas organizational design theory predicts that police organization change and innovation is principally influenced by organizational structures and administrative processes that are largely independent of the external environment.
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Overview of Dissertation Topic

Throughout history there has been a steady societal demand for police organizations to become more accountable, efficient, and effective at their critical tasks of order maintenance and crime control. History shows that American policing officials, primarily concerned with maintaining their legitimacy in the eyes of their constituents (Miller, 1977), have undergone a number of ostensible reforms including changes in strategies, tactics, technologies, and managerial models with varying degrees of success (e.g., professionalism, team policing, community policing, problem-oriented policing, and COMPSTAT).

Advanced by reformers such as August Vollmer and O.W. Wilson and the President’s Crime Commission, the professionalism movement in American policing was widely heralded as a solution to overcoming the widespread problems of corruption and brutality endemic to policing in the 19th and early 20th century, and was further advanced as a solution to the 1960s legitimacy crisis in American policing.¹ A number

¹ In the midst of the 1960s legitimacy crisis in American policing the President’s Commission on Law Enforcement and Administration of Justice advocated that American law enforcement agencies undertake
of problems resulted from the professional policing paradigm, including public demands for increased police presence and increased police interactions with the public by means of foot patrols and other similar programs (Bittner, 1967; Trojanowicz, 1983), and the recognition that traditional patrol car centered patrols fail to reduce crime (Kelling et al., 1974). Moreover, the increasingly popular view that order maintenance is an essential police function (Wilson & Kelling, 1982; Kelling & Wilson, 1988), in time has influenced the development of a variety of “strategic innovations” in policing, including problem-oriented policing, team policing, community policing, and Compstat (Maguire et al., 1997; Braga, 2002; Willis and Mastrofski, 2011).

A number of studies of American policing show that police organizations vary substantially in their capacity to successfully adapt to the change, leading to a growing interest in the topic of police organizational innovation (Langworthy, 1986; Zhao, 1996; Maguire, 1997, 2003; Mullen, 1996; King, 2000; Wilson, 2003, 2005). Damanpour and Evan defined “organizational innovation” as the adoption of a new idea, behavior, technology, or process within an organization (Damanpour & Evan, 1984; see also Damanpour, 1996). In the policing literature the term innovation is generally referred applied to the adoption of something “new to the field of policing” (King, 2000).

Policing scholars have demonstrated a growing interest in understanding why some police agencies embrace change whereas others are extremely resistant to it. This growing interest in police innovation research is evident in the substantial number of professionalism reforms in its 1967 publication titled “The Challenge of Crime in a Free Society.”
of recent studies examining (1) the determinants, (2) patterns of diffusion, and (3) systematic processes of innovation witnessed in American law enforcement organizations (Zhao, 1996; Maguire, 1997, 2003; Mullen, 1996; King, 2000; Wilson, 2005; Klinger, 2003; Weisburd & Braga, 2006; Morabito, 2007; Buruss & Giblin, 2009; Zhao, Ren, & Lovrich, 2010; Buruss, Giblin, & Schafer, 2010; Randol, 2012).

The body of research that examines organization innovation in police departments remains in its relative infancy (Bayley, 2008); unfortunately, to date research in this area has “not yielded a complete understanding of why some departments are more innovative than others” (King, 2000, p. 303). According to Willis and Mastrofski (2011), police research “would benefit from going to greater lengths to specify the intrinsic characteristics of the innovations under investigation on dimensions that are informed by organizational innovation theory” (p.315).

There are a number of gaps in the organizational innovation literature. Most studies of police organizational change are limited due to their cross-sectional designs, and longitudinal analysis of change is lacking. There are competing explanations for police departmental change that have not been systematically compared. Also, existing studies have produced mixed and inconclusive findings. King (1999) refers to this status of the policing innovation research literature as an “empirical morass.” This dissertation endeavors to answer to Willis and Mastrofski’s (2011) calling for researchers to go to these greater lengths to improve our understanding of why some police departments are more innovative and adaptive than others.
Purpose of Dissertation

Theories of organizational innovation and change are important because a police organization’s capacity to innovate is a necessary precondition for the adoption and utilization of a new practice, technology, tactic or strategy (e.g., legal and administrative standards, mobile data terminals, personnel policy, community policing, hot spot policing). Considering the general consensus in the policing literature that police departments are resistance to externally driven change (Greene, 2000; Manning, 1997, 2008; Ikerd & Walker 2010), theories of organizational innovation may assist policing scholars in understanding which police agencies have the greatest capacity for change and why. Additionally, organizational innovation theory may assist policing scholars in addressing a number of important questions related to such capacity for change: What organizational types are most conducive to policing innovations and why? Under what conditions are police agencies most innovative and successful at implementing reforms? Are innovations in police organizations the result of internal or external drivers of change? Is the inclination of an organization to change constant across agencies or do the causes and conditions of innovation differ according to the type, nature, and circumstances surrounding the innovation?

This dissertation study seeks to contribute to the field’s incomplete understanding of why some organizations change whereas others do not by using a variety of data
sources. This study will empirically test two developing areas of policing innovation theory which include *organizational design theory* and *contingency theory*. Organizational design theory posits that the internal structures and the administrative practices of an organizational are the drivers and/or inhibitors of change. Contrarily, contingency theory posits that changing political, social, and socio-economic conditions external to an organization are the principal drivers of change. Furthermore, this study tests the efficacy that these two competing theories of innovation have in explaining three types of innovations in police departments; *technical, administrative,* and *programmatic innovations*. Technical innovations change the equipment or hardware used within an organization to produce a product or service (e.g., information technology), whereas administrative innovations change the management of an organization (e.g., changes in personnel management), and programmatic innovations establish new units within an organization (e.g., development of a crime analysis unit) (King, 2000; Willis & Mastrofski, 2011).

The following section of this chapter provides an introduction to the organizational design theory and contingency theory frameworks. The proceeding section of this chapter outlines the research questions and explains more specifically the research gaps that are addressed in this study. The final section of this chapter outlines specific steps that will be taken to address each of the research questions.

**Theories of Organization Innovation**
Theories of organizational innovation and change provide useful insight into a police organization’s capacity to innovate; openness to a new idea is a precondition for the adoption of new technologies and the effective utilization of new policing strategies and tactics (e.g., community policing, problem-oriented policing). Considering the general consensus in the policing literature that police departments tend to be highly resistant to externally demanded change (Greene, 2000; Manning, 1997, 2008; Ikerd & Walker, 2010), theories of organizational innovation can help scholars of policing understand which police agencies have the greatest capacity for change, and why this is the case.

Studies that evaluate the relationship between the internal features of a police department and innovative organizational changes follow the tradition of organizational design theory which was developed in the field of public administration (Lam, 2004). Organizational design theory presumes that factors endogenous to an organization including organizational structure and administration such as the degree of specialization, hierarchical ranks in the organization, degree of centralization, degree of formalization, and standards of professionalism (just to name a few) may facilitate or impede the capacity of an organization to be innovative. When organizational design theory developed within the field of public administration it was predicated on the notion that there is ‘one best way’ to design and structure an organization; this belief had a substantial impact on the progressive reform movement in American government, as well as on the professionalism movement in American policing.
The goal of progressive reformers to find an optimal organizational structure was later seriously challenged by contingency theorists, who hypothesized that organizational structures, innovations, and degrees of effectiveness at accomplishing objectives are greatly influenced by the organization’s environment and not necessarily by the rational decisions of organizational leaders. It is clear that there is no one best way to structure an organization, and that the best or most appropriate organizational design is contingent upon the organization's operating contingencies, which include the environment in which it must operate within (Burns and Stalker, 1961), the technology it uses (Woodward, 1965; Perrow, 1970), and the scale of operation it maintains (Blau, 1970).

The theoretical conflict between the perspectives of organizational design theory (posits internal drivers of change) and contingency theory (posits external drivers of change) has been salient in the field of public administration for several decades (Downs & Mohr, 1976; Wolfe, 1994; Lam, 2004). In recent decade this same conflict has emerged in police studies of organizational innovation and change (Zhao, 1996; Mullen, 1996; King, 1998). For instance, studies conducted by Mullen (1996) and King (1998) both concluded that organizational innovations in policing were primarily due to internal departmental factors. Alternatively, Zhao (1995) concluded that community policing innovations in local police departments were primarily the result of external environmental factors.

To date the literature provides no clear indications as to whether internal or external factors are principally responsible for policing innovations. This study
endeavors to contribute to the field’s incomplete understanding of the determinants of policing innovation and clarify the open question as to whether internal or external factors drive police organizational change by empirically testing the relative efficacy that both organizational design theory (internal drivers of change) and contingency theory (external drivers of change) have in predicting three types of policing innovations including technical, administrative, and programmatic innovations.

Research Questions

The goal of this study is to contribute to two areas of policing innovation research. This study endeavors to contribute to the stream of innovation research that focuses on the determinants of innovation by examining a number of organizational and environmental correlates of several different innovation types. Furthermore, this study seeks to contribute to the stream of innovation research that focuses on the diffusion of innovation by assessing the predictors of innovation over time. This dissertation intends to contribute to these areas of policing innovation research by addressing the following researching questions;

1. Are technical, administrative, and programmatic innovations in police organizations principally the result of internal or external drivers of change?

First, this study uses a national sample of drawn from multiple data sources to empirically test the relative efficacy of two competing explanations of police organization innovation, namely organizational design theory and contingency
theory. Organizational design theory posits that factors endogenous to an organization are the principal drivers of change whereas contingency theory contends that environmental factors external to an organization are the drivers of change. This question can also be reframed as the following question: Do the most innovative police departments follow an open or a closed systems framework? J.D. Thompson (1967) observed that open systems constantly interact with their environments, whereas closed systems are relatively more insulated from their external environments. Although a few studies have compared the relative ability that organizational design and contingency factors had in explaining innovation (Mullen, 1996; Zhao, 1996; King, 1999); to date, no known studies have used a longitudinal research design to systematically compare the relative efficacy of these competing theoretical perspectives in explaining multiple types of policing innovations.

It is reasonable to predict that the organizational design theory will do a better job overall of explaining technical, administrative, and programmatic innovations than the contingency theory because a number of policing scholars have suggested that the drivers of organizational change in police departments are more likely to be internal rather than external (Miller, 1977; Brown, 1981; Greene, 2000; Crank, 2004; Manning, 1997, 2008). A number of policing scholars have observed that police culture is highly resistant to change (Miller, 1977; Brown, 1981; Greene, 2000; Crank, 2004; Manning, 1997, 2008). Additionally, local police departments tend to be insular and relatively non-responsive to the external demands (Greene, 2000;
Crank, 2004; Manning, 1997, 2008). This relative non-responsiveness to external pressures occurs because many police executives strategically buffer themselves from the external environment (Crank, 2004). This “loose coupling” allows police managers to deal with external politics, while the rank-and-file personnel focus on the crime control functions of the police organization (Crank, 2004). Moreover, Manning (2008) observed that the adoption and uses of technology in police departments were driven by various elements of police culture. Given these observations it is reasonable to expect that internal features of police organizations including aspects of departmental complexity and control\(^2\) will be a stronger predictor of police departmental change than the externally focused predictors hypothesized by contingency theory.

2. Do the correlates of innovation differ across innovation types (i.e., technical, administrative, and programmatic)?

This study investigates three types of innovation in local police departments, including technical, administrative, and programmatic innovations. To date few studies have systematically compared the correlates of these three innovation types (King, 1999; 2000). Although there is disagreement in the research literature concerning whether internal or external factors are the best predictors of organizational innovation and change, a general consensus has emerged that the

\(^2\) Later discussed in Chapter three complexity and control are terms commonly used in the literature to refer to core features of organization structure and accountability (Maguire, 1997).
status of the innovation literature is that of a “empirical morass” (King, 2000) featuring mixed and inconclusive findings that often do not conform to expectations. Few factors have consistently emerged as being predictive of organizational change (Willis & Mastrofski, 2011). Several researchers have observed that the inconsistencies found in the literature likely result from the fact that the causes and conditions of innovation differ according to the type, nature, and circumstances surrounding the innovation. For example, after observing a number of innovation studies Damanpour (1991) concluded that the predictors of innovation differed across innovation types. Furthermore, Kimberly and Evanisko (1981) concluded that there was “no reason to expect that a given set of variables will be related to the adoption of different types of innovation in the same way” (p.710).

3. *Do the most innovative police departments have structural features characteristic of an organic organizational structure? If not do the structural features of the most innovation police departments conform to other organizational forms found in the organizational theory literature?*

Organizational theorists have identified a number of organizational forms to explain why some organizational are more innovative than others (Burns and Stalker, 1961; Mintzberg, 1979; Lam, 2004). For example, Burns and Stalker (1961) observed that organizational structures range from organic to mechanistic. Additionally they hypothesized that the most innovative organizations tend to have
relatively organic organizational structural forms. Although these typologies have been broadly applied in the field of public administration, few studies of police organizations have tested whether the most innovative police agencies conform the hypothesized organization structure archetypes.\(^3\)

4. *Are technological innovations having an impact on the horizontal structural arrangements of police departments?*

This study empirically tests whether technological innovations influence changes in police organization horizontal structure. An important dimension of contingency theory suggests that technological organizations may change organizational processes and procedures, thus having subsequent impact on the administration and structural arrangements of an organization. Given that technological innovations have had a substantial impact on police organizations in the past few decades it is reasonable to assume that technological innovations may be predictive of changes in police organization administration and horizontal structure. To date, few studies have examined the impact that innovations and environmental contingencies have on the structures and administration of police organizations (Langworthy, 1986; Maguire, 2003; Zhao, Ren, & Lovrich, 2010).

\(^3\) With the exception of Wilson’s (2003) study of community-oriented policing innovations in American law enforcement agencies no other known studies have tested whether the most innovative police departments possess either *organic* or *mechanistic* structural forms.
In the process of addressing these research questions this study uses a longitudinal research designs, descriptive and inferential statistical methods, and a variety of data sources. Data used in this study include the United States Department of Justice’s 1997, 2000, 2003, and 2007 Law Enforcement Management and Administrative Statistics (LEMAS) surveys, the Federal Bureau of Investigation’s (FBI) 1996, 1999, 2002, and 2006 Uniform Crime reports, and the RAND Center for Population Health and Health Disparities (CPHHD) Data Core Series.

Organizational Overview of Dissertation

The second chapter of this dissertation provides an overview of the literature on technological innovations in policing (used as a dependent measure for technical innovations), and also discusses the literature on community policing, which serves as an independent measure in this study.

The third chapter reviews the literature pertaining to the particular theories of organizational innovation that will be examined in this study including organizational design theory (a.k.a. innovativeness) and contingency theory, and documents the empirical status of these two theories.

The fourth chapter presents a series of testable hypotheses, provides a methodological plan for this study, features a detailed description of the methods that
are used, explains the data used and sample selection utilized, and provides a detailed description of both the dependent and independent measures.

The fifth chapter first provides a detailed descriptive analysis of each of the dependent and independent measures, and for each of the four time points evaluated in this study (i.e., 1997, 2000, 2003, and 2007). Second, this chapter discusses the methodological steps that were taken to build and diagnose the pooled cross-sectional time-series (panel data) models that are used for the multivariate analyses in this study. Last, the fifth chapter provides the results for the pooled cross-sectional time-series (panel data) multivariate analyses, which regress the dependent measures including technical, administrative, and programmatic innovations onto the predictors of organizational design and contingency theories.

The sixth chapter first provides a detailed discussion of the results of this study and explains how well the results inform each of this study’s research questions. The following section addresses the methodological limitations of this study. The final sections of Chapter Six evaluate the implications that this study’s findings have for future research in the area of policing innovation, and also examine the implications that this study’s findings have for policing policy and practice.
CHAPTER 2
CHANGE AND INNOVATION IN AMERICAN LAW ENFORCEMENT

Introduction

The overall purpose of this chapter is to provide an overview of the extant literature on technical, administrative, and programmatic innovations in American policing which are evaluated in this study. The first section of this chapter titled “Defining Innovation and Innovation Types” provides common definitions of innovation that have been used in the policing innovation literature. Given that this study differentiates between different innovation types (i.e., technical, administrative, and programmatic innovations) this section reviews how innovation has been similarly operationalized in prior studies of organizational change in American municipal police departments.

The second section titled “Technological Innovations in American Law Enforcement Agencies” provides a detailed overview of the literature on technological innovations in American policing, which is important to demonstrate the implications that this study’s empirical analysis of technological innovations has for both the development of policing innovation theory, and policing policies in the area of technological development. The final section of this chapter titled “Popular Innovations in American
Municipal Police Departments” discusses the development of *Compstat* and *Community-Oriented Policing* and explains the relevance that these popular innovations have in this study’s analyses of technical, administrative, and programmatic innovations in American municipal police departments.

**Defining Innovation and Innovation Types**

The study of innovation is a complex inter-disciplinary phenomenon, and its meaning and definition is greatly contingent upon the context in which it arises (King, 2000; Willis & Mastrofski, 2011). Given the complex nature of innovation, the literature has defined, conceptualized, and measured innovation in a variety of different ways (King, 2000). In the policing literature innovation is generally referred to as “the state of the art” or something “new to policing” (King, 2000, p. 305), which can be an idea, policy, program, practice, process, service, or product (Kimberly, 1987; Willis & Mastrofski, 2011). Scholars evaluating innovation in other organizational contexts have similarly defined innovation as the adoption of a new idea, behavior, technology, or process within an organization (Damanpour & Evan, 1984; Damanpour, 1996).

Additionally, differentiating between different types of innovations is important because it makes the results of research more accessible, meaningful, and comparable across studies (Wolfe, 1994). Following the work of Damanpour (1991) and Moore, Sparrow, and Spelman (1997), King (2000) classified organizational innovation in police departments into four distinct types: *administrative, technical, programmatic,* and *radical innovations*. Administrative innovations change the management of an organization by
restructuring the administrative apparatus in which human and financial resources are mobilized (i.e., changes in personnel management or performance measures) (King, 2000; Willis & Mastrofski, 2011). Technical innovations change the equipment or hardware used to produce a product or service (i.e., information technology, computer software or hardware, mobile data terminals). Programmatic innovations establish new units or operational responses within an organization to accomplish a new goal (i.e., development of a crime analysis unit, task force, stakeouts). Finally, radical innovations involve a massive restructuring of an organization (King, 2000). Radical innovations may also be conceptualized as “strategic innovations” that have a significant impact on an array of tasks, practices, and strategies within an organization and alter the basic policing paradigm (Weisburd & Braga, 2006; Moore et al., 1997, p.280; Willis & Mastrofski, 2011). Although radical innovations are not empirically tested in this study it is important to briefly explain what radical innovations are in order to demonstrate how they differ from the technical, administrative, and programmatic types of innovation that are empirically assessed in this study.

King (2000) performed a factor analysis of technical, administrative, programmatic, and radical innovation types and found that police innovation is a multi-dimensional concept, and concluded that it should be treated as such in further studies. This study acknowledges this fact that innovation is a multi-dimensional concept. For example this study assesses technological innovations which include agency uses of computerized crime mapping technology, technologies used for crime related file storage and dissemination, and technologies used to assist in crime control operations.
Although these uses of technology in law enforcement agencies are ostensibly technical innovations in policing, it is important to consider that in some cases these technical innovations maybe associated with broader administrative, programmatic, and strategic changes within an organization. For example the NYPD’s implementation of Compstat was a comprehensive “strategic innovation” that involved an array of simultaneous technical, administrative, and programmatic innovations (Willis & Mastrofski, 2011).

**Technological Innovations in American Law Enforcement Agencies**

This section provides a detailed overview of the literature on technological innovations in American policing which is important to demonstrate the implications that this study’s empirical analysis of technological innovations in municipal police departments has for both the development of policing innovation theory, and policing policies in the area of technological development. This section describes the significance of the broader trend of technological innovations in American policing and discusses explanations in the literature for this trend in American law enforcement. Given that agency developments in the area of crime analysis technology are assessed in this study this section describes uses of crime mapping and crime analysis technologies in municipal police departments and discusses how these technologies are used to assist in crime control operations.

In the 1990s the development of community policing and the advent of Compstat programs were widely heralded as successful and “strategic innovations” in American policing, which influenced the nationwide widespread diffusion of both programs
Several studies have examined the determinants, diffusion, and processes of community policing and Compstat innovations in police departments in the United States (U.S.) (Zhao, 1995, 1996; Wilson, 2005; Buruss & Giblin, 2009; Willis, Mastrofski, & Kochel, 2010; Willis & Mastrofski, 2011, p. 313); however, few researchers have investigated an equally prevalent and significant trend in American policing – namely, the widespread adoption of computerized technologies for a variety of operational uses including crime mapping, hot spot identification, crime analysis, criminal investigations, mobile data terminals used in the field, and information storage/dissemination systems (Travis & Hughes, 2002; Weisburd & Lum, 2005; Manning, 2008). In the past two decades the use of crime mapping technology for the geographical/spatial analysis of crime has become increasingly prevalent among both scholars and practitioners, and the adoption of computerized crime mapping technology among America’s larger police departments has been rapid and widespread (Weisburd & Lum, 2005).

There is great “bureaucratic enthusiasm” for the adoption of computer based technologies in the law enforcement industry (Ratcliffe, 2002). Policy makers, law enforcement officials, and a variety of other key professional law enforcement associations in both the United Kingdom (U.K.) and the U.S. have advocated the adoption of “data-driven,” or “intelligence-led” strategies for policing, operational strategies which rely heavily on state-of-the-art crime analysis technologies (Carter, 2004, 2008; Bureau of Justice Assistance, 2005; McGarrell et al. 2007; Ratcliffe, 2005).
In the United Kingdom (U.K.) the National Criminal Intelligence Service, which developed the U.K.’s National Intelligence Model, strongly encouraged local police department to adopt intelligence-led policing (ILP) (Ratcliffe, 2008). Similarly, in the United States the Department of Justice, the International Association of Chiefs of Police, former Secretary of the US Department of Homeland Security Tom Ridge, and a variety of other key professional law enforcement associations have advocated the adoption of data-driven strategies employing state of the art crime analysis technologies (Carter, 2004, 2008; Bureau of Justice Assistance, 2005; McGarrell et al. 2007; Ratcliffe, 2005). Domestic and international recommendations to adopt technological infrastructure are not only encouraged to prevent and control crime at the local level, but are also advocated to improve the overall capacity of law enforcement agencies at all jurisdictions of government (local, state, federal, and international), to gather and share intelligence data concerning terrorism and a variety of other crime related issues (McGarrell et al. 2007). Accompanied by the growth of a “risk society,” law enforcement agencies have increasingly adopted crime analysis and information technologies to accommodate growing security and knowledge needs emanating from both internal and external sources (Ratcliffe, 2002).

There is a general consensus in the extant literature that the technological trend in policing is growing (Willis, Mastrofski, & Weisburd, 2007; Carter, 2008; Maguire, 2000; Ratcliffe, 2002). Technological innovations particularly the growth in information gathering and analysis technologies within local police agencies is greatly fueled by this demand to collect risk-related information. Ratcliffe (2002) observed that in our modern
“risk society” police agencies are the primary collectors and providers of risk-related information for sources external to the policing organization. Subsequent to the events of the 9-11 terrorist attacks local police agencies are increasingly expected to collect and share intelligence information with state and federal agencies, and with regional fusion centers. Furthermore, local police agencies have been mandated\(^4\) to collect and report uniform crime reports to the Federal Bureau of Investigation (FBI) for decades, and some have chosen to adopt the more comprehensive requirements of the NIBRS process.\(^5\) The increasing reliance of local law enforcement agencies on computers has had the effect of increasing the demands for police time to collect data, which has also expanded the range of data that they collect (Ratcliffe, 2002). After being delegated the role of being among the central gatekeepers of risk-related information many local law enforcement agencies have responded by keeping as much information as possible irrespective of its importance just in case it becomes needed (Ratcliffe, 2002; Ericson and Haggerty, 1997).

It is clear that in the past two decades the adoption of computerized technologies has been a significant innovation in policing. There are a variety of explanations for these technological trends in the policing literature including; (1) the influence of evaluation studies that have demonstrated the potential benefits that crime mapping

\(^4\) Although local police departments have been mandated to report data pertaining to crime incidents it is important to note that not all police departments fully report this information.

\(^5\) The FBI’s National Incident Based Response System (NIBRS) is a comprehensive incident based reporting system for crimes known to law enforcement authorities. The system collects and reports a variety of data pertaining to crime incidents brought to the attention of law enforcement authorities including data pertaining to the nature and types of the particular offenses in the incident, characteristics of the offender(s), victim(s), information pertaining to the property stolen, damaged, or recovered, and the characteristics of suspects arrested in connection to the crime incident (ICPSR, 2013).
and hot spot policing approaches offer to police executives (Weisburd & Lum, 2005); (2) the recommendations of policy makers and professional associations that encourage police executives to innovate technologically (i.e., The International Association of Chiefs of Police, The Police Executive research Forum, and The National Sheriff’s Association) (Ratcliffe, 2008; Willis & Mastrofski, 2011); (3) external pressures for police agencies to become more effective at crime control, a desire among police departments to increase their legitimacy in the eyes of a skeptical public (Willis, Mastrofski, & Wiesburd, 2007; Willis & Mastrofski, 2011); and (4) the initiatives taken by key organizational actors to adopt newer technologies (Henry, 2002; Willis, Mastrofski, & Weisburd, 2004; Manning, 2008).

Despite these explanations, missing from the literature is a complete understanding of why some agencies chose to adopt the newest technologies whereas others do not. To date few studies have examined the determinants of technological innovations in municipal police departments (Mullen, 1996; Travis & Hughes, 2002; Weisburd & Lum, 2005; Manning, 2008). Research that examines the determinants, diffusion, and processes of technological innovations can potentially have valuable policy implications or “strategic implications” for policing officials and practitioners (Willis & Mastrofski, 2011, p. 323). Additionally important, viewing the adoption of technologies as technical innovations in police departments, studies of technological innovations may contribute to the broader literature on police organization innovation.

*Technology and the Crime Analysis Process*
Given that agency developments in several areas of computerized crime analysis technology are assessed in this study, this section defines and describes in detail the process of crime analysis and discusses how police agency uses of computerized crime mapping and crime analysis technologies are intended to assist in crime analysis functions.

As a preventative and proactive approach to crime control, crime analysis was heavily influenced by the principles of problem-oriented policing (Goldstein, 1979; Braga, 2002). Ratcliffe (2008) defines crime analysis as “the systematic study of crime and disorder problems as well as other police-related issues; including, socio-demographic, spatial, and temporal factors, to assist the police in crime apprehension, crime and disorder reduction, crime prevention, and evaluation” (p.93). Gottlieb et al. (1998) defined crime analysis as the systematic study and analysis of crime-related processes aimed at providing timely and relevant information concerning crime-related trends and patterns to assist police commanders and administrative personnel in preventing and suppressing crime, prioritizing investigative processes, and to improve clearance rates. Carter (2008) defines crime analysis as a process of assessing the correlates of crimes that have occurred in order to uncover “perpetrator methodologies,” with the intention of clearing crimes and preventing future incidents through the apprehension of repeat offenders. The process of crime analysis is largely “incident driven,” relies on the analysis of crime incidents, and reported crime data, and uses crime mapping, incident analysis, and other forms of analysis to identify crime sprees, incident trends, and “perpetrator methodologies” of the specific offenders who are
driving these trends (Carter, 2008). According to Cope (2004), there is a theoretical division between two distinct types of crime analysis, *operational* and *strategic*. Operational crime analysis focuses primarily on the identification of crime-related problems for the purpose of changing operational tactics and directing tactical responses such as emphasis patrols or high visibility patrols. Strategic crime analysis alternatively focuses on the more detailed and longer term analysis of crime patterns, trends, and forecasts, and seeks to determine the underlying causes of crime patterns in order to develop longer-term strategic interventions.

Arguably, technological advances in crime analysis technology over the past few decades have contributed to a prevalent societal schema that views technology as playing a central role in the crime analysis process (i.e., technological influence has been mystified and glamorized in popular media including CSI, NCIS, Law & Order, and Enemy of the State). Contrary to this inaccurate schema that myopically focuses on the influence of technology, the crime analysts plays a central role in the crime analysis process and technology is merely a tool that is used to facilitate this process. The actual role that technology plays in this process and the extent in which technology increases the efficiency and effectiveness of crime analysis processes are important empirical questions that remain largely unaddressed in the literature with the exception of a few studies that will be discussed in coming pages (Travis & Hughes, 2002; Weisburd & Lum, 2005; Manning, 2008).

Clarke and Eck (2005) defined the crime analyst as a local crime expert who employs principles of environmental criminology, conducts in depth analyzes, and
applies principles of problem-oriented policing, identifies solutions, reports information to police leaders, and evaluates the outcomes of the crime analysis process on a continuous basis. Alternatively, Cope (2004) defines the ‘crime analysts’ as “information translators, whose role is to provide reliable intelligence in a practical and operational format” (p.188).

Crime analysis resources within police organizations include the development of specialized crime analysis units, trained crime analysts (human capital), and use of computer-based crime analysis technology. Computer-based crime analysis technologies include the use of computers for crime analysis, criminal investigations, crime mapping, and hotspot identification. Police agencies use a range of computer software to assist in crime analysis practices including Microsoft Office Excel and Access programs for “generic–data handling,” collection and storage, software such as ‘Watson’ and ‘Analyst’s Notebook’ are used to assist in criminal investigations, and Geographical Information System (GIS) software such ‘MapInfo,’ ‘Crimstat,’ ‘Geoda,’ and ‘ArcGis’ are used for crime mapping and hot spot identification.

It is important to distinguish the difference between crime analysis technological innovations and other information technology innovations in police departments. Crime analysis technologies include software used to assist in crime analysis, criminal investigations, crime mapping, and hotspot identification activities, whereas information technology infrastructure includes hardware and software used to improve the efficiency and effectiveness of police operations such as administrative functions, service delivery, information processing and data management, and human resource management (Rao,
Information technology improves the administrative operations of police departments by allowing the digitalization of files which improves record keeping and access, supports the automation of various functions that would otherwise be labor intensive, provides easily accessible information to officers in the field, and streamlines a number of managerial functions such as personnel management, inventory of equipment, manpower allocation, and fleet management (Nunn, 2001).

Few studies in the extant literature study the capacity of law enforcement agencies to effectively use crime analysis technology per se, but a number of evaluation studies have shown that the use of problem-oriented policing and COMPSTAT, which both utilize crime analysis, have been effective at reducing crime in many cases (Braga, 2002; Kennedy, 1993; Braga et al. 1999; Eck and Spellman, 1987; Kennedy et al, 1996; Braga et al., 2001). In recent years a number of police departments have taken steps to develop comprehensive proactive crime prevention strategies using Herman Goldstein’s (1979) principles of problem-oriented policing (POP). Goldstein defines the problem-solving process as the following:

Identifying problems in more precise terms, researching each problem, documenting the nature of the current police response, assessing its adequacy and the adequacy of existing authority and resources, engaging in a broad exploration of alternatives, and choosing among them (Goldstein, 1979, pg. 236).
Since the publication of Goldstein’s POP a number of police departments have experimented with the principles of POP and evaluation research suggests that POP is an effective tactic for dealing with a wide range of crime problems, including street-level drug markets (Kennedy, 1993), violent crime and hot spots (Braga et al., 1999), theft and burglary (Eck and Spellman, 1987), and firearm-related homicides (Kennedy et al., 1996; Braga et al., 2001). Furthermore, COMPSTAT, which is a technologically-based managerial process that combines state-of-art management principles with cutting-edge crime analysis technologies (Willis, Mastrofski, & Weisburd, 2007), has been adopted with alacrity amongst the largest police organizations in the U.S. and there is a growing body of research that shows that COMPSTAT, when implemented effectively can be an effective crime management tool (Carter, 2008). The NCJRS website⁶ provides a number of documented case studies of effective COMPSTAT adoption and implementation.

Manning’s (2008) Technology of Policing is the only known published study that has evaluated the effectiveness of police agency uses of crime analysis. In this study Manning questioned whether technology (i.e, crime analysis technology) enhanced the rational capacity of the police organization and concludes that it does not. Manning essentially argued that the technical rationality had not replaced the substantive rationality of collective decision making within three police organizations he evaluated. Manning observed that police officers on duty, which he referred to as “cops on the ground,” tend to rely on highly embodied skill to fulfill public expectations, and therefore,

⁶ [http://www.ncjrs.org](http://www.ncjrs.org) provides a number of case studies that provide evidence that COMPSTAT can be an effective crime management and accountability mechanism for police organizations.
had a tendency to reject information technologies that introduced abstract systems into their daily routines. He concluded that the deeply engrained “practical rationality” of police officers leads to resistance to adopt the decontextualized information provided by information technologies.

Additionally, Manning observed that the meaning ascribed to the use made of technology is shaped by the inter-subjectivity of agents within the police organization. As in the cases studied by Manning, crime mapping technology was developed by top leaders of the organization, and the layers of expertise used to develop the information were largely isolated from the other divisions and ranks of the organization. Technology had little material meaning or relationship to the rationality of crime prevention as practiced by rank-and-file officers in the organization. The ritualistic demonstration of crime analysis technology most often simply affirmed the traditional status hierarchy and divisions of labor within the organization; essentially, technology did not change the rational capacity of the organizations in their routine operations and performance of customary duties. As stated by Manning “the workings of technology are best seen or revealed by looking at how people use them” (p.72-73). One way to characterize the thrust of Manning’s overall argument is to conclude that technology doesn’t change the rationality or operations of the organization, but the rationality and culture of the police organization changes the use of the technology in a manner the technology was not originally intended to be used.

**Popular Innovations in American Municipal Police Departments**
COMPSTAT

It is important to discuss the development and diffusion of COMPSTAT programs in the United States for two reasons. First, it’s important to thoroughly discuss the COMPSTAT model in order to clarify any misconceptions or confusion concerning the relationship between technological innovations and the development and implementation of COMPSTAT programs. Second, it is important to discuss COMPSTAT because this trend in American policing has had a substantial impact on technological developments in American policing in the past two decades (Weisburd et al.’s, 2003). Furthermore, relevant to this study’s analysis of technological innovations it is important to acknowledge that a fair portion of municipal police departments examined in this study, such as the New York City Police Department, had in fact undergone technological innovations as part of their COMPSTAT program. Although COMPSTAT is a technologically driven management model that uses several of the technologies evaluated in this study, it is important to caution that COMPSTAT innovations are by no means synonymous with technological innovations, and this study’s empirical analysis of technological innovations should by no means be misinterpreted as a study of COMPSTAT innovations.

COMPSTAT is a technologically-based managerial process that combines state-of-art management principles with cutting-edge crime analysis technologies (Willis,

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7 Weisburd, Mastrofski, Mcnally, Rosann, and James (2003) found that a substantial number of law enforcement agencies in the U.S. with 100 or more sworn officers reported having adopted COMPSTAT, including 32% in the West, 22% in the North Central region, 42% of agencies in the South, and 27% in the Northeast.
Mastrofski, & Weisburd, 2007). Introduced by former New York City Police Commissioner William Bratton in 1994, COMPSTAT is essentially a police accountability mechanism that consists of four principles: (1) relies on accurate and timely intelligence information; (2) attempts to utilize the most effective tactics to address crime-related problems; (3) focuses on the rapid deployment of resources toward effective tactics; and (4) follows a thorough and relentless follow-up and evaluation process to study the effectiveness of tactics deployed and makes adjustments accordingly (Ratcliffe, 2008). The model operates in a data-driven environment in which crime analysts collect and analyze data to identify the causes and conditions of crime trends and problems. This information is used by top administrators to hold precinct commanders accountable to their beats and failure to provide satisfactory progress and provide satisfactory answers to administrators in COMPSTAT meetings can result in scrutiny, sanction, and even removal from command (Willis, Mastrofski, & Weisburd, 2007).

In the U.S. COMPSTAT has had a substantial impact on American Law enforcement agencies with 100 or more sworn officers (Weisburd, Mastrofski, McNally, Rosann, James, 2003). Throughout the 1990s there was a widespread “diffusion of innovation” of COMSTAT-like programs throughout the U.S., which occurred at a rapid rate. Weisburd et al.’s (2003) analysis of a comprehensive national survey of police agencies that was administered by the police foundation in 1999 found that, among U.S. law enforcement agencies with 100 or more sworn officers, a substantial number of agencies in the U.S. reported having adopted COMPSTAT, including 42% of agencies
in the South, 32% in the West, 22% in the North Central region, and 27% in the Northeast. Only 11% of smaller agencies that were surveyed reported having implemented the COMPSTAT model. However, 30% of smaller agencies reported that they had planned on implementing a COMPSTAT-like program in the future.

Although a growing number of American law enforcement agencies are adopting crime analysis and information technologies, as well as using the rhetoric of data-driven policing strategies such as COMSTAT and ILP in describing their approach to law enforcement operations, not all agencies that develop crime analysis and information technology resources are actually practicing a data-driven policing strategy. Ratcliffe (2002) observed that in our modern ‘risk society’ police agencies are the primary collectors and providers of risk-related information for sources external to the policing organization. Technological innovations particularly the growth in information technologies within local police agencies is in good measure fueled by this demand to collect risk-related information. Although a large number of police agencies are using the rhetoric of data-driven policing models such as COMPSTAT and ILP, it is more likely that not that in reality many of these agencies don’t faithfully practice the tenets of these data-driven policing methodologies. A centrally important aspect of data-driven policing models is that they proactively use crime analysis data and criminal intelligence information in an instrumental manner to improve policing strategies and produce targeted tactical responses to prevent future crime and crime-related threats. Although, there is ample evidence of great “bureaucratic enthusiasm” for the adoption of computer based technologies for information gathering (Ratcliffe, 2002), and many law
enforcement agencies may be effective at collecting and disseminating risk-related information to other agencies, many police agencies that have embraced the technology in principle to improve their operations actually lack intelligence capacity (Carter, 2008), and fail to use crime analysis and/or criminal intelligence data in an instrumental manner to improve their police operations (Manning, 2008).

It is important to caution the reader that this study exclusively assesses technological developments in municipal police departments that are pertinent to crime control functions, and by no means purports to assess the development and diffusion of COMPSTAT in the United States. Although this study does not specifically measure the tenets of COMPSTAT or any other data-driven policing strategy, this discussion on COMPSTAT developments in American law enforcement is relevant to this particular study because COMPSTAT and the broader topic of data-driven policing strategies are important trends that have had considerable influence on the adoption of computerized technologies by municipal police departments.

**Community-Oriented Policing**

A discussion of the development and diffusion of community policing in American law enforcement is important because community policing serves as an independent measure in this study. The development of community policing programs in municipal police departments is presumably associated with and perhaps predictive of technical, administrative, and programmatic innovations for the following reasons. First, because the research literature suggests that agencies that are highly invested in community
policing programs may have also invested in crime analysis technologies to assist their crime fighting efforts (Ratcliffe, 2008). Second, the theory of developmental culture which has been applied in a variety of areas of public administration contends that organizations that have a developmental culture are more likely to embrace change and adopt a variety of innovation types (Pandey & Garnett, 2006); therefore, it is reasonable to assume that some police organizations that previously adopted community policing may have a propensity or disposition to also be technically, administratively, and programmatically innovative.

Additionally, there are conflicting hypotheses in the policing literature concerning the co-implementation of community policing and use of crime mapping for hot spot policing approaches. One perspective contends that community policing efforts and the use of hot spot policing may be conflicting goals, whereas another perspective contends that the two goals in many respects are compatible (Willis, Mastrofski, Kochel, 2010). Using the LEMAS dataset this study will use an additive scale of community policing measures to address these unanswered questions in the literature concerning the relationship between community policing the use of crime mapping, crime analysis, and other computer-based technology innovations.

Community policing, one of the most widespread policing innovations taking place in the later half of the twentieth century, serves as an important independent measure in this dissertation study. Before explaining why community policing will be used as an independent measure in this study it is first important to explain in some
detail what the concept of community policing is and why it has had such a substantial impact on modern American policing.

The movement towards community-oriented policing (COP) is characterized by two primary themes. First, the realization that law enforcement agencies cannot single-handedly combat crime without active involvement and assistance from citizens in the community; and second, the recognition that there is a major role for citizens to promote neighborhood sustainability and revitalization and community-based crime prevention (Kelling & Moore 1988; Sampson et al. 1997). Many local law enforcement agencies faced with chronic resource constraints have embraced the community-oriented policing philosophy as an innovative solution to building bridges with their communities, controlling crime, and maintaining order despite budgetary and personnel shortfalls. This trend has been further augmented by federal grants issued by the Community-oriented Policing Services [COPS] Office in the U.S. Department of Justice to assist local police agencies in leading efforts to promote establish and sustain local neighborhood revitalization and community-based crime prevention efforts. The co-production of public safety has been a long-time core theme of the work of the COPS office.

The increased focus on community policing in the past few decades represented a fundamental shift in the “operational mission” of policing, in the relationship between citizens and police officers, and in their respective roles in the production of public order (Reisig & Giacomazzi 1998). Prior to the development of community-oriented policing practitioners and academics alike called into question the effectiveness of a number of
long-established traditional policing practices (Skolnick & Bayley 1986). The traditional policing model assumes that deterrence and incapacitation are the best methods for promoting crime control, and that crime control responsibility should rest solely in the hands of the police (Hartcourt 2001; Mcardle & Erzen 2001). This traditional crime control strategy views citizens primarily as the passive recipients of police services. Consequently, citizens have historically played only a limited role in the production of public order.

The deterrence-based assumptions underlying traditional policing strategies placed heavy emphasis on crime control, which many believed was best achieved by increasing the number of police officers, arrests made, and prosecutions carried out (Silverman 1999). Consequently, with this heavy emphasis on crime control other important functions of law enforcement, such as order maintenance and service provision, were either frequently overlooked and/or devalued (Kelling & Moore 1988). Traditionally police interactions with citizens were limited to responses to specific calls for services, traffic stops, and questioning in police investigations. Police would patrol the streets in relative isolation from their surrounding communities. This reactive policing strategy frequently alienated citizens and the police from one another (Moore 1992).

Over the course of the past few decades there has been increasingly wide recognition in American society that the police cannot effectively control crime without public support, that law enforcement agencies must place greater emphasis on other important interrelated functions of law enforcement (including order maintenance and
service provision), and that there is a major role for citizens to assist in neighborhood sustainability and revitalization and community-based crime prevention efforts (Kelling & Moore 1988; Reisig & Giacomazzi 1998). Empirical studies have shown that the support and cooperation of citizens in the community is an integral component to effective law enforcement (Sampson, Raudenbush & Earl 1997). These developments have spawned a trend toward community-oriented policing strategies (Friedman 1992; Kelling & Moore 1988; Skogan et. al. 1999).

Many police departments throughout the nation have responded to the problematic relationships with their communities by taking police officers out of squad cars and placing them on foot and bicycle patrols, establishing citizen awareness campaigns, decentralizing operations and opening small policing sub-stations, facilitating meetings between citizens and the police, and creating substantive opportunities for citizen involvement in crime prevention programs (Sunshine & Taylor 2003; Mastrofski 1993). Community-oriented policing shifts the focus of policing away from the traditional reactive strategy of responding to calls towards a more “proactive problem solving” strategy that seeks to mobilize citizens in the community and build enduring positive “police-community partnerships” to address a variety of crime-related issues (Goldstein 1990; Reisig & Giacomazzi 1998; Scott 2001).
CHAPTER 3
THEORIES OF ORGANIZATION CHANGE AND INNOVATION

Introduction

This chapter reviews the extant literature in organizational innovation while placing key emphasis on the organizational theories that will be tested in this dissertation study, including organizational design theory (a.k.a. innovativeness) and contingency theory. In general this chapter evaluates known studies that have tested components of these theories in order to paint an overall picture of the empirical status of these theoretical explanations for organizational innovativeness in municipal police departments.

The first section of this chapter titled “Background: Organization Change and Innovation Literature” discusses the significance and importance of policing innovation research in the policing literature and highlights a variety of gaps in the policing innovation research that have been identified by policing scholars (King, 2000; Willis and Mastrofski, 2011). The second section titled “Organizational Design Theory” discusses the origins of organizational design theory in the field of public administration and documents its import and use in the policing literature. The subsection titled “Police Organization Structure and Innovation” reviews the literature of police organizational structure and documents a variety of empirical innovativeness studies that have tested
the relationship between components of police organization “complexity and control” (Maguire, 1997; 2000; Wilson, 2003; 2005), as well as a variety of changes in police organizations ranging from structural changes to the development of community policing programs.

The third section of this chapter titled “Contingency Theory” explains the origins of contingency theory in the field of public administration, documents its import and use in the policing literature, and reviews empirical studies that have tested contingency theory in the area of policing. The final section of this chapter titled “Theoretical Conflict Between Organizational Design and Contingency Perspectives” discusses the theoretical conflict between internal and external explanations for police organization innovation and change and discusses how this theoretical conflict that has been long characterized in the field of public administration as a difference between open and closed system frameworks (Thompson, 1967) has emerged in the policing literature in recent decades.

**Background: Organization Change and Innovation Literature**

Evidence shows that in the past few decades American law enforcement agencies have adopted popular “strategic innovations” such as community-oriented policing and Compstat with varying degrees of success (Zhao, 1996; Greene, 2000; Wilson, 2005; Willis, Mastrofski, & Weisburd, 2007; Manning, 1997, 2008; Ikerd & Walker 2010). This phenomenon which is characterized by the fact that some policing organizations are more adept to change than others has influenced a growing interest in
policing innovation research that is evident in a number of recent studies (Zhao, 1996; Maguire, 1997, 2003; Mullen, 1996; King, 2000; Wilson, 2005; Klinger, 2003; Weisburd & Braga, 2006; Morabito, 2007; Buruss & Giblin, 2009; Zhao, Ren, & Lovrich, 2010; Buruss, Giblin, & Schafer, 2010; Randol, 2012). In the policing literature, innovation is generally referred to simply as something “new to the field of policing” (King, 2000).

Theories of policing innovation are important because a police organization must have the capacity to innovate to successfully adopt and utilize a new practice, technology, tactic or strategy (e.g., legal and administrative standards, mobile data terminals, personnel policy, community policing, hot spot policing). Given the general consensus in the policing literature that police departments are resistance to externally driven change (Greene, 2000; Manning, 1997, 2008; Ikerd & Walker 2010), theories of organizational innovation may assist policing scholars in understanding which police agencies have the greatest capacity for change and why. Additionally, research studies of innovation and change in police organizations may also have “strategic implications” for police executives and policy makers whom wish to facilitate change in police departments (Willis and Mastrofski, 2011).

The research literature in the area of policing innovation is in its nascent stage of development (Bayley, 2008), and according to King (2000), the research literature has “not yielded a complete understanding of why some departments are more innovative than others” (p. 303). According to Willis and Mastrofski (2011), policing research will benefit greatly by going to greater lengths to use organizational innovation theory to systematically study the “intrinsic characteristics” of change and innovation in law
enforcement organizations (p.315). Studies of organizational innovation have developed largely within three separate streams of literature which evaluate the following aspects of innovation: (1) the determinants of innovation (commonly referred to as “organizational innovativeness”); (2) the diffusion of innovation; and (3) the process of innovation (Wolfe, 1994; King, 2000).

Innovativeness studies that evaluate the correlates of the adoption of an innovation type are typically cross-sectional, and attempt to explain why some organizations are more innovative than others (Weiss, 1992; Zhao, 1995, 1996; Mullen, 1996; Wilson, 2003; Buruss, Giblin, & Shafer, 2010). Diffusion studies typically describe the process or mechanisms in which an innovation spreads across a population of innovators over time and are frequently longitudinal in design but can also be cross-sectional (Zhao, Lovrich, & Robinson, 2001; Buruss & Giblin, 2009; Zhao, Ren, & Lovrich, 2010). Finally, innovation process studies attempt to explain the broader life-course of an innovation including its development, emergence, adoption, implementation and endurance over time (Skolnick & Bayley, 1986; Maguire, 1007; Skogan, 2006; Willis, Mastrofski, & Weisburd, 2007).

Organizational Design Theory

Questions of organizational design have been a central focus among policing reformers and advocates of professionalization since the early 20th century inception of modern American policing. Organizational innovativeness studies that evaluate the endogenous correlates and determinants of innovation follow the field of public
administration and the classical school of management’s tradition of organizational design theory. Heavily influenced by Frederick Taylor’s (1912) Scientific Management, Weber’s\(^8\) work on bureaucracy, and Chandler’s (1962) work on multidivisional forms, organizational design theory was predicated on the notion that there is “one best way” to design and structure an organization (Lam, 2004), a concept which subsequently had a substantial impact on the professionalism movement in American policing.

The influences of organizational design theory in policing is evident in the prescriptions of August Vollmer and O.W. Wilson that police departments could become more accountable and effective by reforming their organizational structures to become more professionalized, specialized, centralized, and formalized. The ideal of early 20\(^{th}\) century police reformers to find an optimal organizational structure was later seriously challenged by a new generation of reform advocates in the 1980s; these later scholars contended that police agencies should change their administrative practices and organizational structures in order to overcome the shortcomings of the professional policing model, and become more flexible to changing societal expectations and more responsive to public demands for changes in police practices (e.g., societal demands for more police emphasis on order maintenance and foot patrols) (Wilson & Kelling, 1982; Kelling & Moore, 1988; Greene, 2000; Zhao, Ren, & Lovrich, 2010). These prescriptions for change included calls for the decentralization of the command and control structures of police departments (Moore & Stephens, 1992; Cordner, 1997), the flattening of organizational hierarchies (Maguire, Zin, Zhao, & Hassell, 2003; Mastrofski, ___)

\(^8\)See Max Weber’s (1946) theory of bureaucratic functions in modern officialdom.
1998), and the increased civilianization of police departments support operations and staff (Bayley, 1994; Greene, 2000).

Although the early twentieth century ideal to find an optimal organizational structure that maximizes performance was largely abandoned, organizational design theories continue to offer utility in understanding some of the endogenous correlates of organizational innovation and change. Today organizational design theories are useful for examining the links between organizational structures, performance, and the innovative capacity of an organization (Burns and Stalker, 1961; Langworthy, 1986; Wolfe, 1994; Maguire, 1997, 2003; Lam, 2004; Wilson, 2003, 2005). Scholars from a variety of disciplines (e.g., business, economics, sociology, public administration), have contributed to the literature on organizational design theory with studies that have investigated the links between environment, structure, and organizational performance (Blau, 1970; Wolfe, 1994; Teece, 1998; Lam, 2004). For instance, studies in the areas of business and economics have shown that certain structural configurations can facilitate the development of new processes and products, and micro-economists have studied the relationship between organizational forms and the strategic positioning of firms in particular markets (Teece, 1998, Lam, 2004). In the past few decades an increasing number of studies have evaluated the organizational structures of police agencies, and many have shown that administrative and organizational factors can either facilitate or impede innovations (Angell, 1975; Cordner, 1978; Wilson, 2005). Applying organizational design theory to the study of technical, administrative, and programmatic innovations may assist in developing theories that can explain and/or
predict what types of organizational structures are most conducive to the adoption of different types of innovations in policing.

The key structures of police organizations, commonly conceptualized in terms of “complexity and control,” have been assessed by a number of policing scholars to evaluate the relationship between organizational structures and administrative factors, the implementation of a variety of innovative policing programs (e.g., community policing), structural changes in police departments (Maguire, 2003), and the evaluation of policing outcomes (e.g., arrests, use of force complaints) (Chappell et al., 2006; Langworthy, 1986; Maguire, 1997; Mullen, 1996; Wilson, 2005). It seems reasonable to hypothesize that, organizational and administrative factors, which have been determined to be significant predictors of structural change, and programmatic innovations in other areas of policing policy may also be significant predictors of innovations in the areas of crime analysis and information technology innovations.

Although most local police departments have similar mandates, functions, and responsibilities of order maintenance and crime control, police agencies vary substantially in their operating policies and procedures, organizational structure, size, administrative apparatus, and style of policing (Maguire, 1997; Wilson, 2005). Following the work of Blau (1970) and that of Blau & Schoenherr (1971), Langworthy (1986) identified spatial, hierarchical, occupational, and functional differentiation as core structures of police organizations. Zhao (1996), Maguire (1997), and Wilson (2003, 2005), subsequently applied many of Langworthy’s organizational structure variables to their studies of police organizations. Maguire (1997) elaborated upon these
organizational attributes by adding formalization, administrative density, and task scope as additional measures of organizational structure and complexity in policing organizations.

The key organizational structures of “complexity and control” have been evaluated in a number of studies of police organizations (Maguire 1997; Wilson 2003, 2005). Complexity refers to the degree of structural differentiation present within an organization. According to Langworthy (1986), differentiation occurs along the spatial, hierarchical, occupational, and functional dimensions of police organizations. Spatial differentiation refers to the degree that an agency’s operations are spread out geographically. Hierarchical differentiation refers to the vertical command structure of an agency. Some agencies have relatively complex chain of commands, while others have “flatter” hierarchical structures. Occupational differentiation refers to the extent that an organization employs specialized staff or trained workers. Functional differentiation refers to the number of specialized units, or departmental units, that an agency uses to perform its tasks (Maguire, 1997).

Structural complexity within an organization is coordinated and managed through structural control mechanisms (Maguire 1997; Wilson 2003, 2005). Prior studies have defined components of structural control as centralization, professionalism, formalization, and administrative density (Maguire 1997; Wilson 2003, 2005). Centralization involves the command structure within an organization in which decisions are made. Administrative density refers to the size of the administrative component of an organization (Langworthy, 1986; Maguire, 1997). Formalization refers to the extent
that an agency uses formally written policies and procedures. Formalization essentially prescribes what, how, and who is responsible for performing tasks within an organization. Professionalism includes training, educational requirements, employment screening, and other standards that are instituted to ensure professionalism among officers and staff (Wilson, 2005).

Burns & Stalker (1961) established a typology of organizational forms that is pertinent to this innovation study. They hypothesized that the structures of organizations fall along a continuum ranging from organic to mechanistic. Organizations that have an organic structure tend to be less formal, geographically dispersed, have flattened hierarchies, and limited functional and occupational differentiation. Organizations that have a mechanistic structure tend to be more formalized, spatially concentrated, and complex in terms of having a high degree of functional, occupational, and hierarchical differentiation (Burns and Stalker, 1961; Wilson, 2005). Burns and Stalker found that mechanistic structures were more rigid, stable, inflexible, and poorly suited for rapid change and innovation, whereas organic organizations were relatively more fluid and adaptive to environmental conditions that call for rapid changes in operations and innovation in status quo habits and traditions. To date, no known studies in the policing literature have found a relationship between mechanistic or organic structural forms and the adoption of organizational innovations.⁹

⁹ With the exception of Wilson’s (2003) study of community-oriented policing innovations in American law enforcement agencies no other known studies have tested whether the most innovative police departments possess either organic or mechanistic structural forms.
Police Organization Structure and Innovation

A number of empirical studies have found links between organizational structures, administrative attributes, and innovations in a variety of different organization types (both private and public sector organizations). Damanpour (1991) conducted a meta-analysis of 23 empirical studies of organizational innovation, founding that a variety of organizational factors were significantly correlated with organizational innovation -- including professionalism, administrative density, functional differentiation, specialization, slack resources, internal and external communications, and managerial attitudes toward change. Damanpour also reported that the meta-analysis revealed that centralization negatively affected openness to organizational change.

Empirical studies have revealed that links between organizational structures and innovations are applicable to municipal police organizations. Maguire (1997) studied organizational change in 236 police agencies over a six-year period. He measured whether the organizations had implemented COP, were planning to implement COP, or not planning to implement COP. Controlling for task scope and organizational size Maguire measured five factors of organizational structure including civilianization, organizational height, functional differentiation, administrative density, and formalization. Maguire also found no significant changes in administrative density, formalization, or civilianization in any of the organizations that he studied. He found that, contrary to expectations, functional differentiation increased the likelihood of innovation adoption;
consistent with expectations, organizational height decreased that likelihood. Maguire examined no significant differences in these variables whether the organizations had implemented COP, planned to implement COP, or had not planned to implement COP.

Wilson’s (2005) study of COP implementation among agencies that responded to the LEMAS survey found that several organizational factors including formalization, funding, police turnover rate, and organizational age, were each significantly correlated with successful COP implementation. Wilson also found that agencies located in the Western region of the country were more likely to have implemented COP measures. Mullen’s (1996) study of technological innovations in local police departments found that internal departmental factors were the primary causes of information technology innovations. Additionally, King’s (1998) analysis of 10 different innovation types in 432 municipal policing organizations found that overall, structural and administrative factors endogenous to police organizations were better predictors of innovation than environmental factors. King’s (1998) study of innovation in American municipal police departments found that organization size, vertical height, and specialization were positively associated with programmatic innovations, whereas formalization was negatively associated with programmatic innovations. King also found that organizational size, vertical concentration, occupational heterogeneity and specialization were positively correlated with technical innovations, whereas the presence of slack resources was negatively associated with technical innovation. Randol’s (2012) analysis of homeland security innovations in local police departments found that organization size, functional differentiation and budget per capita were
positively associated with terrorism preparedness, whereas spatial differentiation and degree of formalization were negatively correlated with terrorism preparedness program adoption.

**Contingency Theory**

Contingency theory views the external environment, particularly the task environment of an organization as being the principal driver of change. Contingency theorists study the organization’s operating contingencies, which include (1) the environment (Burns and Stalker, 1961), (2) technology (Woodward, 1965; Perrow, 1970), and (3) the scale of operation (Blau, 1970). Several streams of contingency theory have developed over the years conforming to these areas of inquiry: The first stream examines organizational adaptations to task environments, which involves examining the link between environments, organizational structures, and innovations (Burns & Stalker, 1961; Lawrence & Lorsch, 1967; Kimberly, 1976; Blau & Schoenherr, 1971; Mintzberg, 1979; Langworthy, 1986; Maguire, 1997, 2003; Zhao, Lovrich, & Robinson, 2001; Zhao, Ren, & Lovrich, 2010;). The second stream examines organizational adaptations to technological change (Perrow, 1967; Dewar & Hage, 1978; Mobrman & Mobrman, 1990; Damanpour, 1991; Mullen, 1996), and the third stream examines the organizational adaptations to the scale of operations, which includes studying the relationship between organizational size, structure, and innovation (Blau, 1972; Marsden et al., 1994; Donaldson, 1995).
The ideal of reform-minded organizational design theorists to find an optimal organizational structure that maximizes performance was seriously challenged by contingency theorists, who hypothesized that organizational structures and innovations are greatly influenced by the organizational context or task environment and not necessarily affected by the rational decisions of organizational leaders. Contingency theory has two assumptions that challenge organizational design theory. First, contingency theory acknowledges that the external demands upon organizations can change over time; therefore, organizations must be adaptive and responsive to changing external demands that periodically bring on shifts in the goals, objectives, and priorities of an established organization (Hage and Aiken, 1970). Second, contingency theorists place emphasis on the importance that there must be a “fit” between an organization and its working environment. Accordingly, contrary to organizational design theory there is no one best way to structure an organization, and that the best or most appropriate organizational design is largely contingent upon the organization’s operating contingencies, which include the environment (Burns and Stalker, 1961), the extant technology (Woodward, 1965; Perrow, 1970), and the scale of operation (Blau, 1970).

Given contingency theory’s emphasis on the importance of organizational fit, a number of studies have evaluated the link between environments and organizational forms (Burns & Stalker, 1961; Lawrence & Lorsch, 1967; Kimberly, 1976; Blau & Schoenherr, 1971; Langworthy, 1986; Maguire, 1997, 2003; Zhao, Ren, & Lovrich, 2010). Burns & Stalker (1961) were among the first scholars to hypothesize a link
between environments and organizational configurations. They hypothesized that the structures of organizations fall along a continuum ranging from organic to mechanistic. Organizations that have an organic structure tend to be less formal, geographically dispersed, have flattened hierarchies, and limited functional and occupational differentiation. Organizations that have a mechanistic structure tend to be more formalized, spatially concentrated, and complex in terms of having a high degree of functional, occupational, and hierarchical differentiation (Burns and Stalker, 1961; Wilson, 2005). Burns and Stalker (1961) found that organizations that operate in unstable task environments have organic and informal internal structures, whereas organizations that operate in stable environments tend to be more formal and mechanistic.

Additionally, Lawrence and Lorsch (1967) hypothesized that there can be “ambidextrous organizations,” entities in which organic and mechanistic structures coexist within the same organization primarily due to differentials in the functional demands of organizational sub-environments. Mintzberg (1979) argued that successful organizational designs that maximize performance are those most suited to their tasks environments. In other words the successful structuring of an organization requires a consistency of contingency factors and design features. Furthermore, Mintzberg created a typology of organizational archetypes and developed a “configurational hypothesis,” which posits that organizations are likely to be dominated by one of five archetypes. These archetypes are dependent upon the organization’s task environment and each has a different potential for innovation. The types in question are simple
structure, machine bureaucracy, professional bureaucracy, adhocacy, and divisionalized form (Lam, 2004). Each of these organizational types and their potentials for innovation are listed in Table 1 (page 51). In summary these organizational archetypes shares many of the characteristics of Burns and Stalker’s (1961) typology of mechanistic and organic forms, and thereby stresses many of the same points but in a more new nuanced and detailed fashion. For example similar to Burns and Stalker Mintzberg found that mechanistic structures are more stable but are also more rigid, inflexible, and poorly suited for innovation, whereas organic organizations tend to be relatively more fluid and adaptive to environmental conditions that demanded rapid change and innovation.

A number of studies have examined the impact that environmental influences have on the structures and innovative capacity of municipal police departments (Langworthy, 1986; Zhao, 1996; King, 1998; Zhao, Lovrich, & Robinson, 2001; Maguire, 2003; Wilson, 2005; Zhao, Ren, & Lovrich, 2010). Zhao (1996) studied the impact that internal and external factors had on COP implementation. Controlling for organizational size and region he found that hierarchical differentiation, measured as the number of line officers as a percentage of departmental personnel, was positively associated with externally focused change, but not internally focused change. He found as well that no association among factors on internally focused change including spatial differentiation, measured as the number of divisions and patrol beats, occupational differentiation, measured as the percentage of civilian in departmental personnel, or hierarchical differentiation, measured as the number of ranks within the agency.
### Table 1: Typology of Organizational Archetypes

<table>
<thead>
<tr>
<th>Organizational archetype</th>
<th>Key features</th>
<th>Potential for innovation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple structure</td>
<td>A organic organization controlled by a few people that is highly adaptive and responsive to changes in the environment</td>
<td>Entrepreneurial in nature and highly innovative. More willing to take risks in innovations but more susceptible to misjudgments.</td>
</tr>
<tr>
<td>Machine bureaucracy</td>
<td>A mechanical organization that represents many of the attributes of a classical Weberian bureaucracy thus having centralized command and control, high degrees of specialization, and always attempting to control task environment through formalization.</td>
<td>Designed for stability and efficiency and good at handling routine problems, yet relatively unresponsive to external environment and not adept to change.</td>
</tr>
<tr>
<td>Professional bureaucracy</td>
<td>Mechanistic in organizational structure yet is relatively decentralized in terms of maintaining high degrees of autonomy and discretion to individual professionals.</td>
<td>Individual experts within the organization may be highly innovative and adaptive in carrying out their respective duties; however, these individual innovations are not necessarily coordinated and carried over across different organizational units and functions.</td>
</tr>
<tr>
<td>Adhocracy</td>
<td>Highly flexible and adaptive project based organizations that are designed to manage complexity and instability. Problem solving teams can easily be reconfigured and re-tasked to quickly respond to changes in the external environment.</td>
<td>Highly innovative and adaptive but short lived due to instability in structure propensity to develop toward a bureaucracy.</td>
</tr>
<tr>
<td>Divisionalized form</td>
<td>A highly decentralized and organic structural form consisting of loosely coupled quasi-autonomous entities that are tenuously held together by a central administrative structure.</td>
<td>Propensity to develop competency in specialized niches, but vulnerable to centrifugal forces pulling units away from the core toward divisional efforts, and also susceptible to competition between units.</td>
</tr>
</tbody>
</table>

Source: Mintzberg (1979); Lam (2004)

Contrary to Zhao’s (1996) findings, Mullen (1996) concluded from his work that internal departmental factors were the primary causes of information technology
innovations in local police agencies. Furthermore, King’s (1998) analysis of 10 different innovation types in 432 municipal policing organizations found that overall, structural and administrative factors endogenous to police organizations were better predictors of innovation than environmental factors. Zhao, Lovrich, and Robinson (2001) tested the efficacy that contingency had in explaining changes in the core functions of police departments (i.e., crime control, order maintenance, and service provision) during the era of community policing in the 1990s. These authors found that the core functions of police departments changed very little during this era and contingency-oriented factors had quite limited efficacy in explaining these changes.

Although a number of studies have examined the influence that environmental factors have on policing innovations, far fewer studies have examined the relationship between environmental complexity and organizational structure. Langworthy (1986) examined the relationship between environmental complexity (organizational size and population diversity) and organizational structure in 176 municipal police departments. Langworthy found that organizational size was a significant predictor of centralization, occupational differentiation, spatial differentiation, and hierarchical differentiation. Maguire (2003) evaluated the impact that several environmental factors including organizational size had on organizational structure and found that organizational size was predictive of three dimensions of organizational structure including functional, vertical, and spatial differentiation. Additionally, Zhao, Ren, and Lovrich’s (2010) longitudinal study tested whether changes in environmental, size, and technological contingencies were associated with changes in police organizational structure in the
1990s. These authors found that organizational structures remained relatively unchanged throughout the 1990s despite the presence of notable contingencies. Although few contingency factors were consistently associated with changes in police organizational structure, organizational size (measured as the number of sworn officers) emerged as a consistent predictor of organizational change.

Although the empirical status of the innovation literature is that it constitutes an “empirical morass” (King, 2000) of mixed and inconclusive findings that often do not conform to expectations, organizational size has emerged as one of the few factors that have consistently been predictive of organizational change (Willis & Mastrofski, 2011). Organizational size matters because an increase in organizational size is a proxy for corresponding increases in organizational complexity and it represents “the scope of an organization and its responsibility” (Blau, 1972, p.3). Additionally, as Marsden, Cook, and Kalleberg (1994) correctly noted organizational size is indicative of “the magnitude of tasks to be coordinated” and has emerged as “the dominant contingency thought to necessitate structural differences” (p.913).

The study of organizational adaptations to technology has developed into an important dimension of contingency theory (Perrow, 1967; Dewar & Hage, 1978; Mobrman & Mobrman, 1990; Damanpour, 1991; Mullen, 1996). Contingency theorists have identified technology as an important feature of the external environment that may have an impact upon organizational structure and influence change (Damanpour, 1991; Zhao, Ren, & Lovrich, 2010). Although the adoption of new technologies and industry standards is a necessity for the operations for most organizations, the introduction of
new technologies may introduce greater uncertainty into an organization’s task environment and alter organizational processes and establish patterns of communication; these changes may in turn lead to corresponding changes in an organization’s structure (Damanpour, 1991). Prior to Damanpour (1991), Woodward (1958) found that technical innovations were a key factor in explaining structural variations in organizations. Furthermore, Perrow (1967) developed a theoretical model to explain the relationship between technological/technical innovations and corresponding differentiations in organizational structure. Woodward and Perrow’s work influenced subsequent research evaluating the link between technological changes and corresponding changes in organizational structure, an area of research which has developed into an important aspect of contingency theory (Dewar & Hage, 1978; Mohrman & Mohrman, 1990).

**Theoretical conflict between Organizational Design and Contingency Perspectives**

The influences of organizational design theory in modern American policing is evident in August Vollmer and O.W. Wilson’s uniform prescriptions for police departments to reform their organizations by professionalizing, specializing, formalizing, and centralizing command structures. Furthermore, the second generation of reform advocates in the 1980s contended that police agencies could overcome the shortcomings of the professional policing model and increase their effectiveness by changing their administrative practices and reforming their organizational structures.
(i.e., focus on order maintenance, decentralization, civilianization, and diversification of staff) (Wilson & Kelling, 1982; Kelling & Moore, 1988; Greene, 2000; Zhao, Ren, & Lovrich, 2010).

From its inception, contingency theory developed with a perspective that is diametrically opposed to the theoretical underpinnings of organizational design theory. The ideals of organizational design theorists to improve organizations by providing uniform prescriptions for reform is seriously challenged by contingency theorists, who hypothesize that organizational structures, innovations, and degrees of effectiveness are greatly influenced by the context of the organization’s environment and are not necessarily dependent upon the rational decisions of organizational leaders. Therefore, there is no “one best way” to structure an organization (Lam, 2004), and that the best or most appropriate organizational design is contingent upon the organization’s operating contingencies, which include the environment (Burns and Stalker, 1961), technology (Woodward, 1965; Perrow, 1970), and the scale of operation (Blau, 1970).

This theoretical conflict between organizational design theory (posits internal drivers of change) and contingency theory (posits external drivers of change) which has been salient in the field of public administration for several decades (Downs & Mohr, 1976; Wolfe, 1994; Lam, 2004), has in the past few decades emerged in police studies of organizational innovation and change (Zhao, 1996; Mullen, 1996; King, 1998). For instance, studies conducted by Mullen (1996) and King (1998) both concluded that organizational innovations in policing were primarily due to internal departmental factors. Alternatively, Zhao (1996) concluded that community policing innovations in
local police departments were primarily the result of a set of external environmental factors.

The conflict between organizational design and contingency perspectives can be further conceptualized as being a sub-set of the larger debate between open and closed systems frameworks of police organizations. J.D. Thompson (1967) was one of the first scholars to differentiate between the open and closed system organizational frameworks. Thompson observed that open systems constantly interact with their environments, whereas closed systems are relatively more insulated from their external environments. A number of policing scholars have viewed police agencies as being insular and unresponsive to external influences of change (Miller, 1977; Brown, 1981; Manning, 1997; Greene, 2000; Crank, 2004). Despite the prevalent perspective that police organizations tend to be insular from their environment and operate in relatively closed systems, there is a growing interest in examining the impact that external influences can have on police organizations (Zhao, 1996; Maguire, 1997, 2003; Maguire et al., 1997; Mastrofski, 1998; King, 1999). Daft (2001) argued that in post-modern societies organizations in general are shifting toward relatively more open system frameworks and are also shifting from being mechanical and closed towards being more organic and open systems. If Daft’s hypothesis holds true academic interest in the open systems frameworks and contextual theories of organizational change, including contingency theory, may continue to grow in future years.

Today, the empirical question concerning whether internal or external factors have greater influence on organizational change remains unanswered. There is
substantial disagreement in the research literature concerning whether internal or external factors are best predictors of organizational innovation and change. Furthermore, a general consensus has emerged that the empirical status of the innovation literature is that of an “empirical morass” (King, 2000) of mixed and inconclusive findings that often do not conform to expectations. Consequently, few factors have consistently emerged as being predictive of organizational change (Willis & Mastrofski, 2011). Several experienced researchers have observed that these inconsistencies likely result from the fact that the causes and conditions of innovation differ according to the type, nature, and circumstances surrounding the innovation. For example, after reviewing a number of innovation studies Damanpour (1991) concluded that the predictors of innovation differed considerably across innovation types. Furthermore, Kimberly and Evanisko (1981) concluded that there was “no reason to expect that a given set of variables will be related to the adoption of different types of innovation in the same way” (p.710).

Conclusion

Although several studies have examined the determinants, diffusion, and processes of community policing and Compstat innovations in local police departments (Zhao, 1995, 1996; Wilson, 2005; Buruss & Giblin, 2009; Willis, Mastrofski, & Kochel, 2010; Willis & Mastrofski, 2011, p. 313), few researchers have investigated an equally prevalent trend in American policing: the widespread adoption of computerized technologies (Travis & Hughes, 2002; Weisburd & Lum, 2005; Manning, 2008). This
The research literature suggests that two theories can explain why some police departments have a greater propensity to adopt technological innovations: organizational design theory and contingency theory. This theoretical conflict between organizational design theory and contingency theory, which has existed in the field of public administration since the 1970s (Downs & Mohr, 1976; Wolfe, 1994; Lam, 2004), has in the past two decades emerged in studies of policing innovations (Zhao, 1996; Mullen, 1996; King, 1998). For instance, studies conducted by Mullen (1996) and King (1998) both concluded that organizational innovations in policing were primarily due to internal departmental factors. Alternatively, Zhao (1996) concluded that community policing innovations in local police departments were primarily the result of external environmental factors. This study uses a longitudinal research design to empirically tests the relative efficacy that these two competing theories of police organization innovation (organizational design theory and contingency theory) have in explaining three innovation types in local police departments (i.e., technical, administrative, and programmatic innovations).

Second, this study empirically tests whether technological innovations influence changes in the horizontal structure of police organizations. Contingency theory suggests that technological changes may alter organizational processes, thereby having an impact on the operations and structural arrangements of an organization. Given that
technological innovations have had a considerable impact on law enforcement agencies in the past few decades. It is reasonable to assume that technological innovations may be predictive of changes in the horizontal structure of police organizations. To date, few studies have examined the impact that innovations and environmental contingencies have on the structures of police organizations (Langworthy, 1986; Maguire, 2003; Zhao, Ren, & Lovrich, 2010). This dissertation seeks to help fill these gaps. Research questions, hypotheses, and the specific methodological steps taken to address each of these highlighted questions from the research literature are discussed in the following chapter.
CHAPTER 4
METHODS

Introduction

The goal of this study is to contribute to two areas of policing innovation research by testing the efficacy that both organizational and environmental factors have in predicting three types of innovation in police organizations; namely technical, administrative, and programmatic innovations. This chapter sets forth in detail the methodological steps that will be taken to accomplish this task. The first section of this chapter titled “Research Questions” describes the specific research questions that this study endeavors to answer, and discusses the particular gaps in the research literature that this study seeks to address. The second section of this chapter titled “Data and Methods” discusses the data sources that will be used to address the research questions which include the Bureau of Justice Statistics’ 1997, 2000, 2003, and 2007 Law Enforcement Management and Administrative Statistics (LEMAS) surveys, the FBI’s 1996, 1999, 2002, and 2006 Uniform Crime reports (UCR’s), and the RAND Center for Population Health and Health Disparities (CPHHD) Data Core Series.

The third section of this chapter titled “Dependent Variable” describes the operationalization for each of the dependent measures evaluated in this study, which include technical, administrative, and programmatic innovations. Additionally, this third
section documents the sources of data for each of the dependent measures and describes the survey items that are used to construct these measures. The third section also discusses the intra-scale reliability for each of the dependent measures.

The fourth section titled “Independent Variables” describes the operationalization for each of the independent measures evaluated in this study, documents the sources of data for these variables, and describes the survey items that are used to construct each of the independent measures. Moreover, this fourth section also discusses the intra-scale reliability of each of the independent measures. The fifth section of this chapter titled “Methodological Plan for Data Analysis” outlines each of the methodological and analytical steps that will be taken in Chapter 5 to address the research questions contained in this study.

Research Questions

This study endeavors to contribute to two areas of policing innovation research. First, this study seeks to contribute to the stream of innovation research that focuses on the determinants of innovation by examining a number of organizational and environmental correlates of several different innovation types. Second, this study seeks to contribute to the stream of innovation research that focuses on the diffusion of innovation by assessing the predictors of innovation over time. This dissertation will contribute to these areas of policing innovation research by addressing the following researching questions;
1. Are technical, administrative, and programmatic innovations in police organizations principally the result of internal or external drivers of change?

First, this study uses a national sample of drawn from multiple data sources to empirically test the relative efficacy of two competing explanations of police organization innovation, namely organizational design theory and contingency theory. Organizational design theory posits that factors endogenous to an organization are the principal drivers of change whereas contingency theory contends that environmental factors external to an organization are the drivers of change. This question can also be reframed as the following question: Do the most innovative police departments follow an open or a closed systems framework? J.D. Thompson (1967) observed that open systems constantly interact with their environments, whereas closed systems are relatively more insulated from their external environments. Although a few studies have compared the relative ability that organizational design and contingency factors had in explaining innovation (Mullen, 1996; Zhao, 1996; King, 1999); to date, no known studies have used a longitudinal research design to systematically compare the relative efficacy of these competing theoretical perspectives in explaining multiple types of policing innovations.

It is reasonable to predict that the organizational design theory will do a better job overall of explaining technical, administrative, and programmatic innovations than the contingency theory because a number of policing scholars
have suggested that the drivers of organizational change in police departments are more likely to be internal rather than external (Miller, 1977; Brown, 1981; Greene, 2000; Crank, 2004; Manning, 1997, 2008). A number of policing scholars have observed that police culture is highly resistant to change (Miller, 1977; Brown, 1981; Greene, 2000; Crank, 2004; Manning, 1997, 2008). Additionally, local police departments tend to be insular and relatively non-responsive to external demands for change (Greene, 2000; Crank, 2004; Manning, 1997, 2008). This relative non-responsiveness to external pressures occurs because many police executives strategically buffer themselves from the external environment (Crank, 2004). This “loose coupling” allows police managers to deal with external politics, while the rank-and-file personnel focus on the crime control functions of the police organization (Crank, 2004). Moreover, Manning (2008) observed that adoption and uses of technology in police departments were driven by various elements of police culture. Given these observations it is reasonable to expect that internal features of police organizations including aspects of departmental complexity and control will be a stronger predictor of police departmental change than the externally focused predictors hypothesized by contingency theory.

2. Do the correlates of innovation differ across innovation types (i.e., technical, administrative, and programmatic)?
This study investigates three types of innovation in local police departments, including technical, administrative, and programmatic innovations. To date few studies have systematically compared the correlates of these three innovation types (King, 1999; 2000). Although there is disagreement in the research literature concerning whether internal or external factors are the best predictors of organizational innovation and change, a general consensus has emerged that the status of the innovation literature is that of an “empirical morass” (King, 2000) featuring mixed and inconclusive findings that often do not conform to expectations.

Few factors have consistently emerged as being predictive of organizational change (Willis & Mastrofski, 2011). Several researchers have observed that the inconsistencies found in the literature likely result from the fact that the causes and conditions of innovation differ according to the type, nature, and circumstances surrounding the innovation. For example, after observing a number of innovation studies Damanpour (1991) concluded that the predictors of innovation differed across innovation types. Furthermore, Kimberly and Evanisko (1981) concluded that there was “no reason to expect that a given set of variables will be related to the adoption of different types of innovation in the same way” (p.710).
3. Do the most innovative police departments have structural features characteristic of an organic organizational structure? If not do the structural features of the most innovation police departments conform to other organizational forms identified in the organizational theory literature?

Organizational theorists have identified a number of organizational types and typologies to explain why some organizational are more innovative than others (Burns and Stalker, 1961; Mintzberg, 1979; Lam, 2004). For example, Burns and Stalker (1961) observed that organizational structures range from organic to mechanistic. Additionally they hypothesized that the most innovative organizations tend to have relatively more organic organizational structures. Although these typologies have been broadly applied in the field of public administration, few studies of police organizations have tested whether the most innovative police agencies conform the hypothesized organizational structural archetypes.10

4. Are technological innovations having an impact on the horizontal structural arrangements of police departments?

10 With the exception of Wilson’s (2003) study of community-oriented policing innovations in American law enforcement agencies no other known studies have tested whether the most innovative police departments possess either organic or mechanistic structural forms.
This study empirically tests whether technological innovations influence changes in police organization horizontal structure. An important dimension of contingency theory suggests that technological organizations may change organizational processes and procedures, thus having subsequent impact on the administration and structural arrangements of an organization. Given that technological innovations have had a substantial impact on police organizations in the past few decades it is reasonable to assume that technological innovations may be predictive of changes in police organization administration and horizontal structure. To date, few studies have examined the impact that innovations and environmental contingencies have on the structures and administration of police organizations (Langworthy, 1986; Maguire, 1997, 2003; Zhao, Ren, & Lovrich, 2010).

Data and Methods

Data for this study came from three principle sources: the Bureau of Justice Statistics’ 1997, 2000, 2003, and 2007 Law Enforcement Management and Administrative Statistics (LEMAS) surveys, the FBI’s 1996, 1999, 2002, and 2006 Uniform Crime reports, and the RAND Center for Population Health and Health Disparities (CPHHD) Data Core Series. This last mentioned source is composed of a broad selection of analytical measures encompassing a variety of domains, all derived from a number of disparate data sources including the 1990 and 2000 US Census reports. Two datasets from the RAND CPHHD were used for this analysis, including
the DS2 Longitudinal Interpolated Data by County, and the DS7 Longitudinal Extrapolated Data by County. The DS2 dataset contains interpolated data for years 1991-1999,\textsuperscript{11} and the DS7 dataset contains extrapolated data for years 2001-2010.\textsuperscript{12}

The LEMAS surveys, which serves as the primary source of data for this study, measures a variety of administrative characteristics of law enforcement agencies across the US. The 1997, 2000, 2003, and 2007 panel years of the LEMAS survey were chosen for this analysis because they are the four most recent time points,\textsuperscript{13} the exclusion of previous years of the LEMAS survey maximized cross-sectional N size\textsuperscript{14}, and provided a large enough number of time points\textsuperscript{15} to maximize degrees of freedom in the pooled cross-sectional time-series models. Furthermore, while earlier panel years of the LEMAS survey could have been included in this study, they were excluded because the LEMAS survey changed in context considerably in 1997 leading to a greater degree of consistency in the 1997 and newer survey questionnaire items than in previous years.

\textsuperscript{11} Interpolation is a data imputation method that uses data from two or more different time reference points and estimates missing data points between the references.
\textsuperscript{12} Extrapolation is a data imputation method that uses data from two or more different time reference points and predicts missing data points that extend beyond the reference points based upon the linear trend that is established from the provided data.
\textsuperscript{13} The 2007 LEMAS survey was chosen as the end point for this time series study because it was the most current LEMAS data available to date.
\textsuperscript{14} Due to the fact that observations for individual police organizations must be matched and clustered across each of the panel years evaluated in the study, case attrition occurs every time an additional panel year is added to the study for a variety of reasons (i.e., data are not always complete across all time points, some police agencies did not respond to the survey in every panel year, and one or more data points maybe missing from one or more of the panel years).
\textsuperscript{15} The parameter estimates of the pooled cross-sectional time series (panel data) regression models used in this longitudinal study are more accurate with four time points (represented with each panel year) than three time points because it maximizes the degrees of freedom in the model.
This study uses a sub-sample of 380 local police departments drawn from the 1997, 2000, 2003, and 2007 LEMAS surveys; all agencies involved employed 100 or more full-time sworn police officers. Police organizations with 100 or more sworn officers has become the standard population of police organizations evaluated in large N police studies (Wilson, 2003; Hickman & Piquero, 2009). Additionally, it is important to note that the Census Bureau solicited every police organization in the United States with 100 or more full-time sworn officers to participate in the LEMAS survey.

Although there were 571 municipal police departments with 100 or more sworn officers in 2007, the subsample of 380 cases was chosen for a variety of reasons. First, the sample was restricted to agencies that responded to all four panels of the LEMAS survey. There were only 461 municipal police departments with 100 or more sworn officers in 1997; therefore, the sample was restricted to these 461 cases. Some agencies did not complete and return the LEMAS survey for all four of the panels, which resulted in further attrition. Additionally, the FBI UCR’s did not have crime rates for every municipal police department, which resulted in missing values and further attrition of the original 461 cases. Furthermore, STATA does a listwise deletion of all cases with missing observations, therefore all cases that had missing values in either dependent measures evaluated in this analysis were omitted from this study. The combination of each of these factors led to a total 18% attrition of the original 461 cases, resulting in a

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16 ORI codes were used to merge the FBI UCR’s with the LEMAS surveys. ORI’s are unique codes that were developed by the FBI to uniquely identify every municipal, county, state, and specialized police department.
final subsample of 380 cases which was used for all of the analyses conducted throughout this dissertation study.

**Dependent Variables**

To facilitate the accumulation of innovation research it is important to differentiate between different types of innovation, making the results of the research more accessible, meaningful, and comparable across studies (Wolfe, 1994). Following the work of Damanpour (1991) and Moore, Sparrow, and Spelman (1997), King (2000) classified innovation in police departments into four distinct types: administrative, technical, programmatic, and radical innovations. This study evaluates three of these four innovation types: technical, administrative, and programmatic innovations.

As previously described in the literature review, technical innovations change the equipment or hardware used to produce a product or service (i.e., information technology, computer software or hardware, mobile data terminals) (King, 2000; Willis & Mastrofski, 2011). Viewing technological developments as a technical innovation in municipal police departments, this study uses a *technology index* representing an aggregate measure of technological changes in local police departments. The *technology index* measure is an additive scale that documents agency uses of technology in a variety of areas, including those of crime analysis, personnel and equipment management, mobile data terminals accessible by patrol officers, and file storage. A summary of the survey items used in this index are presented in table 2.
Each of the technology-related variables used in the scale were dichotomously recorded responses in the LEMAS survey. The yes responses were coded as 1 and the no responses were coded as 0. The Cronbach’s Alpha value for this scale for years 1997, 2000, 2003, and 2007 were respectively 0.74, 0.74, 0.75, and 0.76. These scores ranging between 0.74 and 0.76 reflect a moderate and acceptable level of intra-scale reliability. Each of the principal components had an eigenvalue greater than 1.0 which is frequently used as a measure to determine the appropriate number of constructs that should be used in the model (Kim & Mueller 1978).

**Table 2. Survey Items for Computer Technology Index**

<table>
<thead>
<tr>
<th>Computerized crime analysis functions</th>
<th>Computerized files</th>
<th>Computerized files accessible to in-field/patrol officers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crime mapping</td>
<td>Arrests</td>
<td>Warrants</td>
</tr>
<tr>
<td>Crime analysis</td>
<td>Calls for service</td>
<td>Criminal history records</td>
</tr>
<tr>
<td>Criminal investigations</td>
<td>Fingerprints</td>
<td>Driving records</td>
</tr>
<tr>
<td>Analysis of community problems</td>
<td>Incident reports</td>
<td>Motor vehicle records</td>
</tr>
<tr>
<td></td>
<td>Warrants</td>
<td>Address history (i.e., repeat calls for service)</td>
</tr>
<tr>
<td></td>
<td>Stolen property</td>
<td>Crime analysis/ GIS/ crime mapping data</td>
</tr>
<tr>
<td></td>
<td>Crime analysis files</td>
<td></td>
</tr>
</tbody>
</table>

*Note*: Each of these survey items represent dichotomously coded (yes/no) questions in the LEMAS surveys.
Administrative innovations change the management of an organization by restructuring the administrative apparatus in which human and financial resources are mobilized (i.e., changes in personnel management or performance measures) (King, 2000; Willis & Mastrofski, 2011). First, it is reasonable to assume that agencies that reported having a greater number of written rule and procedures pertaining to a variety of areas of personnel management such as racial profiling, use of force, and high speed pursuit, may have had a substantive impact on the organizations' operations. Given this assumption, this study uses an agency's degree of formalization as a proxy for administrative innovation. The administrative innovation index measures the total number of written policies and procedures utilized by an agency (see table 3 on page 73). Each of the administrative measures used in the scale were dichotomously recorded responses in the LEMAS survey. The yes responses were coded as 1, and the no responses were coded as 0. Higher values for this index indicate a greater degree of administrative innovation. The Cronbach’s Alpha value for this additive scale for years 1997, 2000, 2003, and 2007 were 0.67, 0.57, 0.59, and 0.61 respectively. These scores ranging between 0.5 and 0.60 reflect a “miserable” level of internal consistency, and scores ranging from 6.0 to 7.0 reflect a “mediocre” but acceptable level of intra-scale reliability (Kim and Mueller, 1978, p.54). Although the alpha scores below 6.0 are considered to be unacceptable for measuring latent constructs, Kim and Mueller (1978) suggest that the decision to use a scale “ultimately must be a decision based upon theoretical justification” (p.55). Given that these concepts are not intended
to reflect unobserved latent constructs, but rather reflect an actual and observable number of formal policies within police organizations, high levels of internal reliability are arguably not as critical as the necessity to maintain consistent measure across multiple panels. This uniformity in measures is necessary to test the relative efficacy that contingency and organizational design theories have in explaining administrative innovations over time.

**Table 3. Survey Items for Administrative Innovation Index**

_Admistration innovations_
Does your agency have written policy directives on the following? Yes/No
Use of deadly force firearm discharge.
Use of less-than-lethal force.
Code of conduct and appearance.
Off-duty employment of officers.
Maximum work hours allowed for officers.
Dealing with the mentally ill.
Dealing with the homeless.
Dealing with domestic disputes.
Dealing with juveniles.
Strip searches.
Racial profiling.
Citizen complaints.
Off-duty conduct.
Interacting with the media.
Employee counseling assistance.
Finally, programmatic innovations (see Table 4 page 74) are the third dependent measure evaluated in this study. Programmatic innovations establish new units or operational responses within an organization to accomplish a new goal (i.e., development of a crime analysis unit, task force, and stakeouts, etc...) (King, 2000; Willis & Mastrofski, 2011). This study uses a measure of the number of special units within an organization that have at least one or more full-time personnel dedicated to their function as a direct measure for programmatic changes within an organization.

**Table 4. Survey Items for Programmatic Innovation Index**

*Programmatic innovations*
Does your agency have a separate special unit with one or more employees assigned full-time for any of the following problems or tasks? Yes/No
- Bias/ hate crimes
- Child abuse
- Community crime prevention
- Community policing
- Crime analysis
- Domestic violence
- Drug enforcement/ education
- Drunk drivers/ impaired drivers
- Gangs
- Internal affairs
- Juvenile Crime
- Missing children
- Repeat offenders
- Research and planning
- Victim assistance

74
Independent Variables

A variety of organizational and environmental factors, that are hypothesized to be significant correlates of innovations, and key structural components of police organizations were evaluated in this study. Internally focused organizational factors (measures of organizational design) evaluated in this study include hierarchical, functional, occupational, and spatial differentiation, formalization and administrative weight, community policing, and professionalism measures including training and screening measures for new recruits, and educational requirements. Additionally, the number of full-time sworn officers employed by each agency was used as a control for organizational size in both the organizational design theory and contingency theory models. Environmental factors evaluated in this study (measures of contingency theory) the agency’s operational budget per capita, violent crime and property crime rates per 100,000 residents, the percentage of single mothers, the percentage of unemployed adults, the percentage of minorities, the percentage of homeowners, the percentage of vacant houses, and the percentage of residents living under the poverty level in each community, and the ratio of African American income to white income.

Measures Relating to Organizational Design Theory

Data for all of the variables that are used in the organization design theory models including the number of full-time sworn police officers, hierarchical, functional, occupational, and spatial differentiation, formalization and administrative weight,
community policing, training and screening measures for new recruits, and educational requirements were drawn from the 1997, 2000, 2003, and 2007 LEMAS surveys.

This study uses the number of full-time sworn police officers employed by each agency as a control for agency size, which is a relatively standard measure of organizational size in studies of police organizations (Maguire, 2003; Wilson, 2005; Zhao, Ren, & Lovrich, 2010).

Functional differentiation was measured by adding the total number of specialized units within the police agency that had full-time personnel dedicated to their function. Agencies that had no staff dedicated to the specialized function were coded as 0 and agencies, with staff they were coded as 1. Higher scores on this measure reflect a higher degree of functional differentiation within the agency. Spatial differentiation was measured using a survey question that asked how many facilities, precincts, or community sub-stations separate from the department’s headquarters were operated by the agency. A higher score on this measure indicates a higher degree of spatial differentiation within the agency. It is important to not confuse a high level of spatial differentiation with the concept of decentralization as it applies to police organizations (Wilson, 2005). Decentralization refers to the horizontal flattening of the hierarchical command structure in which decisions are made, which is not necessarily related to the spatial or geographical dispersion of the police organization’s operations.

Occupational differentiation was operationalized as the ratio of full-time administrative personnel (non-sworn employees), and full-time sworn police officers.
Higher ratios (ranging from 0 to 1) on this variable indicate a higher proportion of administrative personnel in relation to police officers with general arrest powers.

The research literature suggests that agencies that are highly invested in community policing programs may have also invested in crime analysis technologies to assist their crime-fighting efforts (Ratcliffe, 2008). Additionally, conflicting hypotheses are found in the policing literature concerning the co-implementation of community policing and use of crime mapping used for hot spot policing approaches. One perspective contends that community policing efforts and the use of hot spot policing may be rather conflicting goals, whereas another perspective contends that the two goals in many respects are quite compatible (Willis, Mastrofski, Kochel, 2010). To test these equally plausible propositions a community policing index will be used which represents an additive scale of survey items pertaining to community policing activities including COP planning and training, SARA-type problem solving, problem solving criteria used in officer evaluations, and police-citizen interaction (appendix A). The Cronbach’s alpha score for this scale was 0.67, and factor loadings for these items ranged from 0.44 to 0.66.

Whereas the goal of community policing is to employ a bottom-up and community-focused approach to policing, data-driven policing strategies that utilize crime mapping and hot spot policing technologies are consistent with a “top-down and hierarchical” management model (Ratcliffe, 2008, p.87; Willis et al. 2007). Considering the observation that data-driven policing strategies that utilize crime mapping and hot spot policing technologies can be used to reinforce exiting hierarchical organizational
structures (Manning, 2008; Willis et al. 2007), it is reasonable to expect that agencies that are most heavily invested in crime analysis technologies may have greater degrees of *hierarchical differentiation* given that data-driven approaches to policing management utilize and rely upon hierarchical structure. *Hierarchical differentiation* measures the magnitude of the vertical command structure of an agency (Maguire, 1997).

In the context of this study *hierarchical differentiation* was operationalized as the ratio between the chief executive’s salary and the base salary for entry-level police officers. Other scholars studying police organizational structures have also operationalized hierarchical differentiation in this manner (Langworthy, 1986; Hickman & Piquero, 2009). Larger values for this variable indicate greater degrees of disparity between the salary of the entry-level officer and the chief executive, which serve as an indicator of greater degrees of *hierarchical differentiation*. There are some notable limitations to the operationalization of *hierarchical differentiation* as the ratio between the chief executive’s salary and the base salary for entry-level police officers, particularly because this measure is merely a proxy for the number of hierarchical ranks within an organization and does not directly measure these ranks. This limitation will be acknowledged in the interpretation of the results in the discussion section of this paper.

Following from the work of Wilson (2003, 2005), indicators of professionalism contained in the LEMAS dataset were used in this study as measures of structural control. These measures include *employment screens*, *training requirements* for new recruits and in-service field/patrol officers, and *education requirements*. The *employment screens* measure represents the sum of the number of screening...
techniques that were used by each agency in selecting new recruits. In these survey items agencies indicated whether they used personal interviews, drug testing, psychological evaluations, polygraph exams, written aptitude tests, physical agility tests, criminal record checks, driving record checks, as well as some other requirements (see appendix B). The second measure of professionalism, *training requirements* for new recruits, assessed the total number of hours (measured in units of 100) of both classroom and in-field service training requirements for new recruits. The third measure of professionalism assessed *educational requirements* for new recruits. Agencies that required no formal education for new recruits were coded as 0, agencies that required a high school diploma or equivalent were coded as 1, those that required at least some college but no degree were coded as 2, agencies that required a two-year or associates degree were coded as 3, and agencies that required a four year-degree for new recruits were coded as 4.

Wilson (2003) used these survey items of the LEMAS survey to measure professionalism in a similar manner. Wilson's (2003) study used confirmatory factor analysis to assess whether these indicators represented a single underlying construct of professionalism. He also used a second order measurement model to test whether these measures were associated with the second order factor of structural control. Wilson concluded that although these indicators did not represent a uni-dimensional concept of professionalism; the findings reported did indicate that these measures were important indicators of structural control.
Measures Relating to Contingency Theory

This study uses a variety of environmental/community context measures that were used by Zhao, Ren, and Lovrich (2010) and other scholars to test the utility of contingency theory. These measures include organizational size represented as the number of full-time sworn police officers employed by each agency, the agency's operational budget per capita, violent crime and property crime rates per 10,000 residents, the percentage of single mothers, the percentage of unemployed adults, the percentage of minorities, the percentage of homeowners, the percentage of vacant houses, and the percentage of residents living under the poverty level in each community, and the ratio of African American income to white income.

Organizational size is an important contingency factor because the size of a public service organization such as a law enforcement agency is greatly dependent upon the size of the jurisdiction or population that it serves. Data for the organizational size variable was drawn from the 1997, 2000, 2003, and 2007 LEMAS surveys and is represented in this study as the number of full-time sworn police officers employed by each agency.

Fiscal resources are an important contingency theory for any public service organization; considering the fact that operational budgets are allocated to police departments by municipal governments. The budgeting process for local police departments is a political process that is contingent upon a variety of factors including public support for the police, and local government revenues (e.g., revenues sources for
local governments are variable and are generated primarily through local taxes such as property taxes, sales taxes, or excise taxes). This study uses a budget per capita measure to represent the availability of fiscal resources to an organization. Data for the agency's operational budget per capita variable were drawn from the 1997, 2000, 2003, and 2007 LEMAS surveys. It seems reasonable to assume that police departments faced with budgetary resource constraints may have used technologies as an innovative solution to manage crime related problems more effectively. Alternatively, research shows that agencies that have slack resources\(^{17}\) may also be in a more auspicious position to invest in technical innovations (Damanpour, 1991). To test these hypotheses each agency's operational budget per capita was used to assess the availability of agency resources relative to the size of the jurisdiction that they serve.

Data for the violent and property crime variables were drawn from the FBI's 2003 Uniform Crime reports dataset. Violent crime represents the total number of murder and non-negligent man-slaughters, forcible rapes, robberies, and non-aggravated assaults per 100,000 residents, whereas property crime measures the total number of burglaries, larceny-thefts, motor vehicle thefts, and arson per 100,000 residents. The raw crime rates were divided by the population of each jurisdiction (broken down to units) to compile figures for the rate of crimes per 100,000 residents.

Data for a number of variables used for the contingency theory models were drawn from the RAND Center for Population Health and Health Disparities (CPHHD)

\(^{17}\) Slack resources represent “underutilized resources within a company that may be recaptured and employed for a variety of tasks” (Adkins, 2005).
Data Core Series; including the percentage of single mothers, the percentage of unemployed adults, the percentage of minorities, the percentage of homeowners, the percentage of vacant houses, and the percentage of residents living under the poverty level in each community, and the ratio of African American income to white income.

Methodological Plan for Data Analysis

Chapter Five of this study will first present the results for the descriptive analysis. The descriptive analysis will first summarize the mean, standard deviations, and ranges for each of the independent and dependent measures for each of the four panel years. Second, the descriptive analysis will evaluate the degree of variance for each of the dependent and independent measures over time across the four panel years through the analysis of empirical growth plots.

Second, Chapter Five will present the results of the multivariate data analysis. The multivariate data analyses assess the results of six pooled cross-sectional time series models that separately regress the three dependent measures (i.e., technical, programmatic, and administrative innovations) onto the predictors of both organizational design and contingency theories. Pooled cross-sectional time series (two way random-effects) models were chosen for this study because they are an appropriate method for simultaneously estimating the cross-sectional and time series variance (panel variance) for repeat measures data. Data diagnostics for each of these models will be discussed.
CHAPTER 5
RESULTS

Introduction

This chapter presents the results of both descriptive and multivariate panel data analyses employed in this study to address the research questions identified in Chapter 4. The descriptive analysis first summarizes the descriptive statistics including means, standard deviations, and ranges for all dependent measures that were used in this study (i.e., technical, administrative, and programmatic innovations). Second, the descriptive analysis evaluates empirical changes in the distributions of the dependent measures over the period 1997 to 2007. Next, the analysis evaluates other descriptive statistics including means, standard deviations, and ranges for each of the independent measures used in both the organizational design theory and contingency theory models, and assesses changes in the distributions of these independent measures across the panel years.

Following the descriptive analysis an overview of the methods used to formulate the statistical models employed in the multivariate panel data analysis is presented (i.e., pooled cross-sectional time series models). In addition to describing the models that were chosen this section also summarizes the results of the diagnostic tests and analyses for the multivariate panel data analysis; these diagnostic tests provide an
assessment of the distributions of each of the dependent measures, assessment of variance inflation factors (VIF’s), and describes the steps taken to mitigate potential threats of multicollinearity. Scatter plots are used to assess homoscedasticity; and additional statistical tests are used to test for auto-correlation in the panel data.

This chapter concludes with a thorough evaluation of the six multivariate panel data analysis models that to address the research questions of this study. First, this section presents the results of Models 1, 2, and 3, which regress the three dependent measures evaluated in this study (i.e., technical, administrative, and programmatic innovations) onto the predictors of organizational design theory. Second, results from Models 4, 5, and 6 are presented, which regress technical, administrative, and programmatic innovations on the predictors of contingency theory.

**Descriptive Analysis**

Table 5 (page 85) presents the descriptive statistics for the three dependent measures, which include *technical, administrative* and *programmatic innovations*. As stated in the previous Methods Chapter, *technical innovation* was operationalized as an additive scale of technologies used by police agencies to assist in crime analysis and other crime control operations, file storage and access, and a variety of management functions. *Administrative innovation* was operationalized as an additive measure of formal policies adopted by agencies, whereas *programmatic innovation* was operationalized as an aggregate measure of the number of special units operating within each agency. The *technical innovation* variable was time-variant across the four
panel years, which is demonstrated by the fact that the mean number of technologies adopted by police agencies increased steadily and consistently across the panel years increasing from a mean of 10.97 in 1997 to 14.08 in 2007; this reflects an average rate of increase of roughly 10% from one panel year to the next.

**Table 5.** Descriptive Statistics for all Dependent Measures

<table>
<thead>
<tr>
<th></th>
<th>1997 M (SD)</th>
<th>2000 M (SD)</th>
<th>2003 M (SD)</th>
<th>2007 M (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Technical innovations</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technology index</td>
<td>10.97 (3.28)</td>
<td>11.09 (3.32)</td>
<td>12.49 (3.43)</td>
<td>14.08 (2.91)</td>
</tr>
<tr>
<td><strong>Administrative innovations</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reported number of formal policies</td>
<td>12.44 (2.27)</td>
<td>7.99 (0.65)</td>
<td>13.42 (1.50)</td>
<td>14.46 (0.54)</td>
</tr>
<tr>
<td><strong>Programmatic innovations</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of special units</td>
<td>8.99 (4.16)</td>
<td>7.89 (3.94)</td>
<td>8.16 (4.04)</td>
<td>8.58 (3.85)</td>
</tr>
</tbody>
</table>

**Notes:** M represents the mean. SD represents the standard deviation. Min reflects minimum value in the range of the variable’s distribution, and Max reflects the maximum number in the range. The range for the administrative innovation measure for 2000 was 0 to 12. Methodological steps that were used to correct for this error are reported in Footnote #10.
The *administrative innovation* variable (see Table 5 page 85) was also time-variant, and modestly increased from a mean number of 12.44 reported formal policies in 1997 to a mean of 14.46 in 2007. There was an average rate of increase of roughly 5% from one panel year to the next. The mean number of reported policies was substantially smaller in the 2000 panel year than the 1997, 2003, and 2007 panel years. This smaller mean occurred because the 2003 LEMAS survey contained far fewer questions regarding formalization than the 1997, 2003, and 2007 LEMAS surveys. To correct for this problem in the panel data analysis the observations for the *administrative innovation index* for the panel year 2000 were omitted from the multivariate panel data analysis.\(^{18}\)

The *programmatic innovation* variable (see Table 5 page 85) was time-invariant which is demonstrated in the fact that the mean for this variable changed very little between the four panel years. In fact, the mean number of special units operating in each agency decreased negligibly, with police agencies operating with an average number of 8.99 special units in 1997, and a mean number of 8.58 special units in 2007.

\(^{18}\) Observations for the *administrative innovation index* for the panel year 2000 were omitted from the panel data analysis Models 2 and 5, which each use *administrative innovation* as a dependent measure. Corrections were also made to the *formalization index*, which was used as an independent measure in panel data analysis Models 1 and 3. Given that the independent variable in the organizational design theory model labeled *formalization* also measures the adoption of formal policies, additional corrections were made. The inconsistency in measurement of this variable was corrected by converting each of the observations into z-scores using the mean and standard deviations of the raw distribution of the formalization variable for each of the panel years. The problem posed by inconsistent measurement of this variable across panels was arguably mitigated given that z-scores are standardized units of variance that can reliably be compared across different samples even if they are measured differently.
Table 6. Descriptive Statistics for all Independent Measures: Organizational Design Theory Model

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>1997 M (SD)</th>
<th>2000 M (SD)</th>
<th>2003 M (SD)</th>
<th>2007 M (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Organizational</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of full-time sworn officers</td>
<td>499 (2060)</td>
<td>503 (2140)</td>
<td>497 (1953)</td>
<td>486 (1917)</td>
</tr>
<tr>
<td>Occupational differentiation (i.e., % of civilian employees)</td>
<td>0.27 (0.10)</td>
<td>0.30 (0.09)</td>
<td>0.25 (0.09)</td>
<td>0.26 (0.09)</td>
</tr>
<tr>
<td>Hierarchical differentiation</td>
<td>3.08 (1.98)</td>
<td>3.00 (0.74)</td>
<td>3.11 (0.71)</td>
<td>3.19 (0.76)</td>
</tr>
<tr>
<td>Spatial differentiation</td>
<td>5.46 (13.68)</td>
<td>5.75 (9.63)</td>
<td>5.39 (9.81)</td>
<td>5.53 (10.36)</td>
</tr>
<tr>
<td>Functional differentiation (i.e., number of special units)</td>
<td>8.99 (4.16)</td>
<td>7.89 (3.94)</td>
<td>8.16 (4.00)</td>
<td>8.58 (3.84)</td>
</tr>
<tr>
<td>Formalization (number of formal policies)</td>
<td>12.44 (2.27)</td>
<td>7.99 (0.65)</td>
<td>13.42 (1.50)</td>
<td>14.46 (0.54)</td>
</tr>
<tr>
<td>Community policing index</td>
<td>3.16 (1.42)</td>
<td>3.07 (1.34)</td>
<td>3.17 (1.48)</td>
<td>3.08 (1.69)</td>
</tr>
<tr>
<td><strong>Professionalism</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Educational requirements</td>
<td>2.1 (0.30)</td>
<td>2.5 (0.31)</td>
<td>2.9 (0.45)</td>
<td>2.6 (0.44)</td>
</tr>
<tr>
<td>Screening measures</td>
<td>8.29 (1.16)</td>
<td>8.25 (1.11)</td>
<td>8.33 (0.92)</td>
<td>8.57 (0.79)</td>
</tr>
<tr>
<td>Training hours (by 100)</td>
<td>11.17 (4.46)</td>
<td>12.72 (3.74)</td>
<td>14.11 (4.02)</td>
<td>14.49 (4.24)</td>
</tr>
</tbody>
</table>

Notes: M represents the mean. SD represents the standard deviation.

Table 6 displays the descriptive statistics for the independent measures used in the organizational design theory models. First, the number of full-time sworn officers, which was used as a control variable reflecting agency size in this study, decreased.
across the four panels. In 1997 agencies in the sub-sample employed an average number of 499 full-time sworn officers whereas in 2007 they employed an average of 486 sworn officers reflecting a decrease of 2.6% in the mean number of sworn officers between the years 1997 and 2007. *Occupational differentiation*, which was operationalized as the proportion of administrative staff employed by an agency relative to the total full-time sworn police force, was time-invariant with an average of 27% of an agency’s workforce consisting of civilian employees with administrative duties. The degree of *hierarchical differentiation* was also time-invariant and changed very little across the four panels. In each of the four years police chief’s made on average three times the salary of an entry-level sworn police officer. *Spatial differentiation* also changed very little across the panels, with each agency reporting on average 5.5 locations for their policing operations.

Agency adoption of community policing practices represented by the *community policing index* also changed very little across the four panels. In 1997 agencies in the sub-sample reported having adopted a mean number of 3.16 out of six community policing practices within a 12-month period. Whereas in 2007 agencies reported having adopted a mean number of 3.08 out of 6 (See Appendix A for questionnaire items). Although *educational requirements* and *screening measures* changed very little over the panel years, training requirements for police agencies increased over the period 1997 to 2007. In 1997 the mean number of hourly *training requirements* for new recruits was 1,100 hours, in 2007 this number increased to an average of 1,450 training hours,
reflecting an overall increase of 32% in the number of required training hours over the period 1997 to 2007.

Table 7 (page 90) reports the descriptive statistics for each of the independent measures used in the contingency theory panel-data analysis models. The descriptive statistics for the contingency theory measures show that violent crime rates in the jurisdictions contained within this sample of American municipal police departments rose slightly from 397 to 406 violent crimes per 100,000 residents; the violent crimes documented are murder and non-negligent man-slaughter, forcible rape, robbery, and non-aggravated assault. This reflects a 2.3% increase in violent crimes over the period 1997 to 2007. These figures are somewhat below national averages; the FBI reported a violent crime rate of 661 per 100,000 residents in 1997 and 467 per 100,000 in 2007. Additionally, among the sub-sample there was an average of 2,903 property crimes per 100,000 residents reported in 1997, which includes the total number of burglaries, larceny-thefts, motor vehicle thefts, and arsons per 100,000 residents. Within the sample the average property crime rate was 2,862 property crimes per 100,000 residents in 2007. This reflects a marginal decrease in property crime between the years 1997 and 2007 within the sub-sample. Additionally, among the sample of municipal police departments used in this study, property crimes were also somewhat below the national average.
Table 7. Descriptive Statistics for all Independent Measures: Contingency Theory Models

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of full-time sworn officers</td>
<td>499 (2060)</td>
<td>503 (2140)</td>
<td>497 (1953)</td>
<td>486 (1917)</td>
</tr>
<tr>
<td>Violent crime rate per 100k residents</td>
<td>397.4 (781.8)</td>
<td>397.5 (828.1)</td>
<td>389.1 (784.3)</td>
<td>405.6 (752.9)</td>
</tr>
<tr>
<td>Property crime rate per 100k residents</td>
<td>2,902 (2100)</td>
<td>2,928 (1860)</td>
<td>2,945 (1796)</td>
<td>2,861 (1590)</td>
</tr>
<tr>
<td>Operational budget per capita</td>
<td>152.9 (76.8)</td>
<td>191.2 (96.9)</td>
<td>214.9 (78.3)</td>
<td>219.2 (117.4)</td>
</tr>
<tr>
<td>% of minorities</td>
<td>0.26 (0.15)</td>
<td>0.29 (0.16)</td>
<td>0.31 (0.17)</td>
<td>0.34 (0.17)</td>
</tr>
<tr>
<td>% of single-mother households</td>
<td>0.08 (0.02)</td>
<td>0.08 (0.02)</td>
<td>0.07 (0.02)</td>
<td>0.07 (0.02)</td>
</tr>
<tr>
<td>% below poverty level</td>
<td>0.08 (0.001)</td>
<td>0.08 (0.003)</td>
<td>0.09 (0.001)</td>
<td>0.09 (0.002)</td>
</tr>
<tr>
<td>% of unemployment</td>
<td>0.06 (0.02)</td>
<td>0.06 (0.02)</td>
<td>0.06 (0.02)</td>
<td>0.06 (0.02)</td>
</tr>
<tr>
<td>Ratio of Black to White income</td>
<td>0.63 (0.18)</td>
<td>0.64 (0.19)</td>
<td>0.65 (0.20)</td>
<td>0.67 (0.19)</td>
</tr>
<tr>
<td>Technology index</td>
<td>10.97 (3.28)</td>
<td>11.09 (3.32)</td>
<td>12.49 (3.43)</td>
<td>14.08 (2.91)</td>
</tr>
<tr>
<td>% of Home owners</td>
<td>0.62 (0.08)</td>
<td>0.64 (0.08)</td>
<td>0.65 (0.08)</td>
<td>0.64 (0.08)</td>
</tr>
<tr>
<td>Number of vacant houses (by 100)</td>
<td>312.1 (386.7)</td>
<td>296.9 (361.6)</td>
<td>283.6 (339.4)</td>
<td>290.3 (351.4)</td>
</tr>
</tbody>
</table>

Notes: M represents the mean. SD represents the standard deviation.

There are several possible explanations for the discrepancies between national average crime rates and the average crime rates for the sample used in this study. First, the sample of municipal police departments chosen for this study is reflective of the largest American municipal police departments in the United States that employing
100 or more full-time sworn officers; this is by no means representative of all police departments in the United States.

Second, considering that many American cities have experienced processes of gentrification and revitalization throughout the 1990s and 2000s, it is possible that crime rates had decreased in the relatively larger urban jurisdictions contained within this sample (McDonald, 1986; Papachristos, Smith, Scherer, & Fugiero, 2011). Research suggests that as a result of the processes of gentrification crime becomes displaced outside of the urban core because a greater proportion of middle-income residents occupy inner city residencies subsequently leading to higher property values and higher rents, which results in a decrease in crime rates; principally because lower-income residents whom have a greater likelihood of committing crime move out of the urban core to other areas where housing is more affordable (McDonald, 1986). McDonald (1986) studied the impact that the process of gentrification in five American cities had on crime rates from 1970 to 1984. He found that gentrification eventually leads to lower personal crime rates. Papachristos et al. (2011) found that the processes of gentrification were associated with lower homicide rates in predominately white neighborhoods.

Another possible explanation for the discrepancy in crime rates experienced among jurisdictions in this study's sample and the national average crime rates is that there is a possible self-selection bias in the police departments that responded to all four panels of the LEMAS survey, such that police departments which experienced higher crime rates may had been underrepresented in the four panels of the LEMAS
survey and/or the FBI UCR reports. Consequently, due to these attributes of the sample it is not surprising that these larger jurisdictions experienced crime rates differing somewhat from the national average.

The average operational budgets per capita for municipal police departments employing 100+ sworn officers increased by 43% over the period 1997 to 2007. Also, the percentage of racial minorities relative to whites living in the communities that were served by police agencies in this sample increased by an average of 8% between 1997 and 2007. In contrast, the percentage of households with single mothers, the percentage of residents that were unemployed, and the percentage of residents living under the federal government’s official poverty level remained unchanged between the years 1997 and 2007. Furthermore, the ratio of black to white income increased from 64% to 67%, and the percentage of residents that were home owners increased from 62 to 64% between the years 1997 and 2007. Interestingly, the percentage of vacant homes in the communities served by America’s largest police departments decreased by 7% between the years 1997 and 2007. This decrease in signs of urban decay likely resulted from the processes of gentrification and revitalization that occurred in many American cities in time frame of this study (McDonald, 1986; Papachristos, Smith, Scherer, & Fugiero, 2011).

**Model Specification and Diagnostics**

Pooled cross-sectional time series analyses (panel data analyses) were used for the multivariate analyses conducted in this study. More specifically, two-way random
effects models using Generalized Least Squares (GLS) estimation were specified for the multivariate panel data analyses undertaken. Generalized Least Squares estimation was chosen for each of the three dependent measures (i.e., technical, administrative, and programmatic innovations) because the frequency distributions for these measures each more closely resembled a Gaussian distribution as opposed to Poisson distributions (See Appendices C, D, and E). Furthermore, two-way random effects models were chosen as opposed to a fixed effects model because the Hausman specification test indicated that there were significant random effects\textsuperscript{19} in all six of the pooled cross-sectional time series models including three organizational design and three contingency theory models. STATA statistical software was used to conduct all of the statistical analyses presented in this study.

Bivariate correlations between each of the independent variables in the organizational design theory models were not high enough to warrant concerns about multicollinearity (See Appendices F, G, H, and I). A variance inflation factor (VIF) test was run and the mean VIF score for the organizational design theory model was 1.28 (See Appendix N). The relatively low VIF scores in the organizational design theory model further suggest that multicollinearity is not a concern. As a general rule of thumb followed by many scholars, multicollinearity becomes a concern when VIF values exceed 4 (Fischer & Mason, 1981).

\textsuperscript{19} The Hausman test compares the fixed versus random effects by testing the null hypothesis that the individual effects are uncorrelated with other predictors in the model. The results in the model were insignificant, suggesting that there were random effects in each of the models. Given these results it is appropriate to specify the statistical models as two-way random effects models.
Bivariate correlations between most of the independent variables in the contingency theory models were relatively low; however, some of the bivariate correlations were rather high, warranting concerns about potential multicollinearity (See Appendices J, K, L, and M). In particular, the bivariate correlations between the percentage of residents under the poverty level and the percentage of unemployed residents, and between the property crime and violent crime rates were each higher than acceptable. A variance inflation factor (VIF) test was run and the mean VIF score for the contingency theory model was 2.62; however, the VIF scores for poverty (VIF=4.13), property crime (VIF=4.03), and violent crime (VIF=4.08) were each above 4, and therefore seen as unacceptably high (Appendix O). To correct for this problem the poverty and property crime variables were omitted from the models; this action reduced the mean VIF for the contingency theory model to 2.02. Additionally, the VIF for the violent crime rate variable was reduced from 4.08 to 2.90. With the mean VIF score being as low as 2.02, and with all individual VIF scores in the re-specified model being below 3.0, multicollinearity in the contingency theory model was no longer a concern.

Diagnostic analyses indicated that each of the organizational design and contingency theory models fulfilled the assumptions of the cross-sectional time-series analyses conducted in this study. The Wooldridge test for auto-correlation indicated that auto-correlation was not a concern. Auto-correlation is the correlation of an observation with subsequent observations of the same unit at later points in time. To test for heteroskedasticity, scatter plots of the residuals’ predicted values and with each
of the independent variables were evaluated. No clear patterns of heteroskedasticity were observed, indicating that violation of this assumption was not a concern.

**Multivariate Panel Data Analysis**

Table 8 (page 97) presents the standardized regression coefficients and robust standard errors (in parentheses) for the organizational design theory models. Model 1 regresses the predictors hypothesized by *organizational design theory* on *technical innovations* (i.e., *technological innovation index*). Whereas Model 2 regresses these measures on *administrative innovations* (i.e., number of formal policies), and Model 3 regresses these variables on *programmatic innovations* (i.e., number of special units). Results show that all three *organizational design theory* models were statistically significant (Wald $\chi^2$ values for Models 1, 2 & 3 were each had $p$ values that were less than <0.001), and did a better job overall of explaining variation in the dependent variables than baseline models with no predictors. Furthermore, results show that *organizational design theory* explained 17.5% of the variation in the *technical innovation index*, 18.2% of the variation in *administrative innovation index*, and 16.8% of the variation in *programmatic innovation index*. Moreover, roughly 14% of the variance in Model 1 was attributable to random effects, 12% in Model 2, and 10% in Model 3.

Model 1 (see Table 8 on page 97) see shows the results of the *technical innovation index* regressed on organizational design theory measures for the period 1997 and 2007. The findings from the analysis indicate that *organizational size, hierarchical differentiation, formalization, community policing, screening measures for*
new recruits, and training hours required for sworn field officers were each positively and significantly associated with technical innovations in municipal police departments.

Larger police departments employing a greater number of full-time sworn officers were relatively more technically and technologically innovative (p<0.001). Also, police agencies that were more hierarchically differentiated were also more technologically innovative from 1997 to 2007. A one-unit increase in hierarchical differentiation was associated with a 0.28-unit increase on the technical innovation index (p<0.05). Also, a one-unit increase in formalization predicted a 0.24-unit increase in the technical innovation index (p<0.05). Additionally, a one unit increase in the community policing index was associated with a 0.34-unit increase (p<0.001), a one-unit increase in screening measures was associated with a 0.22-unit increase (p<0.05), and a one-unit increase in training hours (each unit representing 100 training hours) was associated with a 0.22-unit increase in technical innovations occurring between 1997 and 2007 (p<0.001).

Model 2 (see Table 8 on page 97) shows the results of administrative innovations in municipal police departments regressed on organizational design theory measures over the period 1997 to 2007.\(^\text{20}\) Findings reported reveal that hierarchical differentiation, functional differentiation, educational requirements, screening measures, and training hours were each significant predictors of administrative changes between

\(^{20}\) Results are from pooled cross-sectional time series analysis (a.k.a. panel data analysis). Reported are two-way random-effects models using generalized least squares.
1997 and 2007. In contrast, occupational and spatial differentiation were each negatively, but significantly associated with administrative innovations.

**Table 8.** Panel Data Analysis: The effect of Technical, Administrative, and Programmatic Types of Innovation Regressed on the Predictors of Organizational Design Theory

<table>
<thead>
<tr>
<th></th>
<th>Technical innovation: Adoption of technology</th>
<th>Administrative innovation: Number of formal policies</th>
<th>Programmatic innovation: Number of special units</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Model 1</strong></td>
<td>β</td>
<td>β</td>
<td>β</td>
</tr>
<tr>
<td><strong>Model 2</strong></td>
<td>-0.000 (0.000)**</td>
<td>-3.377 (0.666)**</td>
<td>0.612 (0.248)**</td>
</tr>
<tr>
<td><strong>Model 3</strong></td>
<td>0.000 (0.000)**</td>
<td>0.015 (0.004)**</td>
<td>0.000 (0.000)**</td>
</tr>
</tbody>
</table>

**Organizational**

Total full-time sworn officers: 0.000 (0.000)**
Occupational differentiation: -0.985 (0.894)
Hierarchical differentiation: 0.284 (0.134)*
Spatial differentiation: 0.013 (0.012)
Functional differentiation: 0.353 (0.094)
Formalization: 0.243 (0.024)**
Community policing: 0.341 (0.063)**

**Professionalism**

Educational requirements: 0.439 (0.229)
Screening measures: 0.202 (0.089)*
Training hours (by 100): 0.125 (0.019)**

ρ: 0.141
Wald χ²: 297.70***
R²: 0.175

**Notes:**
*p <0.05, **p <0.01, ***p<0.001.
Robust standard errors are shown in parentheses.
β represents standardized coefficients.
ρ reflects the fraction of variance due to random effects.

Number of observations = 1,520. Number of between-groups = 380. Model 2 also has 380 groups, but only uses 1,140 observations because 380 observations from panel year 2000 were omitted due to an inconsistency in measurement in the LEMAS survey.
A one-unit increase in *hierarchical differentiation* predicted a 0.32-unit increase in the *administrative index* (p<0.05), whereas one unit increase in *functional differentiation* predicted a 0.12 unit increase in *administrative innovations* (p<0.001). Additionally, a one-unit increase in *educational requirements* was associated with a 0.88-unit increase in *administrative innovation* (p<0.001). Moreover, a one-unit increase in screening measures was associated with a 0.28-unit increase (p<0.001), and a one-unit increase in training hours (by 100) was associated with a 0.05-unit increase in *administrative innovation* (p<0.001). Conversely, a one-unit increase in *occupational differentiation* (% of civilian employees) was predictive of a one-unit decrease in *administrative innovations* (p<0.001), and a one-unit increase in *spatial differentiation* was associated with a 0.03-unit decrease in *administrative innovations* (p<0.01).

Model 3 (see Table 8 on page 97) sets forth the results of *programmatic innovations* in municipal police departments regressed on *organizational design theory* measures for the period 1997 to 2007. In Model 3 *organization size, hierarchical, occupational, and spatial differentiation, community policing, screening measures, and training hours* were each statistically significant predictors of *programmatic* changes in municipal police departments.

In Model 3 larger police organizations that employed a greater *number of full-time sworn police officers* were also more likely to have a greater number of special units and programs (p<0.05). Additionally, police organizations that featured greater
degrees of *hierarchical, occupational, and spatial* organizational complexity also developed a greater number of special units and programs. A one-unit increase in *hierarchical differentiation* predicted a 0.13-unit increase in *programmatic innovations* (p<0.001). Furthermore, a one-unit increase in *occupational differentiation* (having a greater proportion of civilian employees) was associated with a 0.61 unit increase in *programmatic innovations* (p<0.05), whereas a unit increase in *spatial differentiation* (the number of locations for police operations) was associated with a 0.015-unit increase in *programmatic innovations* (p<0.001).

Police departments that underwent community policing initiatives were also more likely to increase their number of special units. A one-unit increase in the *community policing index* was associated with a 0.10-unit increase in *programmatic innovations* (p<0.001). Moreover, police departments that were more professionalized in terms of having a higher number of *screening measures* for sworn officers and a greater number of *training requirements* were also significantly more likely to develop a greater number of special units. A one-unit increase in screening measures predicted a 0.076-unit increase in the number of special units (p<0.01), and a one-unit increase in *training hours* (by units of 100) predicted a 0.03-unit increase in *programmatic innovations* (p<0.001).

Table 9 (page 101) shows the standardized regression coefficients and robust standard errors (in parentheses) for the *contingency theory* models.²¹ Model 4

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²¹ Results are from pooled cross-sectional time series analysis (a.k.a. panel data analysis). Reported are two-way random-effects models using generalized least squares.
regresses the predictors hypothesized by contingency theory on the *technical innovation index* (i.e., technological innovation index). Model 5 regresses these measures on the *administrative innovation index* (i.e., number of formal policies), and model 6 regresses these variables on the *programmatic innovation index* (i.e., number of special units). Results show that all three *contingency theory* models were statistically significant overall (Wald $\chi^2$ values for Models 4, 5 & 6 each had $p$ values that were less than $<0.001$), and did a better job of explaining variation in the dependent variables than a baseline model featuring no predictors. Additionally, results show that contingency theory explained 13.2% of the variation in the *technical innovation index*, 10.1% of the variation in the *administrative innovation index*, and 14.6% of the variation in *programmatic innovation index*. Furthermore, roughly 18% of the variance in Model 4 was attributable to random effects, 11% in Model 5, and 12% in Model 6.

Model 4 (see Table 9 on page 101) shows the results of technical changes in municipal police departments regressed on *contingency theory* measures for the period 1997 to 2007. Results from Model 4 show that higher *violent crime rates*, *greater budgets per capita*, and *greater proportions of minorities*, and *greater presence of single mothers* in the community each significantly predicted *technical* (i.e., technological) developments in municipal police departments.

<table>
<thead>
<tr>
<th></th>
<th>Model 4</th>
<th>Model 5</th>
<th>Model 6</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Technical innovation:</strong> Adoption of technology</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total full-time sworn officers</td>
<td>0.000 (0.000)</td>
<td>-0.000 (0.000)</td>
<td>0.000 (0.000)</td>
</tr>
<tr>
<td>Violent crime rate per 100k</td>
<td>0.000 (0.000)**</td>
<td>0.000 (0.000)</td>
<td>0.000 (3.560)***</td>
</tr>
<tr>
<td>Operational budget per capita</td>
<td>0.003 (0.001)***</td>
<td>0.003 (0.002)</td>
<td>0.000 (0.000)</td>
</tr>
<tr>
<td>% of minorities</td>
<td>0.487 (0.186)***</td>
<td>0.881 (0.579)***</td>
<td>0.572 (0.224)*</td>
</tr>
<tr>
<td>% of single parent households</td>
<td>0.388 (0.505)***</td>
<td>0.921 (6.679)***</td>
<td>-0.626 (1.970)</td>
</tr>
<tr>
<td>% of unemployment</td>
<td>-1.720 (9.47)</td>
<td>-2.431 (5.272)</td>
<td>-2.169 (2.149)</td>
</tr>
<tr>
<td>% of black to white income</td>
<td>0.372 (0.461)</td>
<td>-1.510 (0.416)***</td>
<td>-0.042 (0.144)</td>
</tr>
<tr>
<td>% of Home owners</td>
<td>-0.285 (1.435)</td>
<td>1.780 (0.977)</td>
<td>0.095 (0.374)</td>
</tr>
<tr>
<td>Number of Vacant houses</td>
<td>-0.510 (1.261)</td>
<td>-1.981 (2.270)***</td>
<td>0.950 (9.091)</td>
</tr>
<tr>
<td>Technology index</td>
<td>---</td>
<td>0.099 (0.079)</td>
<td>0.146 (0.023)***</td>
</tr>
<tr>
<td><strong>Administrative innovation:</strong> Number of formal policies</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Programmatic innovation:</strong> Number of special units</td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>β</th>
<th>β</th>
<th>β</th>
</tr>
</thead>
<tbody>
<tr>
<td>p</td>
<td>0.177</td>
<td>0.11</td>
<td>0.116</td>
</tr>
<tr>
<td>Wald χ²</td>
<td>144.28***</td>
<td>270.20***</td>
<td>220.07***</td>
</tr>
<tr>
<td>R²</td>
<td>0.132</td>
<td>0.101</td>
<td>0.146</td>
</tr>
</tbody>
</table>

Notes:
*p < 0.05, **p < 0.01, ***p < 0.001.
Robust standard errors are shown in parentheses.
β represents standardized coefficients.
ρ reflects the fraction of variance due to random effects.
Number of observations = 1,520. Number of between-groups = 380. Model 2 also has 380 groups, but only uses 1,140 observations because 380 observations from panel year 2000 were omitted due to an inconsistency in measurement in the LEMAS survey.
As presented in Model 4 (page 101), higher violent crime rates were predictive of technical innovations in municipal police departments ($p<0.01$). Also, higher budgets per capita were also associated with technical changes in local police departments ($p<0.01$). Furthermore, a one-unit increase in the percentage of minorities living in the community was associated with a 0.49-unit increase in technical innovations ($p<0.01$), and a one-unit increase in the percentage of single mother households in the community was associated with a 0.39-unit increase in technical innovations that occurred between the years 1997 and 2007 ($p<0.01$).

Model 5 (see Table 9 on page 101) shows the results of administrative innovations in municipal police departments regressed on contingency theory predictors between the years 1997 and 2007. Findings show that greater proportions of minorities and single mother households in the community predicted administrative innovations in municipal police departments. On the other hand, greater proportions of black to white income and a higher number of vacant homes in the community were negatively associated with administrative innovations.

Findings from model 5 indicate that a one-unit increase in the percentage of minorities living in the community was associated with a 0.89-unit increase in administrative innovations ($p<0.01$), and a one-unit increase in the percentage of single mother households in the community was associated with a 0.92-unit increase in administrative innovations ($p<0.01$). On the other hand, one-unit increases in the ratio of black to white income was associated with decreases in administrative innovations ($p<0.01$).
Model 6 (see Table 9 on page 101) shows the results of programmatic innovations in municipal police departments regressed on contingency theory measures between 1997 and 2007. Results from Model 6 reveal that higher violent crime rates, greater proportions of minorities in the community, and higher degrees of technological development each predicted increases in programmatic innovations in municipal police departments.

Results from model 6 show that higher violent crime rates were predictive of programmatic innovations in municipal police departments ($p<0.01$). Also, a one-unit increase in the percentage of minorities living in the community was predictive of 0.57-unit increase in the programmatic innovations ($p<0.01$). Findings from model 6 also show that a one-unit increase in the degree of technological capacity in police organizations was associated with a 0.15-unit increase in programmatic innovations between the years 1997 and 2007 ($p<0.01$).

Conclusion

In closing, this chapter first provided a summary of the results of descriptive analyses of the dependent and independent measures employed in this study. Second, this chapter described the methodological and statistical tests used to develop and diagnose the multivariate panel data analysis models that were assessed in this study. Lastly, this chapter summarized the findings of the multivariate panel data analysis models that were constructed to test the relative efficacy that organizational design theory and contingency theory had in explaining technical, administrative, and
programmatic innovations occurring in municipal police departments over the period 1997 to 2007. The following chapter titled “Discussion and Conclusion,” interprets these findings and explicates their implications for addressing the research questions of the current study. The chapter concludes with a discussion of the implications of these findings for both the organizational innovation research literature and the development of appropriate public policy.
CHAPTER 6
DISCUSSION AND CONCLUSION

Introduction

The objective of this dissertation study is to contribute to the police innovation literature by testing a number of hypothesized predictors of police innovations and address the specific research questions that were identified in Chapters 1 and 4 (research questions are listed in following section). This chapter begins by discussing how well the findings presented in Chapter 5 address each of this study’s research questions. The following section of this chapter reviews the findings from Chapter 5 and discusses additional implications that these findings have for the police innovation literature. The next section of this chapter addresses the limitations of this study. The final section of this chapter discusses the potential implications that this study has for appropriate policing policy and practice. The conclusion to this chapter summarizes key findings that can be taken home from this study.

Addressing the Research Questions

1. Are technical, administrative, and programmatic innovations in police organizations principally the result of internal or external drivers of change?
In addressing Research Question 1 it is advisable to refer to Table 10, which presents a summary of the results for each of the multivariate panel data analysis models that were discussed in Chapter Five.

<table>
<thead>
<tr>
<th>Table 10. Summary of Findings from all Multivariate Panel Data Analyses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical innovation: Adoption of technology</td>
</tr>
<tr>
<td>Organizational Design Theory</td>
</tr>
<tr>
<td>Total full-time sworn officers</td>
</tr>
<tr>
<td>Occupational differentiation</td>
</tr>
<tr>
<td>Hierarchical differentiation</td>
</tr>
<tr>
<td>Spatial differentiation</td>
</tr>
<tr>
<td>Functional differentiation</td>
</tr>
<tr>
<td>Formalization</td>
</tr>
<tr>
<td>Community policing</td>
</tr>
<tr>
<td>Educational requirements</td>
</tr>
<tr>
<td>Screening measures</td>
</tr>
<tr>
<td>Training hours (by 100)</td>
</tr>
<tr>
<td>R²</td>
</tr>
<tr>
<td>Contingency Theory</td>
</tr>
<tr>
<td>Total full-time sworn officers</td>
</tr>
<tr>
<td>Violent crime rate per 100k</td>
</tr>
<tr>
<td>Operational budget per capita</td>
</tr>
<tr>
<td>% of minorities</td>
</tr>
<tr>
<td>% of single parent households</td>
</tr>
<tr>
<td>% of unemployment</td>
</tr>
<tr>
<td>% of black to white income</td>
</tr>
<tr>
<td>% of Home owners</td>
</tr>
<tr>
<td>% of Vacant houses</td>
</tr>
<tr>
<td>Technology index</td>
</tr>
<tr>
<td>R²</td>
</tr>
</tbody>
</table>
Results from the multivariate analyses (see Table 10 on page 106) show that organizational design theory did a better overall job than contingency theory of explaining organizational change in each of the three areas examined (i.e., technical, administrative, and programmatic innovations). The $R^2$ for the organizational design theory models show that the predictors of organizational design theory explained roughly 18% of the variation in technical innovations, 18% of the variation in administrative innovations, and 17% of the variation in programmatic innovations. On the other hand, the $R^2$ for the contingency theory models show that the predictors of contingency theory explained roughly 13% of the variation in technical innovations, 10% of the variation in administrative innovations, and 15% of the variation in programmatic innovations.

Based upon these findings it is reasonable to conclude that organizational design theory was overall a better predictor of technical, administrative, and programmatic innovations in municipal police departments than contingency theory; however, it is important to caution the reader that organizational design theory was only modestly better at explaining these innovations than contingency theory. Although organizational design theory explained 5% more variation in technical innovations and 8% more variation in administrative innovations than contingency theory explained, the theory explained only 2% more variation in programmatic innovations than contingency theory explained.

The finding that the predictors of organizational design theory (internal factors) were better predictors of technical innovations (i.e, technological developments),
administrative innovations (i.e., having a greater number of formal rules and policies), and programmatic innovations (i.e., having a greater number of special units) than contingency theory (external factors) is consistent with previous studies of organizational innovation in municipal police departments (Mullen, 1996; King, 1998). Consistent with this study’s finding that, organizational design theory predictors did a better job of explaining technological innovations than the predictors of contingency theory, Mullen’s (1996) study of information technology innovations in local police agencies found that internal departmental factors were the primary causes of technological innovations. Additionally, findings from this study are also consistent with King’s (1998) analysis of technical, administrative, and programmatic innovations in 432 municipal police organizations, which found that overall structural and administrative factors endogenous to police organizations were better predictors of innovation than environmental factors. Contrarily, findings from this study were inconsistent with Zhao’s (1996) study, which concluded that community policing innovations in local police departments were primarily the result of external environmental factors.

There are two explanations for these findings. First, it is not surprising that the findings from this study were consistent with the findings from both Mullen’s (1996) study of technological innovations and King’s (1998) study of technical, administrative, and programmatic innovations because both of these studies examined innovation types that were operationalized similarly to the innovation types examined in this study. The findings from these prior studies as well as the current study are generally consistent with research literature that suggests that if police department change does
occur, it’s most likely internally driven because police agencies are relatively insular and resistant to external demands for change due to the fact that police culture buffers the organization from external pressures (Miller, 1977; Brown, 1981; Greene, 2000; Crank, 2004; Manning, 1997, 2008).

Second, this study’s findings were inconsistent with Zhao’s (1996) study, which concluded that community policing innovations in local police departments were primarily the result of external environmental factors, most likely because Zhao’s study focused on community policing which is a fundamentally different type of innovation. Community policing is a radical innovation type, whereas findings from the current and previous studies (Mullen, 1996; King, 1998) focused on technical, administrative, and programmatic innovation types. Several experienced researchers have observed that few factors have consistently emerged as being predictive of organizational change, and that these inconsistencies likely result from the fact that the causes and conditions of innovation differ according to the type, nature, and circumstances surrounding the innovation (King, 1998; Willis & Mastrofski, 2011). Considering the fact that the correlates of innovation likely change due to the type of innovation in question and the circumstances surrounding the innovation, and observing the before mentioned findings from the research literature, it is reasonable to hypothesize that internal factors are better predictors of technical, administrative, and programmatic innovations than external factors (Mullen, 1996; King, 1998); however, external factors are better predictors of radical innovations (i.e., community policing) than internal factors (Zhao, 1996).
2. Do the correlates of innovation differ across innovation types (i.e., technical, administrative, and programmatic)?

The results from the multivariate panel data analyses show that several factors in both the organizational design and contingency theory models emerged as consistent predictors of different types of innovation (see Table 10 on page 106). For instance, in examining the results from the organizational design models several consistent correlates of different types of innovation emerged including the total number of full-time sworn police officer, community policing, hierarchical differentiation, screening measures, and the number of training hours required for officers. The total number of full-time sworn police officers and community policing were each positive and statistically significant predictors of both technical and programmatic innovations. Furthermore, Hierarchical differentiation, screening measures, and the number of training hours required for officers were each positive and statistically significant predictors of all three innovation types including technical, administrative, and programmatic innovations.

Furthermore, in examining the results from the contingency theory models several consistent correlates of different innovation types also emerged including violent crime rates, the percentage of minority residents living in the community, and the percentage of single parent households in the community. Whereas the violent crime rate was both a positive and statistically significant predictor of technical and programmatic innovations, the percentage of single parent households in the community was a positive and statistically significant predictor of technical and
administrative innovations, and the percentage of minority residents living in the community was a positive and statistically significant predictor of all three types of innovations including technical, administrative, and programmatic innovations.

In summary findings from this study show that the correlates of technical, administrative, and programmatic innovations do differ, but the correlates of these different types of innovation share more similarities than differences. The following discussion that addresses Research Question 3 will elaborate on these similarities.

3. Do the most innovative police departments have structural features characteristic of an organic organizational structure? If not do the structural features of the most innovation police departments conform to other organizational forms identified in the organizational theory literature?

Burns and Stalker (1961) observed that organizations that have an organic structure tend to be less formal, geographically dispersed, have flattened hierarchies, and have limited degrees of functional and occupational differentiation. They also observed that organization’s that have a mechanistic structure tend to be more complex in terms of having a high degree of functional, occupational, and hierarchical differentiation, and also tend to be more formalized, and spatially concentrated. In their research Burns and Stalker (1961) found that organic organizations were relatively more fluid and adaptive to changing environmental conditions that require changes in operations and innovation in the status quo habits and traditions of the organization,
whereas mechanistic structures were more stable, ridged, inflexible, and poorly suited change.

Reflecting upon Burns and Stalker (1961) research it is reasonable to expect that the most innovative police organizations should exhibit features of an organic organizational form and organizations exhibiting attributes of a mechanistic structure should be least innovation. Ironically, results from this study show that the most innovative police organizations exhibited many of the features of a mechanistic organization (i.e., strongly reminiscent of the classical Weberian “ideal type” bureaucracy). Findings (see Table 10 on page 106) reveal that consistent with the characteristics of a mechanistic organization, or what Mintzberg (1979) referred to as a professional bureaucracy, police agencies that were more hierarchical, specialized, professionalized, and had greater proportions of civilian administrative staff were the most innovative organizations.

Findings from Chapter 5 show that hierarchical differentiation (i.e., greater distance between entry level officers and police chiefs), functional differentiation (i.e., having a greater number of special units) was positively and significantly correlated with administrative innovations, occupational differentiation (having a greater amount of civilian staff dedicated to administrative duties) was positively and significantly correlated with programmatic innovations, formalization was positively and significantly correlated with technical innovations, and spatial differentiation was negatively and significantly correlated with programmatic innovations. Only one relationship failed to conform to the hypothesized relationships found in a mechanistic organization and that
is the positive and significant correlation between *spatial differentiation* (i.e., the police organization has a greater number of separate precincts or stations in which it conducts operations) and *programmatic innovations*. Given the fact that Burns and Stalker (1961) found that mechanistic organizations were the least innovative, why were the mechanistically structured municipal police departments the most innovative in this study? There are a few plausible explanations that can explain this unexpected finding.

First, police departments were strongly encouraged by reformers (August Vollmer, O.W. Wilson) to become more professionalized and develop mechanistic and para-militaristic organizational structures during the professionalism era in policing. These organizational attributes were widely adopted amongst America’s larger police departments. Reformers believed that the adoption of mechanistic organizational structures, professionalism, formalism, and a legalistic style of policing, could separate politics from policing and provide administrators with professional control of the organization (Wilson, 1968; Zhao, 1996). Furthermore, it is plausible that the mechanistic organizations observed in this study had a propensity to be innovative because they also tend to be more professionalized.\(^{22}\) A number of studies in the organizational literature have shown links between professionalism and innovation adoption (Hage & Aiken, 1967; Hage, 1980; Sabet & Klinger, 1993).

\(^{22}\) It's important to note that findings from this study show that the most innovative organizations were also more professionalized, which is consistent with this argument. For instance Table’s 7 and 9 indicate that screening measures, and the number of training hours required for officers was each positive and statistically significant predictors of all three innovation types including *technical, administrative, and programmatic* innovations.
Second, in reference to the technical/technological innovations evaluated in this study it is important to acknowledge that police administrators in structurally complex organizations have strong incentives to invest in the production or even overproduction of all types of crime-related data and information, to inform senior managers of the organization just in case they need it. Internal and external complexity within an organizational increase the demands for all types of knowledge and information, ranging from incident reports to crime analysis data, as well as the need for police chiefs and executives to use objective data to inform, evaluate, and justify priorities, strategies, and operational decisions (Erickson & Haggerty, 1997; Ratcliffe, 2008).

Third, it seems logical that relatively mechanistic organizations have a propensity to be technically and administratively innovative as a means to more effectively manage both internal and external sources of complexity. Mechanistic organizations exhibiting the attributes of a paramilitary structure, which more heavily relies on strict chains of command and firm managerial controls, may be relatively more inclined to develop a variety of accountability focused technologies, and a greater number of formal administrative policies as tools to hold the rank-and-file accountable.

Fourth, the finding that greater degrees of specialization (having a larger number of specialized units with personnel dedicated to their functions) was positively associated with administrative innovations is consistent with the results of a number of organizational innovation studies. Hage (1965) suggested that organizations that have a larger number of occupational specialists are likely to have greater degrees of internal and external communications of new ideas. Furthermore, Kimberly and Evanisko
(1981) hypothesized that organizational specialization is conducive to innovation because it increases the number of specialists within an organization that are familiar with the state of the art innovations in their field and have knowledge of empirical findings supporting their adoption. The specialization hypothesis was empirically supported by Damanpour's (1991) meta-analysis of innovation research, which found that specialization was significant in a number of studies. Similarly, in the area of policing, the specialization hypothesis was supported by King's (1998) study of innovativeness in municipal police departments, which found that specialization was positively associated with both technical and programmatic innovations.

4. Are technological innovations having an impact on the horizontal structural arrangements of police departments?

The study of organizational adaptations to technology has developed into an important dimension of contingency theory (Perrow, 1967; Dewar & Hage, 1978; Mobrman & Mobrman, 1990; Damanpour, 1991; Mullen, 1996). Woodward (1958) found that technical innovations were a key factor in explaining structural variations in organizations. Furthermore, Perrow (1967) developed a theoretical model to explain the relationship between technological/technical innovations and corresponding differentiations in organizational structure. Given that technological innovations have had a substantial impact on police organizations in the past few decades it is reasonable to assume that technological innovations may be predictive of changes in police organization horizontal structure. Consistent with the work of Woodward (1958) and Perrow (1967) findings from this study reveal that a higher degree of technology
within an organization was a statistically significant predictor of *programmatic innovations* in local police departments.

Damanpour’s (1991) research provided a compelling explanation for how technology influences changes in organizational structure. Damanpour (1991) observed that the introduction of new technologies may introduce greater uncertainty into an organization’s task environment and alter organizational processes and establish patterns of communication; these changes may in turn lead to corresponding changes in an organization’s structure (Damanpour, 1991). In the context of the current study, the introduction of new technologies such as computers used for crime analysis, crime mapping, the analysis of community problems, and mobile data terminals necessitates the development of new programs and special units that are required to successfully implement the application of new technologies. It is reasonable to presume that a number of *programmatic innovations* including the development of crime analysis units, cybercrime units, and research and planning units were developed in tandem or subsequent to the adoption of newer technologies.

**Additional Implications for the Policing Literature**

In addition to discussing the implications that the results of this study have in informing each of the primary research questions, it is also important to discuss additional implications that these findings have for the policing innovation literature. Table 10 (page 106) provides a summary of the results from the multivariate panel data analyses that were presented in Chapter 5.
The results of the organizational design theory models have a few notably important implications for the policing innovation literature. First, it is not surprising that organizational size was a significant predictor of technical and programmatic innovations given that the positive relationship between organizational size and policing innovation has become somewhat axiomatic in the research literature (Blau, 1972; Marsden, Cook, & Kalleberg, 1994; Willis & Mastrofski, 2011). Interestingly, organizational size has emerged as one of the few factors that have consistently been predictive of organizational change in the police innovation literature (Willis & Mastrofski, 2011). As early as 1972 Blau recognized that organizational size matters because an increase in organizational size is a proxy for corresponding increases in organizational complexity and it represents “the scope of an organization and its responsibility” (p.3). Furthermore, Marsden, Cook, and Kalleberg (1994) provided an equally compelling argument for why size matters when they correctly noted that organizational size is indicative of “the magnitude of tasks to be coordinated” and has become “the dominant contingency thought to necessitate structural differences” (p.913).

Results from this study show that all three professionalism measures assessed in this study were associated with innovations in local police departments. For instance, higher educational requirements were positively associated with administrative innovations (i.e., having a greater number of formal policies), and both increased screening measures for new recruits (i.e., having a greater number of screening measures for new recruits) and increased training hours for officers were each
associated with all three types of innovation assessed in this study. These findings are consistent with a number of studies in the organization innovation research literature that have shown links between professionalism and innovation adoption (Hage & Aiken, 1967; Hage, 1980; Sabet & Klinger, 1993).

Community policing was also a significant predictor of technical and programmatic innovations. There are two plausible explanations for this relationship in the research literature. First, findings from this study are consistent with Ratcliffe's (2008) hypothesis that agencies that had invested in community policing programs as a means to address a variety of crime related issues may also have a propensity to invest in a variety of computer technologies to assist in their crime fighting efforts (Ratcliffe, 2008). Second, the theory of developmental culture may also provide some explanation for this relationship between community policing and other types of innovation. The theory of developmental culture, which has been applied in a variety of areas of public administration, contends that organizations that have a developmental culture are more likely to embrace change and adopt a variety of innovation types (Pandey & Garnett, 2006). It is reasonable to assume that some police organizations that had previously adopted community policing programs may have organizational cultures that are accepting of new ideas and are at least willing to experiment with the latest developments in police management; therefore, these organizations having previously adopted community policing may have a propensity or disposition to be innovative in other areas.
There are several findings from the contingency theory models that have notable implications for the policing innovation literature. First, results show that technical and programmatic innovations in municipal police departments are positively and significantly influenced by violent crime rates. This finding is not surprising given that many of the technical and programmatic innovations evaluated in this study involve technologies and specialized units adopted by police departments to assist in their efforts to control serious crime. For instance, many of the technologies represented in the technical innovation index were directly oriented toward crime-related functions including computerized technologies used for crime analysis, crime mapping, criminal investigations, analysis of community problems, and mobile data terminals, just to name a few (see Table 2 on page 71). Furthermore, many of the specialized units represented in the programmatic innovation index were specifically oriented toward violent crimes including crime analysis units, domestic violence units, gang intelligence units, child abuse units, and bias/hate crimes units just to name a few (see Table 4 on page 74).

Another interesting finding from the contingency theory models was the relationship between operational budgets per capita and technological innovations. Although it seems reasonable to expect that police departments faced with budgetary resource constraints may have used technologies as an innovative solution to manage crime related problems more effectively with limited resources, results indicate a contrary relationship between budgets and technical innovations. This study shows that higher operational budgets per capita were in fact positively associated with technical
innovations. This finding is consistent with prior research that shows that agencies that have slack resources\textsuperscript{23} may also be in a more auspicious position to invest in technological innovations (Damanpour, 1991).

**Methodological Limitations of this Study**

Before discussing the results and drawing conclusions, it is first important to discuss the methodological and conceptual limitations of this study. First, a shortcoming with the measures that were used in this study is that they rely upon agency self-reports that they adopted specified practices and enhanced their capacities in various areas. In some cases however, these responses may not reflect actual implementation activities. It is possible that some organizations may have responded yes to each of the items in the survey, whereas the organizations may not have taken substantive steps toward adopting these innovations. Maguire (1997) acknowledged a similar limitation in his use of the LEMAS to measure COP implementation. Trojanowicz & Bucqueroux (1998) also observed in their study that some agencies, which claimed to have adopted COP measures, had not faithfully fulfilled its requirements. Furthermore, these limitations are augmented by measurement errors that may result from the dichotomous and ordinal response categories that were provided in the LEMAS survey. These dichotomous and ordinal level response categories lack the measurement accuracy that interval-based measures can alternatively provide.

\textsuperscript{23} Slack resources represent “underutilized resources within a company that may be recaptured and employed for a variety of tasks” (Adkins, 2005).
Second, there is also a notable limitation with the operationalization of hierarchical differentiation as the ratio between the chief executive’s salary and the base salary for entry-level police officers, particularly because this measure is merely a proxy for the number of hierarchical ranks within an organization and does not directly measure these ranks. This limitation is important to acknowledge because other studies that use the term hierarchical differentiation (i.e., Maguire, 2003; Wilson, 2005) have operationalized the concept differently, which may reduce the external validity of this study.

Third, it is important to address the limits of interpreting the results of the technology index. The technology index does not reflect the tenets of the COMPSTAT model. Although some of the agencies that responded to the 1997, 2000, 2003, 2007 LEMAS survey may have been faithfully practiced COMPSTAT or some other data-driven policing strategy, it is important to acknowledge that many of the agencies that responded yes to the crime analysis technology related survey items were not necessarily practicing the COMPSTAT management model. Acknowledging that the technological measures used in this study do not necessarily reflect the use of COMPSTAT by police agencies is important in order to reduce the common misconception by lay persons that police organizations that use crime mapping also practice COMPSTAT or some other data driven policing strategy.
Implications for Future Research and Police Policy

The results of this study have several implications for further research and police policy. First, findings from this study are consistent with prior studies that have shown that factors endogenous to police organizations are relatively stronger predictors of technical, administrative, and programmatic innovations than environmental factors (Mullen, 1996; King, 1998). A notable limitation of this study is that it fails to test whether internal or external factors are predictive of radical innovations such as community policing or COMPSTAT. This limitation exists because sufficient data were not available to test these radical innovation types. Zhao’s (1996) study indicates that external factors were better predictors of community policing innovations in local police departments. Given these facts it is reasonable to hypothesize that factors endogenous to police organizations are stronger predictors of technical, administrative, and programmatic innovations, and that factors exogenous to police organizations are stronger predictors of radical innovation types. Scholars endeavoring to conduct similar studies of policing innovations in the future are strongly encouraged to test these hypotheses.

Second, consistent with prior studies (Hage & Aiken, 1967; Hage, 1980; Sabet & Klinger, 1993) findings from this study show that all three professionalism measures assessed in this study were associated with innovations in local police departments. These findings are consistent with a number of studies in the organization innovation research literature that have found links between professionalism and the adoption of
innovation (Hage & Aiken, 1967; Hage, 1980; Sabet & Klinger, 1993). To date, few known studies have examined this relationship in police innovations (Wilson, 2005) and no known studies in the policing literature have found a link between professionalism and innovation. Further research investigating this link can be beneficial because additional support for this finding can have strategic implications for police policy. For example, police executives and policy makers that actively encourage technological, administrative, and programmatic developments in local police departments could promote specific types of professional developments in these areas. Furthermore, policy makers that wish to promote the development of crime analysis units in local police departments could provide professional development grants for crime analysts to attend crime analysis and crime mapping workshops and attend professional conferences. Moreover policy makers can further promote specialization in the area of crime analysis by expanding the number of grants that provide local police agencies with seed money to hire and train crime analysts.

Third, the finding that \textit{operational budget per capita} was a strong predictor of technological innovations in municipal police departments ($p<0.001$) suggests that federal, state, and local policy makers that wish to promote technological developments in municipal police departments can facilitate technological development by focusing their resources on jurisdictions that have the greatest fiscal resource constraints. Federal granting agencies including the U.S. Department of Justice can potentially use

\footnote{The U.S. Department of Justice’s Community Oriented Policing Services (COPS) Office offers a variety of training and development grants; however, this analysis makes an argument that additional resources for professional development will be beneficial.}
findings from police innovation studies to improve grant awarding policies. The U.S. Department of Justice’s Community Oriented Policing Services (COPS) Office has awarded 827 million dollars in technology grants to over 1400 local police agencies (COPS, 2013). In all likelihood a number of the agencies evaluated in this study may had received technology grant funds from the COPS office. Under the existing COPS office grant policy local police agencies must match 25% of the technology costs in order to secure federal grant funds for technology related expenses (COPS, 2007). It is plausible that local police agencies assessed in this study which had higher operational budgets per capita were statistically more likely to have invested in crime related technologies because they were arguably in a better position to support the 25% match in funds for technology related expenses. With the 25% matching funds policy municipal police departments in highly impoverished and lower income areas that have chronic resource deficiencies are in the least likely positions to secure COPS technology grants.

Conclusion

There are a number of gaps in the police innovation literature and existing studies of police innovation have produced mixed and inconclusive findings. Most studies of police organizational change are limited due to their cross-sectional research designs, and longitudinal analysis of change is lacking. There are also competing explanations for police organizational change and innovation that have not been systematically compared. This dissertation overcomes these limitations in the research
literature and fills gaps in the police innovation research literature by using a variety of
data sources and a longitudinal research design to test empirically two competing
theories of policing innovation, which include organizational design theory and
contingency theory. To date, no known studies of police innovation have used a
longitudinal (panel data) research design to compare systematically these competing
theoretical explanations for police organizational change.

Based upon the findings from this study it is reasonable to conclude that
organizational design theory was overall a better predictor of technical, administrative,
and programmatic innovations in municipal police departments than contingency theory; however, it is important to caution the reader that organizational design theory was only
modestly better at explaining these innovations. A number of factors evaluated in this
study emerged as consistent predictors of different types of innovation. Also, a variety
of findings from this study are consistent with findings from prior studies.

Reflecting upon Burns and Stalker (1961) research it is reasonable to expect that
the most innovative police organizations should exhibit features of an organically
structured organization because organic organizations are presumably more fluid,
flexible, and responsive to change. On the other hand, mechanistic structured
organizations should be least innovative because their mechanistic structure
presumably makes them more rigid, inflexible, and less adaptable. Contrary to
expectations results from this study show that the most innovative police organizations
were not organically structured, and contrarily exhibited many features of a mechanistic
organization. This finding is interesting because scholars have hypothesized that
mechanistically structured organizations should be least apt to change and innovation (Burns and Stalker, 1961).

Arguably the relatively more mechanistic organizations that were evaluated in this study were the most innovative because they were professionalized bureaucracies that were more specialized in their operations and placed greater emphasis on professionalism standards. This finding is consistent with a number of existing studies (Hage, 1965; Hage & Aiken, 1967; Hage, 1980; Damanpour, 1991; Sabet & Klinger, 1993; King, 1998). According to the specialization hypothesis (Hage, 1965; King, 1998) organizations that are more specialized and have a greater number of professionalism standards tend to be more innovative because they have more expertise within specialized units. Experts that tend to be more educated and have more specialized professional training are more aware of state-of-the-art changes in the industry because they are more likely to read specialized trade journals, to regularly attend professional conferences, and be networked with professionals from others departments outside of the organization.
BIBLIOGRAPHY


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Community-oriented policing

During the twelve month period which of the following did your agency do? Yes/No.

- a. Does your agency have a formal community policing plan?
- b. Actively encouraged officers to use SARA-type problem solving.
- c. Maintained or created a formal, written community policing plan.
- d. Included collaborative problem-solving projects in evaluation criteria of police officers.
- e. Trained citizens in community policing.
- f. Partnered with citizen groups and included their feedback in the development of neighborhood or community policing strategies.
Appendix B. Employment Screening Index

Employment screening survey items
Which of the following screening techniques are used by your agency in selecting new officers?

**Background/records checks**
- Background investigation. Yes/No
- Credit history check. Yes/No
- Criminal history check. Yes/No
- Driving record check. Yes/No

**Personal attributes**
- Personal interview. Yes/No
- Personality inventory. Yes/No
- Polygraph exam. Yes/No
- Psychological evaluation. Yes/No
- Voice stress analyzer. Yes/No
- Written aptitude tests. Yes/No

**Community relations skills**
- Analytic/problem-solving ability assessment. Yes/No
- Assessment of understanding of diverse cultural populations. Yes/No
- Mediation/conflict management skills. Yes/No
- Second language tests. Yes/No

**Physical attributes**
- Drug test. Yes/No
- Medical exam. Yes/No
- Physical agility/fitness test. Yes/No
Appendix C. Histograms and Count Distributions for Technological Innovation Measures
Appendix D. Histograms and Count Distributions for Administrative Innovation Measures
Appendix E. Histograms and Count Distributions for Programmatic Innovation Measures
**Appendix F.** Bivariate Correlations between all Measures for 1997: Organizational Design Theory Model

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<th>Variables</th>
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<td>3. Number of special units</td>
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<td>0.13*</td>
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<td>4. Total full-time sworn officers</td>
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<td>0.20*</td>
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<td>6. Hierarchical differentiation</td>
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<td>0.10</td>
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<td>7. Spatial differentiation</td>
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<td>8. Functional differentiation</td>
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<td>10. Community policing</td>
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Notes: *p < 0.05
### Appendix G.

**Bivariate Correlations between all Measures for 2000: Organizational Design Theory Model**

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**Notes:** *p < 0.05
Appendix H.

Bivariate Correlations between all Measures for 2003: Organizational Design Theory Model

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Notes: *p <0.05
### Appendix I. Bivariate Correlations between all Measures for 2007: Organizational Design Theory Model

| Variables                              | 1  | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 10   | 11   | 12   | 13   |
|----------------------------------------|----|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 1. Technology index                    | 1.00 |      |      |      |      |      |      |      |      |      |      |      |      |      |
| 2. Administrative innovation index    | 0.20* | 1.00 |      |      |      |      |      |      |      |      |      |      |      |      |
| 3. Number of special units             | 0.32* | 0.26* | 1.00 |      |      |      |      |      |      |      |      |      |      |      |
| 4. Total full-time sworn officers      | 0.16* | 0.08 | 0.33* | 1.00 |      |      |      |      |      |      |      |      |      |      |
| 5. Occupational differentiation       | 0.11* | 0.06 | 0.15* | -0.10 | 1.00 |      |      |      |      |      |      |      |      |      |
| 6. Hierarchical differentiation        | 0.14* | 0.11* | 0.30* | 0.44* | 0.02 | 1.00 |      |      |      |      |      |      |      |      |
| 7. Spatial differentiation             | 0.12* | 0.05 | 0.28* | 0.67* | -0.11* | 0.27* | 1.00 |      |      |      |      |      |      |      |
| 8. Functional differentiation          | 0.32* | 0.26* | 1.00* | 0.33* | 0.15* | 0.30* | 0.28* | 1.00 |      |      |      |      |      |      |
| 9. Formalization                       | 0.20* | 1.00* | 0.26* | 0.08 | 0.06 | 0.11* | 0.05 | 0.26* | 1.00 |      |      |      |      |      |
| 10. Community policing                 | 0.24* | 0.11* | 0.27* | 0.09 | 0.10* | 0.11* | 0.11* | 0.27* | 0.11* | 1.00 |      |      |      |      |
| 11. Educational requirements           | -0.00 | -0.09 | -0.10 | -0.00 | 0.14* | -0.07 | 0.00 | -0.10 | -0.09 | 0.03 | 1.00 |      |      |      |
| 12. Screening measures                 | 0.06 | 0.04 | 0.23* | 0.00 | 0.14* | -0.09 | -0.03 | 0.23* | 0.04 | 0.05 | -0.20* | 1.00 |      |      |
| 13. Training hours (by 100)            | 0.24* | 0.04 | 0.19* | 0.30* | 0.17* | 0.15* | 0.20* | 0.19* | 0.04 | 0.18* | 0.04 | 0.06 | 1.00 |      |

**Notes:** *p <0.05
### Appendix J. Bivariate Correlations between all Measures for 1997: Contingency Theory Model

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Notes: *p < 0.05
**Appendix K.** Bivariate Correlations between all Measures for 2000: Contingency Theory Model

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Notes: *p < 0.05
### Appendix L. Bivariate Correlations between all Measures for 2003: Contingency Theory Model

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**Notes:** *p < 0.05
### Appendix M. Bivariate Correlations within all Measures for 2007: Contingency Theory Model

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<td>7. % of minorities</td>
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<td>13. % of Vacant houses</td>
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Notes: *p < 0.05
Appendix N.
Variance Inflation Factors (VIF) for Organizational Design Theory Measures

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<td>Hierarchical differentiation</td>
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<td>Spatial differentiation</td>
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<td>Functional differentiation</td>
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Mean VIF score: 1.28
## Appendix O. Variance Inflation Factors (VIF’s) for Contingency Theory Measures

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<td>% of Home owners</td>
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