AN EXAMINATION OF THE APPLICABILITY OF THE CITISTAT PERFORMANCE MANAGEMENT SYSTEM TO MUNICIPAL FIRE DEPARTMENTS

by

JAMES HORTON

Presented to the Faculty of the Graduate School of

The University of Texas at Arlington in Partial Fulfillment

of the Requirements

for the Degree of

DOCTOR OF PHILOSOPHY

THE UNIVERSITY OF TEXAS AT ARLINGTON

December 2010

ACKNOWLEDGEMENTS

I must first acknowledge the support and patience of my wife Tasha and son Will who provided unwavering support for the entire length of this project. Their encouragement along the way provided the needed motivation to complete a project such as this.

Next, I am indebted to Professor Sherman Wyman for his constant belief in my success and assistance along the way with not only critiquing my work but challenging me to excel. I would also like to thank the other members of my committee, Professors Rod Hissong and Alejandro Rodriguez for their insight and assistance. Their helpful comments further improved the quality of my work. In addition, the assistance of Dr. Nancy Rowe was an invaluable part of the methodology.

Finally, a thank you to the members of the Fort Worth Fire Department and those that provided encouragement and assistance with everything from studying to stuffing envelopes. I am especially indebted to the members of stations 17-A and 24-A. In addition, I appreciate the support from Fire Chief Eddie Burns and Fire Chief Rudy Jackson who have encouraged me and always allowed me to “act up” in the organization.

November 4, 2010

ABSTRACT

AN EXAMINATION OF THE APPLICABILITY OF THE CITISTAT PERFORMANCE MANAGEMENT SYSTEM TO MUNICIPAL FIRE DEPARTMENTS

James Horton, PhD

The University of Texas at Arlington, 2010

Supervising Professor: Sherman Wyman

Local governments continue to face difficulty transitioning from performance measurement systems to performance management systems. The purpose of this research is to determine if the Citistat performance management system influences organizational behavior, organizational efficiency, or organizational effectiveness in the local government setting. Citistat is a recent performance management innovation claiming budgetary savings and improved performance, but has yet to be empirically tested across multiple jurisdictions. This research examines organizational behavior, efficiency and effectiveness in larger municipal fire departments which serve a population greater than 100,000. Organizational behavior is assessed by a survey sent to fire chiefs of the largest 254 municipal fire departments. The effectiveness of municipal fire departments is measured by dependent variables which include the number of building fires, the number of civilian fire fatalities and the amount of property loss. Data envelopment analysis is used to determine the relative efficiency of each municipal fire department using a ratio of budget and personnel to number of building fires and civilian fire fatalities. Findings indicate there is a difference in organizational behavior when comparing Citistat and non-Citistat departments. However, there is no difference in organizational efficiency and effectiveness when comparing Citistat and non-Citistat cities.

Data for this research is obtained from the United States Fire Administration (USFA), the International City Management Association (ICMA), and a survey instrument distributed to fire chiefs of the nation's largest municipal fire departments. This research is pertinent to any public manager or elected official interested in implementing the Citistat performance management system because it contributes to the scholarly debate regarding the public administration values of efficiency and effectiveness, informs the reader of the theoretical basis underlying a popular new performance management system, and answers the practical question of whether or not a Citistat performance management system increases organizational efficiency or effectiveness in the local government setting.

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

LIST OF TABLES

Table Page

CHAPTER 1

INTRODUCTION

1.1 Statement of the Problem

Efforts to improve local government productivity that began at the turn of the 20th century are still present today. Instead of reformers voicing complaints against an unresponsive government filled with political patronage and corruption, citizen customers and political leaders now call for bureaucrats to focus on performance and results (Osborne 1992). This proves challenging for public servants as they attempt to balance limited resources and social responsiveness. To facilitate a delicate balance, managers often rely on performance measurement systems. Unfortunately, many performance measurement systems are adaptations from the private sector and are not only ill suited for public management but lack empirical testing. Under pressure to improve results, managers can easily be swayed by the latest fads for improving performance. This dissertation seeks to evaluate a recent performance measurement innovation, Citistat, through an examination of its applicability to municipal fire departments. The purpose of this research is to determine whether a Citistat type performance management system positively influences organizational behavior, organizational efficiency or organizational effectiveness.

1.2 Purpose of the Study

This study will examine the Citistat performance management system and evaluate its influence on organizational efficiency, organizational effectiveness and organizational behavior in municipal fire departments. This research attempts to determine whether or not a Citistat type performance management system improves organizational efficiency and effectiveness in municipal fire departments by evaluating the number of fires, civilian fire fatalities, and property loss. Following the reported success of Compstat, the precursor to Citistat, one would expect to find a Citistat type performance management system as a statistically significant negative

independent variable in explaining the incidence of building fires, amount of property loss and rate of civilian fire fatalities.

Injury, death, and property loss from fire incidents initially described in the 1973 National Commission of Fire Prevention and Control report titled “America Burning” remain persistent today. The United States has one of the highest property loss and injury rates of the developed world. The most recent statistics available from the United States Fire Administration (USFA 2010) report an annual 1.5 million fires resulted in 3,320 civilian deaths, 16,705 civilian injuries and caused an estimated $15.5 billion in direct property loss in 2008. According to Hall (2009), the combination of direct property loss, cost of infrastructure and cost for fire protection services elicits a total fire cost of $231-278 billion annually.

The need for better data and a measurement system in the fire service is well documented. *America Burning* (1973) not only described the fire problem but put forth recommendations to reduce loss and destruction from fire. Of these, data development was listed as one of eight important functions for fire departments (Tipton 1973). However, when *America Burning* was commissioned again in 1999 little had changed. *America at Risk* (2002, p. 15) began with the following introduction: “To a great extent the fire problem in America remains as severe as it was 30 years ago.” The authors specifically list data acquisition and research improvements as problems of national concern to the fire service. Furthermore, the National Fallen Firefighters Foundation listed “the development of emergency response performance measures for use by fire and rescue departments” and “data requirements to make quality fire safety decisions” as two key issues during their Firefighter Life Safety Summit (USFA 2004). Although the federal government has appropriated $5.7 billion in grants to local jurisdictions over the last decade to improve fire department capabilities, there is not a corresponding reduction in the number of firefighter injuries, firefighter deaths, civilian injuries or civilian deaths from fire incidents (Muhlhausen 2009).

Property loss and civilian death from structure fire incidents continues to be a national problem addressed by a multitude of fragmented local governments in need of a better system to measure performance. Citistat may be that system, but has yet to be empirically tested in fire departments or any other local government service areas. This research will examine organizational behavior, efficiency and effectiveness of municipal fire departments that utilize a Citistat type performance management system. Fire service leaders and public administrators can then make a more informed decision on the need and type of performance management system they implement.

1.3 Theoretical Perspective

Citistat's importance to performance measurement and the broader field of public administration lies with its renewed emphasis on accountability, communication, and leadership. Citistat proponents believe outcomes are improved by focusing on key outputs within the control of managers. Focusing on outputs stands in contrast to recent performance measurement literature that prescribes a broader focus on outcomes (Kelly 2002; Ho 2005). Some believe too much of an emphasis on outcomes can make it difficult to hold public managers accountable for results, especially when societal problems are part of the cause (Radin 2006).

Citistat proponents chose to focus on select key outputs thought to have a direct influence on outcomes and then demand strict accountability from public managers for accomplishment. Authors in the criminal justice field describe this as a return to the classical paradigm of public management (Moore 2003). However, given Citistat's requirement for an active role of political leaders (especially in strong mayor cities), amount of managerial accountability, the unique method of communication, and the transparency of the process, others describe Citistat as a leadership strategy (Behn 2008).

It is important to conduct an inter-city examination and evaluation of Citistat in order for public administrators to understand the challenges and benefits that may come with using this particular performance management system. Outside of limited single agency criminal justice

research with Citistat's predecessor, Compstat, the influence of Citistat on outcome variables in other agencies has not been thoroughly tested. Figure 1.1 illustrates the key elements of Citistat and their relationship.

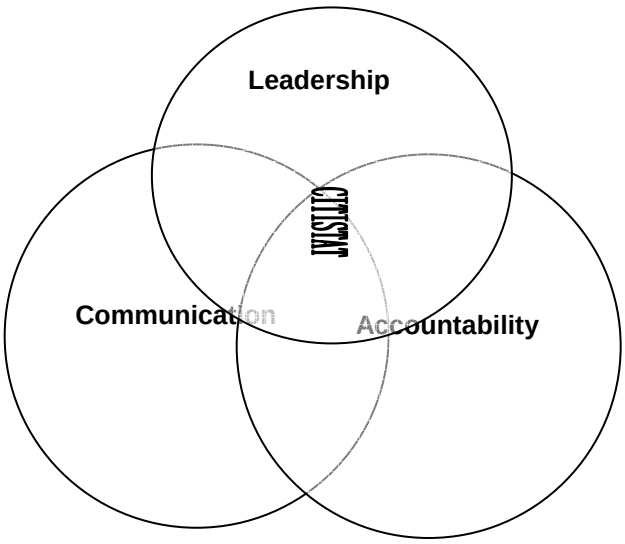

Figure 1.1 Elements of Citistat

Citistat and similar "Stat" performance measurement systems are portrayed as a new paradigm, a method of strategic problem solving, a combined technical and managerial system, a major innovation and finally as a leadership strategy (Henry 2003; Moore 2003; Weisburd 2003; Willis 2004; Behn 2007). Behn (2006) identifies three important components in a Citistat system including regular meetings, the use of data, and comparison of past performance followed by discussions regarding future improvement. Others describe the key elements as mission clarification, accountability, geographic divisions, organizational flexibility, data driven decisions, and innovative problem solving techniques (Weisburd 2003; Willis 2004). Many of these elements are not new to performance measurement but their combination and interaction is distinct.

According to deHaven-Smith and Jenne (2006), the method of communication between leaders and managers along with the setting in which it occurs are unique to Citistat. Citistat meetings are conducted in a specially designated room typically on a biweekly or monthly schedule. Within this room, managers stand at a podium with large display screens projecting their past and current performance metrics. Seated at a table in front of the podium are leaders who question managers about past, present and future performance. A separate seating area is reserved for interested stakeholders. This unique setting and dialogue create a level of stress to perform well in front of one's peers which has its own implications for performance management (Mausolff 2004). The combination of traditional performance measurement elements, a unique public setting, and frequent dialogue between managers and leaders is unique and unlike any other performance measurement system.

Several large urban police departments already use Compstat, the precursor to Citistat. Compstat is the name given to the performance management system developed by William Bratton and staff during his tenure as Commissioner of the New York Police Department. Central to Compstat is the belief that police officers can reduce crime through their actions and the rigorous measurement and analysis of crime data (Henry 2003). This system of policing suggests increased measurement and enforcement of minor offenses (misdemeanor crimes) will also cause a decline in more serious crimes. Known as the "broken windows" theory of policing (Wilson 1982; Kelling 1996), Compstat sought to provide data to assist precinct commanders with reducing crime in their geographic areas (Henry 2003). Contrary to popular belief that crime is prevented by increased attention to socioeconomic indicators such as unemployment, poverty and racism, New York City police attained unprecedented drops in violent crime and caused doubt with conventional policing theory. Academics continue to debate whether Compstat was a significant variable in reducing crime or if the decline was simply coincidental because of socioeconomic changes and sentencing guidelines (Moore 2003). Regardless of the debate, Compstat is now replicated by many large urban police departments across the United States

and is being adapted to other service areas, including municipal fire departments. As that performance management system spread beyond police to other municipal agencies it became known as Citistat. According the Behn (2005, p. 296), "Citistat is Compstat applied to an entire city."

The continued adaptation of Compstat from police departments to fire departments is likely for several reasons. First, both organizations share a clear public perception concerning their public duty. Police departments reduce crime; fire departments prevent and suppress fires. Second, the incidence of fires and civilian fatalities are linked to social and economic factors, as is crime (Schaenman 1977; Karter 1978; Gunther 1981; Munson 1983; Jennings 1996). Third, similar to police departments, fire departments are traditionally reactionary; often responding after someone calls to request assistance. In addition, both services use a single point of emergency contact through the "911" telephone system. Fourth, fire departments, like police departments, wear distinctive uniforms and are highly committed to their jobs (Lee 2002). Finally, performance measurement systems currently in use by municipal fire departments are unproductive; solving the "fire problem" has stalled (Bernstein 2002). The similarities between the two organizations provide an optimal place to study Citistat and extend the research related to Compstat and performance management.

1.4 Definition of Terms

Citistat: A type of performance measurement system that is characterized by regular meetings, the use of data, and the comparison of past and present performance with a discussion about future performance applied to all or a majority of agencies within a local government (Behn 2006)

Compstat: A type of performance measurement system relying on timely and accurate intelligence, effective tactics, rapid deployment of personnel and resources and relentless follow-up and assessment applied to police agencies (Henry 2003)

Efficiency: The production of a maximum amount of output determined by a ratio of outputs to inputs (Hatry 1999; Cooper 2007; Geys 2009)

Effectiveness: Ability to achieve an end result or goal which is important, or has value to customers or society in general (Hatry 1999; Cooper 2007)

Fire Property Loss: The direct dollar loss per capita or percent of property damaged as a result of a building fire within the jurisdictional boundary of a municipal fire department

Building Fire: A fire within an assembly of materials forming a construction for occupancy

Civilian Fire Fatalities: A person, who is not a member of the fire department, which is killed as a result of a fire incident or during the mitigation of a fire incident

1.5 Procedures

There are three primary sources of data for this study. First, the United States Fire Administration's (USFA) National Fire Incident Reporting System (NFIRS). Begun in 1977, this database represents the most comprehensive collection of municipal fire department incident data for the US fire service. The National Fire Data Center (NFDC) reports that more than 21,000 fire departments submit fire incident data to NFIRS which total more than two million incidents per year. In addition, the number of reporting departments continues to increase as recent efforts require participation in order for fire departments to receive federal funding from the Assistance to Firefighters Grant Program.

Second, budget and personnel information is available from the International City Management Agency's (ICMA) Police and Fire Personnel and Expenditures survey. The ICMA also collects information regarding fire department activities from cities that participate in its voluntary Center for Performance Measurement (CPM). However the ICMA CPM data includes only 30 cities reporting for multiple years; none of those cities utilize the Citistat type performance management system.

Finally, a survey will gather otherwise unavailable data from municipal fire departments that participate in the national fire incident reporting system. Organizational activities and the types of

performance measurement system utilized are not reported as part of NFIRS. The survey instrument solicits information from the fire chief (department head) of the most populous municipal fire departments regarding the type of performance measurement system in use and activities of the organization. To improve validity and reliability, a pilot survey is distributed to the fire chief (department head) of six municipal fire departments not included in the study. At least one of those departments currently utilizes the Citistat performance management system.

Only municipal fire departments serving a residential population of 100,000 or more that participate in the national fire incident reporting system are included in this study. Larger cities are selected as the unit of analysis for three reasons. First, larger cities are more likely to employ the council-manager form of government and adopt performance measurement (Poister 1999). Second, even though fire departments are comprised of multiple organization types, such as career and volunteer, career fire departments protect the majority of the U.S. population. Career and mostly career departments (as compared to all volunteer) comprise only 14% of approximately 30,000 U.S. fire service organizations, but protect 62% of the U.S. population (USFA 2010). Twelve cities within this group of approximately 200 are known to utilize Citistat: Atlanta, GA; Baltimore, MD; Buffalo, NY; Chattanooga, TN; Cleveland, OH; Pittsburgh, PA; Providence, RI; San Francisco, CA; Somerville, MA; St. Louis MO; Syracuse NY; and Washington D.C. Third, larger cities have unique problems associated with fire risk including higher densities of people and buildings (TriData 1999).

Municipal fire departments with performance measurement systems consistent with Citistat are expected to have fewer building fires, fewer civilian fatalities, and less property loss (dependent variables) and better relative efficiency (ratio of outputs to inputs) over time when compared to non-Citistat municipalities, and thus are therefore characterized as more effective and efficient. A regression analysis with separate equations for each dependant variable is performed to determine statistically significant independent variables and data envelopment analysis is used to determine the relative efficiency with which each agency conducts their

activities (Nyhan 1999; Moore 2005). Data envelopment analysis allows researchers to compare the ratio of outputs to inputs in similar organizations and determine their relative efficiency based on a linear scale (Ramanathan 2003; Cooper 2007). Municipal fire departments serve as the decision making unit and their relative efficiency is based on a comparison of budget and staff to civilian fire fatalities and number of building fires. Finally, survey results detailing the perceived impact, challenges, and satisfaction with performance measurement in municipal fire departments are compared among Citistat and non-Citistat jurisdictions to assess organizational behavior.

1.6 Significance of the Study

Previous research directed at explaining the variation in number of fires, property loss, and fatalities typically focuses on socioeconomic and physical indictors such as poverty, education, parental presence, building stock and climate (Jennings 1996; TriData 1997; TriData 1998; TriData 1999). Other research concerning fire service productivity is often limited to one or two variables and typically evaluates a single municipal fire department (Wallace 1977; Coe 1983; Folz 1986). This research will be the first to evaluate a specific performance management system in municipal fire departments and the first to empirically test Citistat in the setting of multiple local governments.

1.7 Organization of the Study

This dissertation is organized into five chapters. Chapter 1 provides an introduction to the research problem and its importance. A brief description of the research method and tools used for analysis are also included. Chapter 2 contains a review of literature pertaining to performance measurement, the fire service, and Citistat. Chapter 3 explains the design of the study and the conceptual model. The dependent and independent variables are explained in depth. In addition, efficiency and effectiveness are discussed as they relate to performance in the fire service. Chapter 4 informs the reader about the findings and their implications for the proper null hypothesis. An interpretation of the results is given as they relate to the original research questions. Chapter 5 offers a discussion, recommendations for further study and implications for

the broader field of public administration. An additional appendix contains the survey instrument and correlation analysis.

CHAPTER 2

REVIEW OF THE LITERATURE

2.1 Introduction

Performance measurement in local government continues to be an elusive target at the dawn of the twenty-first century. Issues of efficiency, effectiveness, accountability and transparency continue to be problematic for public administrators as they must work with limited resources, engage citizens and are expected to emulate the private sector. Governments at all levels have implemented a variety of performance measurement programs since Clarence Ridley (1938, p. 1) first wrote "it is not enough to be honest, but governments must be efficient as well." Today "Stat" performance measurement systems are gaining popularity as public administrators continue their quest to improve local government efficiency and effectiveness. Known originally as "Compstat," this unique performance measurement system uses available technology to combine up to date statistics with management principles in an effort to improve local government performance.

There are three distinct periods of "Stat" performance measurement including NYPD's Compstat, Baltimore's Citistat, and Behn's (2008) PerformanceStat. While each of these evolutions appears similar, there are subtle, yet key differences of importance to public administrators. All three systems rely on leadership, communication, and accountability but in different ways. This review of the literature will examine the historical origins, structural composition, and theoretical orientation of each.

2.2 Compstat

Compstat originated with the New York Police Department in 1994 under the leadership of police commissioner William J. Bratton. Compstat is not a pre-packaged system adapted from the private sector, but rather the culmination of efforts to reduce crime, enhance agency

performance, and improve data collection. The simple eight letter moniker, Compstat, comes from the computer file name given to the first set of comparative crime statistics used in evaluating the New York City crime problem (Silverman 1999). Compstat has since grown to much more than a simple computer file; According to Moore (2003), it is a strategic management system combined with administrative and technical innovations. Compstat is further described as a new paradigm in police management and one of the most important innovations in policing for the last decade (Silverman 1999; Henry 2003). In 1996 Compstat was awarded the Innovations in American Government Award from Harvard University's Kennedy School of Government.

2.2.1 Historical Origins

Rudy Giuliani became Mayor of New York City in 1993 after campaigning to reduce crime and improve quality of life (Bratton 1998). Giuliani also intended to improve government through accountability, decentralization and focusing on results (Weikart 2001). Giuliani chose William. J. Bratton as his police commissioner to help accomplish this task. Once in place, Bratton and his team quickly identified high crime, agency apathy and the limited amount of information available for decision-making as key problems in the NYPD.

2.2.1.1 High Crime

Prior to Bratton, the NYPD was using community policing as its strategy for crime reduction. According to Henry (2003), community policing achieved minor reductions in the rate of crime, did not reduce the public perception of crime and thus was partly responsible for the election of Mayor Rudolph Giuliani. Bratton supported a variant to community policing known as Broken Windows (Wilson 1982). Wilson and Kelling hypothesize that as a community falls into disrepair, criminals find it an ideal place to operate because nobody in the community cares enough to maintain it. Wilson and Kelling suggest that a community and police must pay attention to small details such as broken windows, or they will grow into much larger problems. These small details are characterized by quality of life disturbances such as vagrancy and prostitution.

Consistent with Broken Windows, Bratton supported the attention to minor offenses in the community, but his mechanism for dealing with them was in stark contrast to previous efforts with community policing. Whereas community policing decentralized authority to solve community problems to front line police officers, Bratton's efforts to reduce crime use problem oriented policing and demand accountability from middle managers. Problem oriented policing (Goldstein 1979) suggests that police agencies identify policing problems, research those problems and explore alternatives. Policing problems are any number of situations that police officers may face while on patrol. Bratton chose to use crime data to identify problem areas and then targeted enforcement of minor "Broken Windows" offenses in those areas to attack crime. As a previous commissioner of the New York Transit Authority, Bratton successfully implemented this strategy to reduce crime in the subway system. Although Compstat was not initially associated with Broken Windows, it did combine targeted patrol with the enforcement of minor offenses to improve quality of life and reduce crime (Bratton 1998). Eventually Bratton and his staff would realize how well Compstat fit the Broken Windows theory (Henry 2003). Compstat is a renewed effort to reduce crime that builds on community policing but challenges its emphasis on decentralization. Compstat comes from the leadership within the police department and supports the hypothesis that order maintenance policing and police actions can reduce crime.

2.2.1.2 Agency Apathy

Bratton also recognized a need to improve agency performance internally. Shortly after their arrival, Bratton's staff would discover that managers in the New York Police Department (NYPD) were not informed about crime in their districts and unable to identify crime trends (Henry 2003). In addition, there was a general sense of apathy toward crime control and setting expectations (Weisburd 2003). According to Henry (2003, p. 261), "mediocrity was tacitly authorized; the emphasis was not on reducing or eliminating crime, but rather at maintaining crime at tolerable levels that would not cause the department or its executives too much trouble." The lack of knowledge on the part of managers coupled with the particular crime reduction

strategy that Bratton was implementing would require monumental organizational change in the nation's largest police department (Weisburd 2004). Compstat became the driving force behind Bratton's efforts to reform the organization. In opposition to academics and other police chiefs, Bratton believed that police officers could control crime and would control crime if given the opportunity (Henry 2003; Walsh 2004). Bratton made the bold promise to reduce crime by 10% in one year and delivered (Silverman 1999).

2.2.1.3 Limited Information

To further improve agency performance, the NYPD would need to improve data collection and dissemination. Prior to Bratton, crime statistics were not available in a timely manner and managers could not identify crime trends or high crime areas (Henry 2003). Bratton and his staff worked to develop up to date crime statistics that could be used for decision making. This crime data, although preliminary in nature, is sufficient to develop strategies for reducing crime and deploying resources.

Compstat requires timely crime data from all precincts on a weekly basis for review by organizational leaders. Each Monday, New York police precincts submit data and receive it back on Tuesday in the form of a book with combined data from all other precincts. These "Compstat Books" allow for the comparison of all 76 police precincts (Henry 2003). According to Silverman (1999, p. 100), "It was like a bill. The price for being a commander was to do something about crime in your area." Each precinct commander then reviews their data in preparation for Wednesday morning meetings with the police commissioner and his staff.

Weekly meetings are a key component in Bratton's effort to renew the department and are a very visible aspect of Compstat. These meetings provide an opportunity for two way discussion and the dissemination of crime data and strategies. Compstat meetings not only provide a forum for precinct commanders to discuss crime and strategies in their region, but a regular location for interested stakeholders to meet (Silverman 1999; Henry 2003). Through the weekly collection and presentation of data, Bratton and his staff assure members of the

department that data are a key element in decision-making and the deployment of resources. In addition, each commander becomes more aware of the specific crime trend in their precinct and that of the entire city.

The efforts of Bratton and his staff to reduce crime, enhance agency performance, and improve data collection created the basis of Compstat and its four tenets: 1) accurate and timely intelligence, 2) rapid focused deployment of personnel and resources, 3) effective tactics and 4) relentless follow-up and assessment (Bratton 1998). These four tenets spread to police departments across the nation and are used as the basis to reduce crime in their jurisdiction.

2.2.2 Structural Composition

The key tenets of Compstat are "a goal-oriented strategic management process that uses computer technology, operational strategy and managerial accountability to structure the manner in which a police department provides crime control services (Walsh 2001, p. 347)." Within each tenet, Walsh (2001) finds principles consistent with strategic management including information serving as the foundation for decision-making, an organization focused on priorities, proactive and reactive responses consistent with learning organizations, and an ongoing process with open communication. Although the four tenets represent one point of reference, Weisburd (2003) identifies and defines six characteristics unique to Compstat. These six characteristics are mission clarification, internal accountability, geographic organization of operational command, data-driven problem identification and assessment and innovative problem-solving tactics. A seventh characteristic, external information exchange, was later added by Willis (2004).

Weisburd (2003) defines mission clarification as the commitment of organization leaders to a specific goal. In their survey of police departments with more than 100 officers, Weisburd and colleagues asked if agencies had a public goal of reducing crime or other problem by a specific number. His results indicate that Compstat agencies accomplish this task 48 percent of the time compared to 23 percent of the time for non-Compstat agencies. Although many police departments have a mission to reduce crime, Compstat agencies are more likely to make a public

commitment to reduce crime by a certain percentage. Bratton was explicit in his mission to reduce crime and improve quality of life through the operational use and management of police officers (Walsh 2004).

Internal accountability is another feature of Compstat evaluated by Weisburd and colleagues (2003). Police agencies were asked if their district commanders were replaced if they did not know about crime patterns in their district or if crime remained high in their district. In both cases there are statistically significant differences in the answers between Compstat and non-Compstat agencies. Compstat agencies are more likely to replace district commanders. Because of these sanctions, Compstat is often criticized for its harsh nature and lack of reward structure at weekly crime control meetings (Weisburd 2003). These meetings and the berating of middle managers by agency leaders has even been popularized by television in such shows as "The Wire." However, the constant scrutiny and reality of consequences works to focus middle managers on the aforementioned publicly stated performance goals. Compstat became powerful because Bratton not only published data, but used that data in making personnel and organizational decisions (Moore 2003).

Geographic organization of command refers to the territorial division of the city and the authority of its commander. The New York Police Department (NYPD) primarily uses the 76 precincts as the territorial division within the city. In an effort to increase responsibility, Bratton gave precinct commanders additional accountability for decision-making and placed more resources under their direct command. Instead of centralized divisions such as vice, narcotics, and detectives, Bratton placed these functional groups under the authority of precinct commanders. Through Compstat, precinct commanders received the resources needed to manage their command on a daily basis. This shift in authority represents a departure from conventional policing as specialized commands now report to geographic precinct commanders (Moore 2003). However, as other cities continue to divide their jurisdictions into distinct

geographic regions, Weisburd (2003) found no significant difference regarding additional decision-making authority between Compstat and non-Compstat cities.

Compstat's organizational flexibility requires agencies to review up to date data and deploy resources to address specific problems. Upon his arrival, Bratton (1998) was surprised to find that most officers assigned to community policing had the weekend off and did not coordinate their schedule according to crime trends. Weisburd (2003) later found a significant difference between Compstat and non-Compstat agencies in the reassignment of patrol officers to new units, areas or work shifts. However, there was no difference in the allocation of civilians or specialized units.

The use of data for decision making is another key feature of Compstat. Although analysis of crime data is not new to policing, recent technological improvements have improved the one dimensional pin maps of the past. Current computer mapping technology allows analysts to map not only the location of crime, but provide a multi-dimensional approach with additional layers such as gun arrests, drug arrests and other specific elements of the crime. These additional layers allow analysts to view more details about crimes which in turn help identify developing trends. Weisburd (2003) found Compstat agencies are significantly more likely to perform detailed crime analysis and mapping.

Innovative problem solving is concerned with the selection of problem solving strategies and which strategies are implemented. Weisburd (2003) specifically developed survey questions to determine how a strategy was selected and whether or not that strategy was innovative by how it differed from traditional police approaches. Compstat agencies are more likely to engage in innovative problem solving through the use of computer or mapping based analysis but the solutions of Compstat and non-Compstat agencies are consistent with traditional police strategies (Weisburd 2003).

The final element, external information exchange, is concerned with the transparency of Compstat and the ability to communicate information to the public and receive feedback from

interested stakeholders (Willis 2004). Compstat meetings are not only valuable in ensuring accountability, but provide a forum for open dialogue between agency leaders and middle managers. According to Moore (2003, p. 481), "NYPD not only collected the information, reviewed it at top management, and published the information, but they also required managers to discuss the information in a public forum that included not only peers, superiors, and subordinates but also members of the public." Eventually, "Compstat Books" would provide information beyond crime statistics such as sick leave, overtime use and other administrative measures. Compstat books are able to produce a snapshot of each precinct and how they rank in comparison to other NYPD precincts; all stakeholders had the same information prior to meeting (Henry 2003).

In their research, Weisburd (2003) are able to identify, define, and evaluate six characteristics associated with Compstat. However, mission clarification, internal accountability and use of data are the only characteristics more likely to be found in Compstat agencies. The authors offer an explanation for the popularity of Compstat, and an explanation regarding its key characteristics.

First, Compstat's popularity is influenced by data driven decision making, an increase in knowledge about crime, technology and acceptance of progressive management techniques (Weisburd 2003). Furthermore, as these "strategic" trends are widely accepted, Weisburd reasoned that non-Compstat agencies also adopt them making it difficult to distinguish Compstat and non-Compstat agencies. According to the authors, "The New York Police Department's contribution appears to be its leadership in bringing all of these elements together in a single program (Weisburd 2003, p. 445)." Second, agencies choose those characteristics consistent with their organization which often reinforce the traditional, rational model of policing; "The combined effect overall is to reinforce a traditional bureaucratic model of command and control (Weisburd 2003, p. 448)."

2.2.3 Theoretical Orientation

Compstat not only challenges conventional policing theory but also presents a challenge to contemporary public management theory. Compstat's challenge to contemporary public management theory is built on a unique foundation of leadership, communication and accountability. According to Vito (2005, p. 195) "Compstat will require re-engineering of the adapting police department; otherwise it will fail to achieve its purpose." While leadership, accountability and communication are not new to public administration, the combination of them into a specific performance management system presents a challenge for public administrators (Firman 2003). Some scholars view Compstat as a return to rational theory with an emphasis on centralization and hierarchy while others view Compstat as a strategic innovation that enhances organizational learning (Walsh 2001; Willis 2004).

2.2.3.1 Leadership

The first principle, leadership, challenges public administrators to practice bureaucratic leadership (Behn 1998) and reignites the debate concerning hierarchy and centralization. Some authors view Compstat as a return to a traditional management model of policing that favors centralization and hierarchy (Weisburd 2003; Kania 2004). According to these authors, Compstat is favorable to police organizations because it reinforces traditional management methods of command and control which came into question with the advent of community policing in the 1980's. With the exception of technology, Kania (2004) finds nothing new in Compstat. Weisburd (2003) suggests Compstat is a top-down management tool designed to carry out only the objectives of top management with severe sanctions for underperformers. While calling Compstat "innovative," Weisburd's findings indicate police agencies are designing systems "much heavier on control than on empowerment (Weisburd 2003, p.448)."

Walsh (2004) believes Compstat is a fusion of the rational model, community policing and strategic management. According to Walsh (2001, p. 63) "critics may be confusing command and control with accountability." Moore (2003) cautions leaders to be aware of how much "voltage"

occurs in any performance measurement system and whether it adversely affects organizational performance. Behn (1998) proposes five initiatives conducted by bureaucratic leaders including 1) articulating and clarifying purposes, 2) setting and pursuing performance targets, 3) educating, persuading and motivating people, 4) choosing among alternatives, and 5) experimenting with strategies and tactics.

As police commissioner, Bratton exercised bureaucratic leadership by emphasizing to the members of the police department that it was their job to reduce crime and accept responsibility for this task. Furthermore, he set a specific goal of reducing crime by 10% in one year. In addition to setting goals, Bratton's accountability system decentralized decision-making and authority to middle managers. Precincts became the focus of the police department's effort to reduce crime with strict accountability on precinct commanders.

2.2.3.2 Communication

The second principle, communication, is evident during weekly Compstat meetings and through publication of data. During Compstat meetings, precinct commanders present crime statistics and strategies to the police chief and his staff from a podium at the front and center of the room in a very public "theatrical" proceeding (Moore 2003). Current and previous crime statistics are displayed by a projector for all to see. For Bratton, this created a transparent "web" of communication (Henry 2003). In addition, the presenter does not control the agenda, the police chief does. Dehaven-Smith (2006, p. 64) describes this as a process of inquirement; "an obligation to respond discursively and publicly to a future inquiry about a specified responsibility."

During the presentation, the police chief questions the precinct commander and together they discuss future crime strategies and past crime problems. This process ensures communication is not simply a transfer of information, but rather a dialogue between organization leaders and middle managers (deHaven-Smith 2006). To add further pressure, other precinct commanders and interested stakeholders are present during the process.

Weekly Compstat meetings allow Bratton to have frequent two-way communication with his precinct commanders during which he can clarify goals and objectives. Moore (2003) finds three benefits to the format of Compstat meetings: 1) precinct commanders learn from each other, 2) the precinct commander and their problems become the focus of the organization, and 3) public meetings present an opportunity to engage citizens, although he notes Compstat is weak in this area.

Communication is further enhanced by certain follow-up and the publication of precinct crime data. Bratton insists on follow-up of key items at the next meeting which provide ongoing and direct communication (Walsh 2001). This form of communication also helps resolve internal conflicts, prioritize resources and clarify misunderstandings (Silverman 1999). In addition, the publication of precinct level crime statistics provide an opportunity for each member of the department to see how well they are doing compared to another precinct. This peer pressure helps increase the effectiveness of Bratton's accountability system (Willis 2007).

2.2.3.3 Accountability

The final principle, accountability, is concerned with results. For Compstat, the bottom line is reduced crime. With Compstat, precinct commanders are accountable for crime trends and having a plan of action to reduce them. Strict accountability and regular follow-up at weekly strategy and crime control meetings ensure precinct commanders are well informed concerning crime in their precincts. Through Compstat, Bratton provides clear goals and objectives that middle managers can meet (Henry 2003). In addition, internal rewards and sanctions exist for precinct commanders. Precinct commanders are promoted and demoted based on their performance. During his first year in office, Bratton would replace three-fourths of the precinct commanders as he implemented Compstat (Silverman 1999; Henry 2003). Through Compstat, Bratton is able to align both the public's expectations and organization's values (Moore 2003). For Walsh (2004) Compstat represents a strategically managed, open organization; a learning organization. Bratton firmly believes police officers can have an impact on reducing crime

(Bratton 1998). Several scholars have attempted to assess Bratton's claim and determine whether or not police officers and Compstat can reduce crime.

In their study of violent crime in New York City, Kelling and Sousa (2001) posed the question "Do Police Matter?" Kelling and Sousa developed a violent crime composite consisting of all murders, rape, robberies, and felony assaults occurring in New York City during the 1989-1998 time periods. Using regression analysis with the 76 police precincts as their population, Kelling and Sousa determined that order-maintenance policing, as evidenced by the amount of misdemeanor arrests, is significant in explaining the decline in violent crime.

Kelling and Sousa (2001) make a unique distinction between order maintenance policing and Compstat. According to the authors, the two are separate; order maintenance policing is a patrol strategy based on "Broken Windows" and Compstat is an administrative strategy. Although misdemeanor arrests led to a decrease in violent crime, the authors admit that other factors, such as Compstat's administrative attention to problem solving and accountability, may also explain crime reduction.

Rosenfield (2005) specifically evaluates three police interventions, including Compstat, and compares the homicide rates of the 95 largest U.S cities during the 1992-2001 time periods. Rosenfield (2005, p. 424) did not differentiate between any particular aspects of Compstat and considered it a single program; "In practice it is nearly impossible to separate the two components of Compstat." His results indicate homicide rates in New York City did not differ significantly from the average rate of homicide decline among other large U.S. cities.

Messner (2007) evaluates the homicide and robbery rates from 1990-1999 among New York police precincts in order to build on the earlier research of Kelling and Sousa. Messner chose misdemeanor arrest rates and cocaine use as key independent variables. In addition, Messner also differentiated between gun related and non-gun related homicides. According to their results, both misdemeanor arrests and cocaine use were significant variables in explaining the total decline in homicides. In addition, after separating homicides into gun related and non-

gun related, misdemeanor arrests were only found to be significant in gun related homicides. Messner concluded that order maintenance policing, as evidenced by misdemeanor arrests, did have an effect on the decline in homicide rates, but that other variables were also present.

Two other studies have attempted to replicate the earlier work of Kelling and Sousa. Refuting the work of Kelling and Sousa, Harcourt and Ludwig (2006) reexamined New York City police data and conclude that decreases in crime rates are attributed to mean reversion. In other words, crime may spike, but will eventually return to average levels without any specific intervention. Harcourt and Ludwig believe mean reversion occurs in precincts with previously high crime rates because of the crack cocaine epidemic of the 1980's. These precincts will also see the largest decreases as crime begins to subside. Rosenfield (2007) also replicated the Kelling and Sousa work and chose to examine homicide and robbery rates among police precincts and the amount of misdemeanor and ordinance violation arrests per 10,000 precinct residents. Rosenfield concluded that order maintenance policing did have a significant, negative effect on homicide and robbery rates. However, the authors caution that the impact was small and that other factors contributed.

Without a doubt, Compstat is focused on the reduction of crime. To increase police effectiveness, Bratton relied on a policing strategy of order maintenance policing and an administrative strategy of strict accountability. Much of the preceding research indicates that Compstat is a significant variable in explaining the reduction in crime, especially homicides. The research also indicates that Compstat is not the sole factor, but one of many. If a Compstat performance management system can help reduce crime in the nation's largest city, the question becomes what else can it do?

2.3 Citistat

After witnessing the Baltimore police department use Compstat and meeting with Jack Maple of the NYPD to discuss Compstat, former Mayor Martin O'Malley recognized the applicability of Compstat to managing the entire city of Baltimore (Behn 2006; Perez 2007).

Following his election as mayor, O'Malley began using Citistat to manage city departments, starting with public works. Today, ten years later, current Baltimore Mayor Stephanie Rawlings-Blake continues to use Citistat to manage Baltimore, and government officials from across the country frequently visit to learn more about it.

During its first year of operation, Citistat is credited with saving $13.2 million and by 2007 had accumulated $350 million in total savings (Perez 2007). In addition, Baltimore was able to reduce absenteeism and overtime. After combining Citistat with a centralized 311 non-emergency request line, Baltimore created an even better tool to serve its citizens. In 2004, Citistat was recognized with the Innovations in American Government Award from Harvard University's Kennedy School of Government.

2.3.1 Historical Origins

Upon his election, then Mayor Martin O'Malley inherited a city with many problems. Baltimore suffered from fiscal distress, high crime rates, and disenfranchised employees (Perez 2007). A Citistat performance management system allowed O'Malley to stay in frequent contact with department directors and prioritize the work of each department. To accomplish this, O'Malley established performance targets for each department and began to implement a service culture that prioritized citizens (Behn 2006).

O'Malley's departmental performance targets are similar to efforts of the NYPD to focus on reducing crime. Mission clarification, or in Baltimore's case, specific target objectives, are a key component in Compstat agencies and readily replicated by O'Malley. Department directors, like NYPD precinct commanders, are required to have an intimate knowledge of departmental workings and some plan for achieving target objectives, as in Compstat.

A citizen first service culture is comparable to efforts of the NYPD to improve citizen quality of life. The NYPD intended to improve quality of life by focusing on minor "Broken Windows," but O'Malley's approach was more direct. Through the utilization of a 311 non-emergency request line, O'Malley knew exactly what citizens wanted and could focus city

departments directly on those needs. O'Malley became famous for his guarantee that requests to fill potholes would be accomplished within 48 hours.

To O'Malley, accomplishing specific targets, with a focus on service were compatible goals that could be accomplished through Citistat (Behn 2006). However, there is much more to Citistat than setting a performance target and waiting for citizens to phone in requests. Although cities utilizing Citistat will customize it to their organization, there are specific structural components that underlie a Citistat system.

2.3.2 Structural Composition

Behn (2005) identifies six core drivers of Citistat. These components are: 1) the active engagement of the city's top executive, 2) the timeliness and scope of the data as well as its analysis, 3) the perseverance of the questioning, feedback, and follow-up, 4) the consequences for good, poor and improved performance, 5) a focus on problem solving, continuous experimentation and learning, and 6) the institutional memory of the city's top executives. Together, these components provide a blueprint for city leaders to follow which are reinforced at frequent meetings synonymous with Citistat. Behn (2005) believes it is the collective synergy of these core drivers that give Citistat its power.

The active engagement of the city's top executives has two components. First, Behn (2005) suggests that city leaders must be committed and show this commitment through the investment of their personal time. Without a positive commitment to success, department directors may dismiss Citistat as a recent fad that is sure to be short lived. Second, city leaders must set a direction. In Baltimore, O'Malley set specific performance targets. For Compstat, it was the clear mission to reduce crime. For Citistat to be successful, department directors must have a direction to follow and a specific goal to achieve. By establishing specific performance targets, O'Malley was assigning department directors personal responsibility for achieving them (Behn 2006).

The timeliness and scope of data are essential to the operation of any organization; cities are no different. The data must be both timely and relevant (Behn 2005). For Baltimore, Citistat meetings are frequent and consistent; department directors make their presentation on a set bi-weekly schedule. In addition to a thorough review of the data by a Citistat analyst from the Mayor's office, department directors often conduct their own "agency stat" (Behn 2005) meeting prior to presenting in an effort to identify areas of concern. Data for Citistat discussion can appear from any number of sources including departmental records, 311 service requests or from an independent Citistat investigator assigned to the mayor's office. Most importantly, the purpose of the data is to initiate discussion about a department's performance and inform decision-makers in their effort to choose managerial strategies (Behn 2006; Perez 2007).

The perseverance of questioning, feedback, and follow-up is specifically tied to the format of the bi-weekly meetings. Different than most city performance meetings, it is not the department director that controls the agenda. In Baltimore's Citistat, the Mayor controls the agenda (Behn 2007). The agenda consists of questioning, feedback and follow-up, and is dependent on the data and specific performance of a department. Citistat is specifically designed not to be a show and tell presentation of data. Citistat is a two way discussion of data and performance (deHaven-Smith 2006) between city leaders and department directors. Important to the success of Citistat are that questions are specific, the feedback intelligently informed, and unanswered issues are positively resolved; the meetings need a purpose and must be beneficial (Behn 2006).

Consequences for good, poor, and improved performance are consistent with accountability. In Baltimore, like the NYPD, Citistat identified poor performing department directors which were eventually replaced. However, the fear of job loss is not the only motivating factor. More importantly, there is always another Citistat presentation due two weeks away (Behn 2005). That the meetings are attended by peers, superiors and subordinates adds stress to the

situation. The need to answer questions regarding department performance is a consequence in itself (Behn 2005).

Citistat meetings should discuss performance with a focus on problem solving, continuous experimentation and learning. According to Behn (2005) city leaders and department directors are both responsible for improving performance. Citistat provides the forum for a two way discussion. Behn (2005, p. 308) describes the process as "less hierarchal, more collegial than the conspicuous layout of the room or the obvious direction of the questioning might suggest." Citistat provides an ideal forum for organizational learning because it brings together city leaders and department directors on a frequent basis for the sole purpose of discussing organizational performance.

Finally, institutional memory reinforces the previous five core components. Without frequent meetings between city leaders and department directors it becomes difficult to recognize when a department has actually improved performance (Behn 2005). The meetings of city leaders and department directors not only reinforce expectations and ensure accountability but builds trust. This trust can further motivate individuals and the organization to accomplish more.

Through Citistat, city leaders have a system to evaluate performance and better manage their organization. While the structural components provide a framework for cities to follow, one must also identify the underlying values of Citistat. Understanding these values is important to city leaders as they embark on adopting and implementing Citistat.

2.3.3 Theoretical Orientation

Citistat presents a theoretical challenge to public managers by emphasizing and expressing the values of leadership, communication, and accountability. Citistat differs from Compstat in three respects. First, leadership is provided by an elected official through a strong-mayor form of government. Second, communication is enhanced through the use of a 311 non-emergency phone system and greater use of the Internet. Third, Citistat subtly replaces Compstat's focus on effectiveness with a focus on efficiency.

2.3.3.1 Leadership

A unique feature of Baltimore is the strong mayor form of government. This form of government places both policy adoption and implementation of performance measurement systems in a singular individual. Julnes and Holzer (2001) previously reported policy adoption is most often a result of rational and technocratic theories whereas implementation is a result of politics and culture. Through Citistat, the strong mayor is afforded a powerful system to exercise control over the bureaucracy and implement programs (Behn 2007). Scholars continue to debate whether a council manager or strong mayor form of government provides better service to citizens. Hayes and Chang (1990) found no difference in the efficiency levels between the two types of municipal government. Strong mayor forms of government are usually preferred in larger cities because of the need for strong policy leadership in heterogeneous cities with complex problems (Morgan 1992; Svara 1999). Although Behn (2007) believes Citistat can work in cities with the council-manager form of government, few have implemented it.

Department directors are responsible for results and report to the mayor on a bi-weekly basis in a public forum to discuss the performance of their departments. The questioning of these directors sets the tone and helps to establish personal responsibility (Behn 2006; deHaven-Smith 2006). According to Behn (2005, p. 308) "Citistat is a confrontational, accountability-holding process." This dynamic, reinvigorates the debate concerning the politics-administration dichotomy. Of concern is whether Baltimore has enacted a strict accountability system via a principal-agent relationship and how much discretion bureaucratic leaders posses.

Agency theory is used to describe the relationship between a principle and an agent. According to Eisenhardt (1989) it is most useful in situations of goal conflict, outcome uncertainty and when behavior is difficult to evaluate. In the case of Baltimore, the relationship is between an elected strong mayor and bureaucratic department directors. Agency theory is concerned with reconciling the goals of the principle and the performance of the agent (Eisenhardt 1989). In a government setting, bureaucracies are characterized as budget maximizing and reluctant to

share information (Bendor 1987; Banks 1992). Contracts represent the performance agreement between the principle and agent and are often in the form of performance measures (Baker 1992). The performance measures can be either outcome-based or behavior-based. When outcomes are hard to define, they are often behavior-based and heavy on control. This control is considered necessary to monitor the performance of agents and prevent shirking (lack of effort to accomplish goals), adverse selection and reconcile information asymmetry (Eisenhardt 1989).

Viewed from an agency theory perspective, Citistat becomes a behavior-based system used by an elected strong mayor to control the bureaucracy. As a monitoring system, built on a foundation of defined outputs and frequent meetings, Citistat empowers elected officials while reducing shirking and information asymmetry. The challenge is balancing the amount of monitoring with that needed to accomplish specified goals. In lieu of better defined outcomes coupled with less monitoring, the implications for public managers include the limitation of administrative discretion (Calvert 1989; Feldman 2002) and goal conflict (Eisenhardt 1989). Once again, a separation of politics and administration appear and questions of democracy abound (Wilson; Feldman 2002).

2.3.3.2 Communication

Frequent communication is another key feature adopted from Compstat. Without frequent meetings and follow-up it becomes difficult to apply ideas from meetings (Meekings 2005; Behn 2008). Citistat meetings are conducted in a public forum of peers, superiors and subordinates. In addition to department data, data from the non-emergency 311 system are presented. 311 systems have recently become a popular way for cities to receive immediate feedback from citizens and engage them in local government (Moulder 2007). Eventually, department reports are posted on a specific public web site maintained by the city of Baltimore. The city of Buffalo, NY goes one step further and not only videotapes their meetings, but posts the video on the Internet. The transparency and stress to perform in front of the public and peers

created by Citistat helps motivate department directors to achieve performance targets (Mausolff 2004; Behn 2007).

The collection and dissemination of data through Citistat is important from both a rational theory perspective and democracy perspective (Weitzman 2006). First, from a rational theorist perspective, additional information is available for improved decision making. Second, from a democracy perspective, additional information is made available to the public which can be used to engage the citizenry. In addition, citizens may find the 311 system provides a more personal experience with the city, which in turn improves their attitude toward government performance (Orr 2007).

2.3.3.3 Accountability

Efficiency is implicitly expressed in O'Malley's accountability for performance targets. It is evident that O'Malley felt the Baltimore bureaucracy was unresponsive and underperforming (Behn 2007; Perez 2007). Therefore, his establishment of performance targets in Baltimore was about increasing productivity (Behn 2007); citizen service requests were O'Malley's bottom line (Behn 2005). This stands in contrast to Bratton's efforts with the NYPD to focus more on an outcome, reducing crime. For O'Malley, outputs are most important. According to Behn (2006, p. 8) "After all, to many of Baltimore's citizens, outputs are the outcomes. A city government delivers concrete services. Thus, citizens perceive improved outputs to be improved outcomes."

O'Malley's ultimate outcome is citizen satisfaction achieved through a responsive and productive city. He is concerned more with results than the quality of those results (Behn 2007). During difficult times trying to link administrative performance measures and citizen satisfaction (Kelly 2003; Roch 2006), O'Malley may have found the solution in Citistat and 311. Citizen satisfaction is surely one type of outcome, especially if you are interested in re-election, but it is not the only outcome.

Citistat represents a unique system for managing an entire city government. O'Malley did an exceptional job of gaining control of the bureaucracy and focusing the organization on

increasing productivity and accepting a citizen first service culture. It appears Citistat was successful because O'Malley established clear performance targets and provided leadership through the commitment of his time. Within Citistat, leadership, communication and accountability through the value of efficiency are manifested. In his effort to increase productivity and responsiveness in the city of Baltimore, the unspoken true outcome is citizen satisfaction. City leaders must recognize the values expressed in a performance management system such as Citistat. There are currently no studies to determine if residents of Baltimore are better off after Citistat, but it appears they are satisfied. O'Malley, now the elected Governor of the state of Maryland, has since embarked on a journey to apply Citistat to state government.

2.4 Performance Stat

PerformanceStat is the most current adaptation of the performance management strategy, Compstat, which began with the NYPD. Whereas Compstat is applicable to police agencies and Citistat to local governments, PerformanceStat is the evolution of a "Stat" strategy to a variety of agencies including local, state, national and international organizations (Behn 2008). The Philadelphia School District has implemented "SchoolStat," Maryland and Washington use a "Stat" system to manage state government and the federal government has "BorderStat." Internationally, Australia and Scotland implemented their own "Stat" performance management systems.

2.4.1 School Stat

The Philadelphia School District implemented a pilot for SchoolStat during the 2005-2006 school years. The primary purpose of SchoolStat was to help the district achieve measureable improvements, and the federal program No Child Left Behind, was leveraged to employ the change (Patusky 2007). In an effort to improve schools and student achievement, SchoolStat requires all 270 principals, 12 regional superintendants and the chief academic officer to meet on a monthly basis. SchoolStat contains three unique features not found in earlier "Stat" systems.

First SchoolStat uses a dual layer of meetings. Initially, principals of similar schools meet with regional superintendants and then, within two weeks, superintendants meet with the chief academic officer. The dual layer of meetings provides for both horizontal and vertical communication (Patusky 2007). Horizontally, principals from similar schools (elementary, middle and high school) attend the same session and can work to solve common problems. Vertically, priorities from the chief academic officer are reinforced on a monthly basis. Monthly meetings for principals are selected to give them enough time to implement a plan that solves problems and provide feedback on how well it works (Patusky 2007). Second, SchoolStat meetings are more collegial than earlier described versions of Compstat or Citistat. SchoolStat facilitators specifically decided to include additional peer principals and regional superintendants in an effort to focus on problem solving (Patusky 2007). The format of the meeting continues to rely on quantitative data, but follows a specific regimen of analysis of issues, focus on problem solving, follow-up on action plans and evaluation (Patusky 2007). Finally, SchoolStat was implemented with minimal expectations. Initially, administrators chose SchoolStat to focus on climate, attendance and other non-instructional processes with the intent to improve a learning environment (Patusky 2007). However, it was quickly realized that SchoolStat contained much more potential. Administrators realigned the priorities of SchoolStat to achieve successful schools. Through a process of analysis, it was decided that successful schools would be measured through academic achievement, a safe climate, student attendance and teacher attendance (Patusky 2007). These measures fit three specific criteria for the Philadelphia School District including a relationship to efficient or effective operations, it was something the principal could influence, and data is available in a timely manner (Patusky 2007). In Philadelphia, administrators determined which outcomes are most important, then determined which outputs would most likely lead to their attainment and finally, could be influenced by school principals.

According to Patusky (2007), after Schoolstat, school performance improved and communication was enhanced. Both vertical and horizontal communications were improved and

survey results among principals indicate they value SchoolStat and find it a useful tool to help meet their goals. Work continues to further enhance horizontal communication by including support staff in the meetings.

2.4.2 State Stat

Governors in Maryland and Washington State have also begun to use "StateStat" as a management tool. For Maryland, it is no surprise that Governor O'Malley would replicate his work from Baltimore. O'Malley created legislation to implement StateStat and holds monthly meetings with state agencies to discuss performance. O'Malley finds that accountability is more difficult at the state level with broader goals, but believes progress will be made. O'Malley also created BayStat to oversee the multiple stakeholders involved in the Chesapeake Bay restoration. Since taking office, his website reports efforts have reduced overtime in state agencies, reduced assaults in prisons and reduced pollution in the Chesapeake Bay.

Governor Christine Gregoire created the Government Management Accountability and Performance (GMAP) system for the state of Washington. Although GMAP is based on "Stat" performance with the use of data and regular meetings, GMAP differs in its focus. Instead of agency leaders reporting individual performance, meetings are focused on themes. These themes include economic vitality, government efficiency, health, safety, and transportation. Gregoire is instilling a cooperative and collaborative environment to solve Washington State's problems. Her website states she has improved responses to child abuse and neglect complaints, streamlined permit processes and reduce traffic congestion.

2.4.3 Fed Stat

The federal government has yet to implement a widespread "Stat" system and is still under mandate to comply with the Program Assessment Rating Tool. Shortly after the September 11, 2001 attacks on the World Trade Center, Macdonald (2001) called on the Federal Bureau of Investigation to implement a Compstat system to combat terrorism. Additionally, in his bid for the Republican Party nomination for U.S. President, former New York City Mayor Rudy

Giuliani suggested a BorderStat program to reduce illegal immigration. Currently, the Los Angeles Bureau of Alcohol, Tobacco, and Firearms and the U.S. Border Patrol are the only two federal agencies to experiment with a "Stat" performance management system. Recently elected U.S. President Barack Obama appointed the first federal Chief Performance Officer but there is currently not a plan to deviate from the current performance reporting requirements of federal agencies.

2.4.4 World Stat

Internationally, Australia and Scotland both experimented with their own versions of "Stat" performance management. Queensland, Australia implemented a program of Operational Performance Reviews, based on Compstat, in 2001 to help reduce crime. The Operational Performance Reviews focused on five key areas including public safety, reducing property crime, improving service, event planning and distinct district issues. The police commissioner chairs all meetings for the 9000 member Queensland state police which protect a population of 3.5 million persons. After conducting Operational Performance Reviews from 2001-2004 Mazerolle (2007) completed a time series analysis for a period of ten years to evaluate crime statistics. Mazerolle found that Operational Performance Reviews were statistically significant in reducing crime. Mazerolle was not able to conclude that Operational Performance Reviews were the sole factor in reducing crime but felt they help establish priorities and accountability.

Scotland took a different approach and selected four distinct groups for a "Stat" pilot project. During 2005-2006 two city councils with different structures and two health boards were selected to test "Stat" performance management. Based on Citistat, these groups were given flexibility to build their own program after visiting Baltimore. The two city councils focused on environmental quality of life while the health boards focused individually on the delivery of services and discharge times from hospitals (Sharp 2006). Following the pilot project, all groups reported positive experiences with the "Stat" system. Key to success is the flexibility of the system, the engagement of top leaders, improved data quality and prioritization of goals (Sharp

2006). Groups in Scotland were most critical of the adversarial type meetings and a perceived focus on short term goals. Final recommendations indicate most elements of Citistat should be kept, except that meetings should be more collaborative and focus on continuous improvement toward achieving outcomes (Sharp 2006).

2.5 Conclusion

Since its inception in 1994, Compstat has grown from a system to manage the NYPD and help reduce crime, to a performance management system with applicability to local, state, and federal governments in the United States and abroad. The use of up to date data to manage a government organization represents a shift from reactive performance measurement to proactive performance management. Defining characteristics such as frequent meetings, engagement of top leaders, the use of data for analysis, and the discussion of past, present and future performance with certain follow-up represent a unique way to manage government organizations. As noted by Behn (2005), when these characteristics are used together they represent a powerful performance management system. In his speech at the second annual Public Performance and Reporting Network Conference (2009), public administration scholar David Ammons declared "Stat" performance measurement systems as the fourth stage of performance measurement and the time when organizations begin to use data to better manage their organizations. The first three stages are comparative performance measurement projects, the Balanced Scorecard, and citizen involvement in performance measurement.

Many varied agencies report positive results after implementing "Stat" systems, but for a system so intent on quantitative measures, there is limited academic evidence to support greater gains in either efficiency or effectiveness. The next section of this research will outline a study design intended to determine whether or not a Citistat type performance management system actually produces improved outcomes in the form of gains in efficiency or effectiveness.

CHAPTER 3

DESIGN OF THE STUDY

3.1 Introduction

The purpose of this research is to examine Citistat type performance management systems in municipal fire departments and determine whether or not they effect organizational behavior or contribute to making the organization more effective or efficient. For purpose of this study, a Citistat type performance management system consists of regular meetings, the use of data, and the comparison of past and present performance with a discussion about future performance applied to all or a majority of agencies within a local government (Behn 2006). This chapter describes the research methods and explains the research design, including the dependent and independent variables and survey instrument.

Citistat is gaining popularity among governments at the local, state, and federal level, without rigorous testing (Moore 2003). The assumption that Citistat performance management systems improve local government performance is based upon recent interest in the City of Baltimore, Maryland and research regarding Compstat and New York's reduction in crime rates (Kelling 2001; Rosenfield 2005; Messner 2007). This research extends the knowledge pertaining to Citistat performance management systems and more generally concerning performance measurement in local government. This research proposes the following five null hypotheses:

- There is no difference in organizational behavior within the jurisdictional boundaries of municipal fire departments that utilize a Citistat type performance management system and municipal fire departments that do not.
- There is no difference in the number of structure fires within the jurisdictional boundaries of municipal fire departments that utilize a Citistat type performance management system and municipal fire departments that do not.

- There is no difference in the number of civilian fire fatalities within the jurisdictional boundaries of municipal fire departments that utilize a Citistat type performance management system and municipal fire departments that do not.
- There is no difference in the amount of fire property loss within the jurisdictional boundaries of municipal fire departments that utilize a Citistat type performance management system and municipal fire departments that do not.
- There is no difference in relative efficiency within the jurisdictional boundaries of municipal fire departments that utilize a Citistat type performance management system and municipal fire departments that do not.

Because Citistat is new to the fire service and local government in general, this research uses multiple tools to assess its impact on municipal fire departments. A survey instrument, analysis of secondary data with ordinary least square regression and data envelopment analysis are used independently to evaluate organizational behavior, organizational effectiveness and organizational efficiency in municipal fire departments. This methodology provides a comprehensive perspective and includes the opinions of practicing administrators in addition to testing variables previously found to be significant in related literature.

All municipal fire departments serving a population greater than 100,000 are invited to participate in this research (N=254). A random sample is not possible because there is no reliable indicator of how many municipal fire departments use a Citsitat type performance management system. Citistat has not permeated the fire service in the same way that Compstat spread among police departments (Weisburd 2003). Although Compstat is embraced and implemented among police chiefs, Citistat is more often implemented by elected strong mayors in an effort to improve local government. For this reason, and because previous research (Poister 1995; Berman 2000) indicate larger jurisdictions are more likely to use performance measurement systems, larger municipal fire departments are selected as the population for study. To distinguish between fire departments that use a Citistat type performance management

system and those that do not, survey respondents are asked at the conclusion of the survey instrument whether or not their department engages in a Citistat type performance management system. Respondents then self select whether or not they utilize a Citistat type performance management system (see Appendix A).

Secondary data is obtained from the U.S. Fire Administration's National Fire Data Center and its National Fire Incident Reporting System (NFIRS). NFIRS houses the most comprehensive database of fire incident responses in the United States. NFIRS began collecting data from six states in 1976 following the congressional report *America Burning* and its identified need for fire data. Although NFIRS is a voluntary reporting system, it is now a requirement for fire departments receiving federal Fire Act grant money. By 2004 departments from all fifty states were participating in the NFIRS system. 2004 also marks the first year in which only version 5.0 data are used for reporting (USFA 2010). In previous years, older versions had to be converted to version 5.0, which was introduced in 1999. Schaenman (1977) indicates there is often variation in the annual amount of total structure fires, property loss and civilian fire fatalities among cities; because of this, dependent variables represent an average of fire incidents, civilian fatalities and property loss from 2005 to 2007.

Two other databases are evaluated for secondary municipal fire department data but found insufficient. First, the National Fire Protection Agency (NFPA) compiles a sample survey of fire and injury data each year. This data is proprietary and not available. The NFPA uses its sample of departments for a "national estimates" approach to fire information (Hall 1989). This is considered necessary because NFIRS is voluntary and not all fire departments may be represented. Using factors from the NFPA survey, NFIRS data is "scaled-up" to reflect what is believed to be a better estimate of fire related data. In this research, NFIRS data are not scaled up because the survey population consisted of larger fire departments which are well represented in both the NFIRS and NFPA databases.

Next, the International City Management Association collects data from municipal fire departments as part of its Comparative Performance Measurement program. While this program offers great promise in its ability to standardize measures across departments, there are not enough participants to accomplish the current research.

3.2 Organizational Behavior

The purpose of the survey is twofold; first to examine the effect a Citistat type performance management system has on the organization, and second to obtain information about municipal fire department performance not otherwise available.

A review of the literature pertaining to Compstat, Citistat and performance measurement in local government was undertaken to build the survey. The survey consisted of thirty-two questions pertaining to organizational performance measurement and nine questions about the structure of the organization (see appendix A). A Likert scale consisting of strongly disagree, somewhat disagree, somewhat agree and strongly agree were used for scoring.

Extending the work of Poister and Streib (1999), the first group of items evaluates the type of performance indicators in use by municipal fire departments. Poister and Streib's survey of city managers in the nation's largest cities helps determine the extent and type of performance measures in use. Although their survey is not specific to any particular city agency, municipal fire department responses are expected to be consistent with responses from city managers.

The second group of items integrates research by Weisburd (2003) and Behn (2005) to determine the structural components of each municipal fire department's performance measurement system. Because Citistat was created from Compstat, it is expected that respondent's answers will be similar to those reported by Weisburd. Additionally, the survey presents an opportunity to determine which of Behn's (2005) "core drivers" are truly essential to the composition of Citistat which include: 1) the active engagement of the city's top executive, 2) the timeliness and scope of the data as well as its analysis, 3) the perseverance of the questioning, feedback, and follow-up, 4) the consequences for good, poor and improved

performance, 5) a focus on problem solving, continuous experimentation and learning, and 6) the institutional memory of the city's top executives.

The third group of items asks respondents their opinion regarding the effect performance measurement systems have on their organizations. This continues the work of Poister and Streib (1999) and includes difficulties faced by the organization. This section is followed by the final section of questions which asks respondents questions concerning characteristics of their organization that may influence expenditures, fire suppression and fire prevention efforts.

A pilot of the survey was drafted and sent to the fire chief of five smaller municipal fire departments not included in the study population. This included municipal fire departments which serve population ranges of 40,000-50,000 persons. Respondents were asked to review the survey and provide written comments concerning clarity, relevance and ease of answering. After recommendations were considered, the survey was placed into electronic format and posted to a secure website maintained by SPSS Inc. To increase the response rate, a letter of endorsement was obtained from the fire chief of an included municipality. This letter attested to the importance of the study and the potential benefits from participating (see appendix A).

The final survey instrument was mailed to a select population of 254 municipal fire chiefs in July 2008. Respondents were given the opportunity to key a unique identifier into their web browser and complete the survey online. Respondents also had the opportunity to return the survey by mail or use the secure web site. Surveys returned by mail were subsequently placed in the online database. A second mailing was accomplished in October 2008, 194 surveys were received by December 2008 for an overall response rate of 76%.

3.3 Effectiveness

Effectiveness is concerned with the extent to which municipal fire departments achieve certain outcomes which are of value to society. Schaenman (1977) best articulates these goals as "to minimize losses to persons and property by helping to prevent fires from occurring and to suppress losses from fires that occur." Coulter (1979, p. 67) also states "effectiveness is defined

as the extent to which the fire service avoids or reduces property loss, death and injury due to fire." A review of fire service related literature establishes three outcomes for the measurement of municipal fire service effectiveness. These outcomes are the number of fire incidents, the number of civilian fire fatalities, and the amount of fire property loss (Schaenman 1977; Wallace 1977; Coulter 1979). Each of these outcomes represents a dependent variable.

Previous researchers discovered several factors that explain the variation in the number of fires, number of civilian casualties and amount of property loss. These factors are categorized as socioeconomic characteristics, demographics, building characteristics and climate (Karter 1978; Munson 1983; Jennings 1996). Central to this study is the absence of a management variable. Therefore, each equation in this study contains one of the dependent variables and a selection of independent variables representing socioeconomic characteristics, demographics, building characteristics, climate and management. The independent variables are selected based on their reliability in literature pertaining to the fire service.

A dummy variable indicating whether or not a department utilizes a Citistat type performance management system is the primary management variable. Another management variable, the Insurance Services Organization (ISO) rating of each department is also selected because of its historical significance with the fire service. ISO ratings represent a "report card" for fire departments and are often used as a singular rating of a department's effectiveness. ISO ratings are given on a scale of "one" the best and "ten" the worst. ISO ratings are not without criticism, according to Coe (1983) the ratings do not adequately predict performance or result in lower insurance rates but are widely used. Wallace (1977) suggests ISO ratings emphasize quantity and a lack of quality. In addition, ISO ratings are also criticized because of the weighting placed on dispatch procedures, fire suppression and water supply to the exclusion of fire prevention efforts and other programs.

3.3.1 Building Fires

Buildings are defined in the NFIRS reference guide (2008) as an assembly of materials forming a construction for occupancy. Buildings are built objects and can be further categorized as either residential or non-residential (TriData 2008). Residential structures include one and two family dwellings, apartments and other residential structures such as hotels and dormitories. Non-residential structures include industrial and commercial properties, institutions, educational establishments, mobile properties and storage properties (TriData 2007). Structure fires account for the largest number of civilian fire deaths, injuries, and amount of property loss on an annual basis (TriData 1998; TriData 1999). In 2004 residential and non-residential structure fires accounted for 38% of all fires, 79% of deaths and 86% of dollar loss (TriData 2007).

Further analysis indicates residential structure fires account for the majority of civilian fire fatalities, while non-residential structure fires account for the largest amount of dollar loss per fire (TriData 2007). The principal causes of structure fires include cooking, intentionally set (arson), heating, and electrical. Cooking is the leading cause of residential structure fires and intentionally set is the leading cause of non-residential structure fires. Smoking, however, is the leading cause of civilian fire fatalities (TriData 1999).

Karter and Donner (1978) completed one of the first analyses of residential fire rates among different cities. Using census data and 1975 departmental data from five cities, the researchers evaluated population characteristics and housing characteristics in an attempt to explain fire rates. Using fires per 1000 people, Karter and Donner compared the average fire rate among high and low risk groups and concluded that family stability (percentage of persons under 18 and living with both parents) and poverty (percentage of persons below the poverty level) best explained the fire rates with population characteristics. In addition, housing characteristics that best explained average fire rates were crowdedness (percentage of year-round housing with at least 1.01 persons per room), ownership (percentage of year-round housing units that are owner occupied), and vacancy rates (percentage of year-round housing units that are vacant).

In his study of fire-cause patterns in Toledo, Ohio, Gunther (1981) questioned whether race and income were explanatory variables for the various causes of fires. Using NFIRS data from 1976-1979, Gunther first examined the overall residential fire rates per 100,000 population and then seven different categories of fire causes including incendiary, smoking, children playing, cooking, heating, electrical distribution and appliances. Gunther found that median income explained the variation in average residential fire rates as a total and for six of the seven causes of fire; race was only relevant as related to differences in income.

Munson and Oates (1983) further examined the systematic relationship between structural, climatic, and socioeconomic variables. Utilizing three separate samples consisting of census tracts in a single city, smaller municipalities and larger cities, the authors tested seven separate hypotheses and discovered similar results among all groups. Among fifty-four larger urban cities, with a 1970 population exceeding 200,000, Munson and Oates (1983) identified colder winter temperatures, median family income, percent of families with 1969 income below the poverty line, percent of owner-occupied dwellings, percent African American, and the percentage of units built prior to 1940 as significant variables in explaining the variation in building fires per 1000 persons. Independent variables tested and found not to be significant include percent of the population age 15 years of less, the percent unemployment rate, and crowding. This study demonstrated a clear link between community characteristics and an increased fire risk.

Fahy and Norton (1989, p. 32) examined the urban fire problem for 50 of the nation's largest cities with populations greater than 250,000. In comparing the median fire rate per 100,000 and the median death rate per 100,000 reported to the National Fire Protection Association in 1986 or 1987, the authors concluded "overall, cities with higher levels of poverty do have higher rates of residential fires and deaths in residential fires."

More recently, Charles Jennings (1996) explored the relationship between socioeconomic factors and the environment in his study of residential fire rates among census

tracts in Memphis, Tennessee. Jennings hypothesized that four factors interacted to either directly or indirectly increase fire risk. These factors were building stock, social and household system, demographics, and economics. In his final regression model, Jennings identified four significant variables which together explained 63% of the variation in residential structure fires. These variables, representing each of the four interrelated factors, were percent of vacant dwelling units, percent of households headed by female single parents, percent of population less than 17 or older than 65, and median household income.

Finally, a report from the National Fire Data Center examined the relationship between city characteristics and residential fire rates with NFIRS data from 1993-1995. The authors were particularly interested in climate, demographics and socioeconomic factors as explanatory variables. With a sample population of 27 large U.S. cities and counties, the authors evaluated the overall fire rate and the rate of fires for eight other causes. The fire rates were calculated using the aggregate number of residential fires in each category divided by the population (TriData 1998). Concerning the overall fire rate, OLS regression found 64% of the variation was explained by three significant variables including annual precipitation, percent of pre-1940 housing units, and percent of population under age 5. Interestingly, the authors did not find poverty to be a significant variable. The researchers explain this result is most likely attributed to the selected sample population which contained newer southern cities with high poverty rates and low rates of fires along with older northern cities with low poverty rates and higher fire rates (TriData 1998).

This research intends to build on the previous studies concerning the link between city characteristics and the number of structure fire incidents by using NFIRS data from 2005-2007 and making the following improvements. First, a larger sample population of U.S. cities with populations exceeding 100,000 is selected to increase generalizability and reduce statistical bias. Second, an independent variable for management is added to the previous explanatory factors of socioeconomic characteristics, demographics, building stock and climate. Third, a climate

variable is used to control for local conditions that have been problematic in inter-city comparisons (Schaenman 1977).

The dependent variable, number of building fires, is operationalized as the average number of building fires per 10,000 population from 2005-2007. This data is obtained from the NFIRS Basic Module for all fires coded 111. The independent variables are selected based on their reliability in related literature and to represent socioeconomic characteristics, demographics, building stock, climate and management. The list of independent variables, definitions and predicted direction of influence are listed in Table 3.1.

Table 3.1 Building Fire Independent Variables

Variable Name	Description	Dimension
Poverty (+)	% income below poverty line	Socioeconomic
Income (-)	median household income	Socioeconomic
Family Stability (-)	% under 18 and living with both parents	Socioeconomic
Supervision (+)	% of female headed household	Socioeconomic
Age (+)	% under age 5 or older than 64	Demographic
Black (+)	% African American	Demographic
Ownership (-)	% owner occupied	Building Stock
Housing (+)	% built prior to 1940	Building Stock
Vacant (+)	% vacant	Building Stock
Precipitation (+)	annual precipitation	Climate
Citistat (-)	Citistat type performance management system	Management
ISO (+)	Insurance Service Organization rating	Management

3.3.2 Civilian Casualties

Civilian casualties represent any civilian (non-fire service member) injured or killed as a result of a structure fire incident. The U.S. Fire Administration has successfully met its goal of reducing civilian deaths from fire by 50% from a 1974 average of 12,000 persons to approximately 4,000 persons in 2004. Unfortunately, the U.S. still has one of the highest civilian fire death rates when compared to other developed nations (TriData 1997). Most deaths occur in private residences and are caused by smoking (TriData 1999). Fire incidents account for more fatalities than all natural disasters combined, but is obscured because they occur over approximately 1.8 million fires throughout all fifty states (TriData 2007). More troublesome, fire deaths are not evenly distributed among the population but adversely affect certain segments of society. Fahy and Norton (1989) reported that cities with high levels of poverty have higher rates of fire fatalities. In addition, African Americans and American Indians have a higher fire death rate per capita than the national average and men are more likely to die in a fire than women (TriData 2007). Previously, Gunther (1981) found inner city neighborhoods were 8.5 times more likely to have fires caused by smoking as high income neighborhoods and the U.S. Fire Administration (TriData 1998) reported that the age of housing stock was positively related to careless smoking fire rates.

Following the deaths of 55 Baltimore, Maryland residents in a three-year period, Mierley (1983) conducted a review of the case reports for all unintentional deaths related to house fires. Her findings revealed children under age 5 had the highest death rate followed by those over age 60, cigarettes were the reported source of ignition in 47% of fatal fires and high levels of alcohol were found in 50% of adults that died in cigarette-ignited house fires. In addition, Mierley reported the death rate for African Americans were twice that of Caucasians and 3.4 times higher for those living in areas with the lowest median rental value regardless of race.

Patetta and Cole (1990) reviewed 200 civilian fire fatalities in North Carolina which occurred in 1985. Their findings indicate most fatalities are caused by heating units, followed by

smoking. Patetta and Cole attribute this finding to the increased use of portable heating equipment use in Southeastern states. Similar to other researchers, 56% of fatalities tested for alcohol had levels considered legally impaired and the highest death rate was for those age 75-84 years. Another North Carolina study also found persons under age 5 and greater than age 64 were more likely to die in residential fires. Individuals less than age 5 were six times more likely to perish than persons age 18-64 (Marshall 1998). Again, alcohol was a factor in 53% of fatalities.

Similar findings were discovered in New Jersey and a Dallas, Texas multi-year retrospective study of fire fatalities and injuries. According to Barillo and Goode (1996), children and the elderly were overrepresented among fire fatalities and children under age five experienced the highest fire fatality rate. In addition, smoking materials were the most common cause of ignition. Although not discussed in their research, Table I (p86) indicates the fatality rate for White as 53.3% while representing 48.7% of the population and Black as 37.5% while representing only 13.4% of the population. Istre (2001) found the rate of injuries related to house fires was highest among the elderly, minorities and low-income populations.

Hannon and Shai (2003) extend the research regarding racial disparity among fire fatalities by arguing that race alone is insufficient to explain the increased risk but should be viewed as a combination of racial disparity in income and geographic concentration. Their argument follows the thesis of William Julius Wilson's (1987) work *The Truly Disadvantaged*. Their analysis of U.S. metropolitan counties found the percent African American, the proportion of houses built before 1940, population density, location within the Southern region, median family income, and their resource deprivation index to be significant variables in explaining the variation in fire death rates. The authors suggest this supports their "cumulative disadvantage" theory that the combination of low income and high populations of African Americans results in extremely high fire death rates. Hall (2008) also found poverty, low education, and smoking to be correlated with fire death rates. In addition, age of housing is believed to be a poor predictor because the

issue is not the age, but who occupies the home; usually poorer, less educated individuals (Hall 2008).

The previous research on civilian fire fatalities is very conclusive regarding the overrepresentation of certain segments of society. This overrepresentation occurs for those in lower socioeconomic settings and even more so if one's race is African American. In addition, the previous research is clear that the very young and old are more susceptible to fire and that most fatal fires are ignited by smoking materials.

The dependent variable, number of civilian fire fatalities, is operationalized as the average number of civilian deaths per 10,000 population from 2005-2007. The data is obtained from the NFIRS civilian casualty module. Only civilian deaths are used because of the believed inaccuracy regarding injury reporting in NFIRS (TriData 2007). The independent variables are selected based on their reliability in related literature and to represent socioeconomic characteristics, demographics, building stock, climate and management. The list of independent variables, definitions and predicted direction of influence are listed in 3.2.

Table 3.2 Civilian Fire Fatality Independent Variables

Variable Name	Description	Dimension
Poverty (+)	% below poverty line	Socioeconomic
Income (-)	median household income	Socioeconomic
Age (+)	% under age 5 and over 64	Demographic
Black (+)	% African American	Demographic
Housing (+)	% built prior to 1940	Building Stock
Precipitation	annual precipitation	Climate
Citistat (-)	Citistat type performance management system	Management
ISO (+)	Insurance Service Organization rating	Management

3.3.3 Fire Loss

Fire loss is typically portrayed as the amount of direct dollar loss associated with structure fire incidents. Direct loss is an estimated $10 billion dollars per year for the United States (TriData 2007). When other indirect loss such as the cost of fire departments, the cost for building protection, and the cost of insurance is added, the total cost of fire is estimated at $165 billion per year or 2 percent of GDP (Frazier 2005; TriData 2007; Hall 2009). Direct property loss accounts for 5-6 percent of the total cost of fire while maintaining the fire service itself is estimated to comprise 30-45 percent (Frazier 2005).

There are two concerns regarding the use of fire loss to rate the effectiveness of a municipal fire department. The first concern is "non-reporting" of loss from departments which is compounded by the difficulty in accurately assessing monetary damage and loss (TriData 2007). One study contained a sample of fire incidents with 30% of the dollar loss recorded as zero (Hasofer 2006).

The second concern is the amount of loss associated with non-residential structure fires. Non-residential structure fires currently have the highest dollar loss per fire. Non-residential structure fires account for seven percent of total fires and 24 percent of annual dollar loss (TriData 2007). On an annual basis, a few large loss non-residential structure fires could skew the results concerning dollar loss. Gunther (1981) observed inner cities have 14.4 times as many intentionally set fires as higher income areas. Socioeconomic indicators found to explain the variation in arson rates for residential fires includes median income and the proportion of rental housing units (TriData 1998).

Another method for evaluating a municipal fire department's effectiveness concerning the amount of property loss is to use the amount of fire spread (Schaenman 1977; Ammons 2001; Hasofer 2006). Fire spread is defined in the NFIRS reference guide (2008) as how far the flame damage extends and only includes those areas actually burned or charred. There are five classifications including 1) confined to object of origin, 2) confined to room of origin, 3) confined to

floor of origin, 4) confined to building of origin, and 5) beyond building of origin. Schaenman (1977) first suggested flame spread as a supplement for loss estimates. Today, the ICMA Comparative Performance Measurement Program recommends the percent of fire confined to the room of origin as an in-depth effectiveness measure.

In their examination of fire casualties, Hasofer and Thomas (2006) specifically evaluated the connection between fire damage and dollar loss. The authors determined the dependence of fire loss on the extent of fire damage is highly significant. In their opinion, fire spread and dollar loss can be used interchangeably. Because of the inaccuracies among direct dollar loss reporting, this study utilizes the percent of fire confined to the room or object of origin as its dependent variable. This data is obtained from the NFIRS structure fire module.

The independent variables are selected based on their reliability in related literature and to represent socioeconomic characteristics, demographics, building stock, climate and management. The list of independent variables, definitions and predicted direction of influence are listed in Table 3.3.

Table 3.3 Fire Loss Independent Variables

Variable Name	Description	Dimension
Poverty (+)	% income below poverty line	Socioeconomic
Income (-)	Median household income	Socioeconomic
Teen (+)	% of persons under age 17	Demographic
Child (+)	% of persons under age 6	Demographic
Black (+)	% African American	Demographic
Rental (+)	% of rental units	Building Stock
Vacant (+)	% vacant	Building Stock
Precipitation (+)	Annual precipitation	Climate
Citistat (-)	Citistat type performance management system	Management
ISO (+)	Insurance Service Organization Rating	Management

3.4 Efficiency

Because Citistat proponents primarily claim budgetary savings and improved performance, it is necessary to develop a test for efficiency. Studies of municipal fire department efficiency are less common than those pertaining to effectiveness. The fire service is like many other public agencies with multiple inputs, outputs and constraints that make studying efficiency difficult. In this research, efficiency is concerned with the optimal use of inputs and production of outputs or municipal fire department productivity.

Wallace (1977) examined the productivity of the Syracuse, New York fire department following its reorganization. First, he notes the difficulty in measuring the outputs of a service which has the responsibility to minimize the number of fires and amount of property loss. For fire suppression productivity, he ultimately selects expenditures and average time spent fighting fires as measures. The average time spent fighting fires was selected because it indicates the amount of time a unit is unavailable for other emergency incidents. While his results show an increase in productivity between 12 and 35 percent following the reorganization, he advises that efficiency should be based on multiple measures.

Coulter (1979) was also concerned with fire department productivity which he measured as the total cost of fire (fire loss plus expenditure) per capita. The fire department's budget was used to represent expenditures because he reasoned that cities which spent more for fire suppression would also spend more for fire prevention. He believed it was not sufficient to reduce loss or expenditure alone, but a department must reduce the sum of both. First, he examined fire department expenditures using discriminant analysis and found it to be a function of the number of paid firefighters, unionism, city social class, climate and the number of alarms. Productivity became a function of less emergency response versatility, smaller administrative staff size, part-time status of the fire chief, and quicker average response times. The part-time status of the fire chief is probably a result of his sample which included smaller cities. The

realization that environmental and organizational variables influence fire department efficiency and effectiveness is the greatest contribution of his work.

More recently, Moore, Nolan and Segal (Moore 2005) use data envelopment analysis (DEA) to measure the efficiency of 11 municipal services (including fire departments) in 46 of the largest U.S. cities over six years. DEA allows the authors to select a set of similar decision making units (similar to firms) and compare multiple inputs and outputs amongst the sample for each service. For the fire service sample (n=18), budget and number of staff were selected as inputs and number of civilian fire deaths and total fire losses as outputs. According to their results, the most efficient cities are El Paso, San Diego and Seattle. Detroit ranked as the least efficient city. The authors also use regression analysis to determine which factors most influenced the overall efficiency of all cities.

The type of governance, used to distinguish city manager versus strong mayor type of government, was the only significant variable. Cities with city managers were more likely to rank as efficient (Moore 2005). In addition, the authors provided an overall city service efficiency ranking. Phoenix ranked first among the final 46 cities as having the most efficient service overall, whereas Citistat Baltimore ranked 38.

Choi (2005) also uses data envelopment analysis to determine the relative efficiency of county fire and emergency services in Florida. His data include six expenditure categories for inputs and five outputs. The outputs are total fires (structure, vehicle and outside fires), rescue/ emergency medical incidents, other incidents, dollar loss and casualties (civilian and firefighter). Choi evaluates each output independently and then as a combined model. According to his results, approximately 40 percent of county fire and emergency services in Florida are operating below 65 percent efficiency.

3.4.1 Data Envelopment Analysis

Data envelopment analysis (DEA) has recently become a useful tool in comparing the overall performance of similar groups in the public and non-profit sector such as schools, police

departments and hospitals (Chalos 1995; Nyhan 1999; Coates 2002). DEA is a form of linear programming. Initial DEA models were proposed by Farrell (1957) and Charnes, Cooper and Rhodes (1978) to evaluate the technical efficiency of a group, or Decision Making Unit (DMU). Each DMU is compared to the "most efficient" DMU and ranked accordingly. When graphically displayed, the line connecting the most efficient organizations is termed the efficiency frontier. Any DMU falling on the line is termed efficient, others are inefficient and "enveloped" by the line. Efficient firms receive a rating of 100 percent; inefficient firms receive a rating of less than 100 percent.

The strength of DEA is the ability to measure multiple inputs and outputs of similar groups and determine the relative efficiency with which each one operates. The ability to measure multiple performance measurement variables and determine the best benchmark gives DEA an advantage over ratio and regression analysis (Nyhan 1999). DEA also has the ability to use categorical variables in order to control for environmental factors outside the control of an organization (Banker 1986; Ruggiero 1998). In addition, outputs can be broadly defined as quality measures or effectiveness measures (Nyhan 1999). Another advantage is that weights need not be assigned to inputs or outputs for comparison (Ludwin 1989).

There are several considerations in building and evaluating a DEA model. These considerations include group selection, variable selection and measurement (Golany 1989; Dyson 2001). Groups are expected to be similar in activities and the production of outputs. Groups should also have similar resources available and operate in similar environments. Variables are minimized and selected because they represent all the resources used, represent all the outputs produced, and take into account any environmental factors. Measurement ideally conforms to a ratio scale and consists of twice as many DMU's as the sum of all input and output variables.

Limitations of DEA include selection bias of input and output variables, the number of variables selected and no capability to measure error (Lee and Brower 2006). Selection bias

occurs when input and output variables do not represent the DMU well. Selection is also dependent on adequate, timely and accurate data (Geys 2009). In addition, when too many variables are selected, more DMU's will appear to be efficient. Because of these limitations, it is important to evaluate the DMU as relative to the group selected and not as a measure of absolute efficiency (Golany 1989; Geys 2009).

The selection of variables for the comparison of municipal fire departments is based on previously related literature. The input variables include total fire department expenditures and total staff obtained from the ICMA survey. The output variables include the number of building fires and number of civilian casualties. In addition, environmental variables consisting of median household income and percent of the population African American are used to account for a fire department's external environment.

3.5 Summary

This chapter contains the research design for the study. A comprehensive approach is used to examine the Citistat performance management system. Organizational behavior, effectiveness and efficiency are all assessed in the nation's largest municipal fire departments to determine the influence of a Citistat type performance management system. The measurable outcomes include the number of building fires, the number of civilian casualties and the amount of fire property loss. The next chapter presents the results of the analysis.

CHAPTER 4

ANALYSIS OF THE DATA

4.1 Introduction

This chapter presents the findings for an examination of the Citistat performance management system in municipal fire departments serving a population greater than 100,000. The results are based on a survey instrument sent to the fire chief of the nation's largest cities and secondary information obtained from the National Fire Incident Reporting System (NFIRS), the International City Management Association (ICMA) and the 2000 U.S. Census. Contingency table analysis, standard regression, and data envelopment analysis are used to test hypotheses and establish whether or not a Citistat type performance management system has an effect on organizational behavior, efficiency or effectiveness. Respondents self selected whether or not their jurisdiction utilizes a Citistat type performance management system. Table 4.1 provides a population comparison between the sample population and respondents. Table 4.2 provides a census region comparison between the sample population and respondents.

Table 4.1 Population Comparison

Population Served	Sample N	Respondent N	Percentage
751,000-	12	10	83%
501,000-750,000	14	13	93%
251,000-500,000	38	33	87%
100,000-250,000	190	137	72%
Total	254	193	76%

Table 4.2 Census Region Comparison

Census Region	Sample N	Respondent N	Percentage
Northeast (1)	26	18	69%
Midwest (2)	44	33	75%
South (3)	92	71	77%
West (4)	92	71	77%
Total	254	193	76%

Cities are adequately represented from all population sizes and census regions. However, a majority of the respondents are from cities with a population of 100,000-250,000 (71%) and the southern and western census regions (74%). An independent-samples t-test comparing the population, diversity, and median household income of Citistat and non-Citistat cities indicates there is a significant difference between the two. The results presented in Table 4.3 indicate Citistat cities are larger, more diverse, and have lower median household incomes. Each of the results is significant, $p < 0.05$.

Table 4.3 City Mean Comparison

	citistat	N	Mean	Std. Deviation	Std. Error Mean
pop	0	155	254808.8000	341527.85827	27432.17771
	1	38	436474.1316	572961.48430	92946.62624
%black	0	155	.1624	.16519	.01327
	1	38	.2376	.17181	.02787
mhic	0	155	42489.7742	11053.49610	887.83817
	1	38	36351.3158	8203.93882	1330.85461

4.2 Organizational Behavior Results

A survey instrument was sent to the fire chief of the nation's largest fire departments to explore practitioner's opinions regarding their current performance measurement system and its

effects on the organization. A total of 254 surveys were mailed and 194 were returned for a response rate of 76%. The purpose of the survey was to determine if there was a difference in the organizational behavior of municipal fire departments that had implemented a Citistat type performance management system and those that had not. The survey instrument contained a series of thirty-two questions concerning leadership, accountability and communications which built on the work of earlier scholars (Poister 1999; Weisburd 2003; Behn 2005). Respondents were asked to choose responses among strongly disagree, disagree, agree and strongly agree. Because so few responses were recorded in the strongly disagree and strongly agree categories, each was consolidated into disagree and agree.

4.2.1 Leadership

Leadership for the purpose of the survey is concerned with setting a direction for the organization. Thus, initial survey questions asked about the design of the performance measurement system. Questions are based on common practices in performance measurement and the earlier work of Poister and Streib (1999). Respondents are asked to what extent their department developed measures relating to outputs or outcomes and to what extent they track unit costs. In addition, respondents are asked if they developed performance targets, measured quality or measured citizen satisfaction. The results are presented in Table 4.4.

Table 4.4 Leadership

Behavior	Percent Agree Citistat	Percent Agree Non-Citistat	Significance
The mayor or city's chief administrative officer are centrally involved and actively participate in our performance measurement system**	81.6%	55.5%	0.003
The fire department has developed performance measures to track outputs (workload)*	92.1%	77.6%	0.043
The fire department has developed performance measures to track outcomes (effectiveness)	84.2%	73.1%	0.154
The fire department has developed performance measures to track unit cost (efficiency)*	78.9%	60.9%	0.037

Table 4.4- *Continued*

Behavior	Percent Agree Citistat	Percent Agree Non-Citistat	Significance
The fire department has developed performance measures to track service quality	81.1%	67.1%	0.096
The fire department has developed performance measures to track citizen satisfaction	63.2%	60.6%	0.776
We establish targets for our performance goals with specific numbers or percentages	81.6%	73.7%	0.314

*p<0.05 **p<0.01

Survey results indicate the mayor or city's chief administrative officer is more likely to be centrally involved and actively participate in the performance measurement system for fire departments that use a Citistat system. In addition, Citistat departments are more likely to have performance measures to track outputs and unit costs (efficiency) than non-Citistat departments.

There is no statistical difference, when measuring significance at .05, between municipal fire departments utilizing Citistat type performance management system and those not in terms of their behavior for measuring outcomes (effectiveness), service quality, citizen satisfaction, or setting specific performance targets. However, there is a general increase in the use of performance measurement by fire departments when we compare the current results of non-Citistat agencies to the earlier work of Poister and Streib (1999). Fire departments responding to the Poister and Streib survey indicated the use of output measures 71% of the time, efficiency measures 31% of the time, effectiveness measures 57% of the time, service quality measures 56% of the time and citizen satisfaction measures 41% of the time.

In the decade since Positer and Streib (1999) first examined performance measurement use in the fire service, more fire departments now report using measures related to outputs, efficiency, effectiveness, service quality and citizen satisfaction. According to this research, it appears fire departments are increasingly measuring efficiency, service quality and citizen satisfaction. This overall increase lends support to Weisburd's (2003) hypothesis that many agencies are already using "strategic management" concepts. Those fire departments using a

Citistat performance management system appear to be even more advanced in their use of these performance measures.

4.2.2 Accountability

Accountability questions focused on responsibility and follow–up in addition to department sanctions for non-performance. Compstat and Citistat are both criticized for the harshness of their performance meetings. Seven questions focused on accountability including whether or not a department's performance measurement system increased the accountability of managers, whether the performance data were routinely questioned and if there were real consequences for good, poor, or improved performance. Additional questions asked respondents if middle managers choose problem solving strategies for high profile problems, and whether or not the department compares their performance internally or externally against other fire departments. The results are presented in Table 4.5.

Table 4.5 Accountability

Behavior	Percent Agree Citistat	Percent Agree Non-Citistat	Significance
Our performance measurement system increased the accountability of managers**	94.6%	67.5%	0.001
Our middle managers select problem solving strategies for high profile problems	65.8	49.4%	0.069
We compare our performance against other municipal fire departments	71.1%	62.8%	0.342
We compare our performance internally among geographic divisions**	78.4%	52.3%	0.004
We track performance over time and regularly compare data to determine whether performance has improved**	97.4%	75.6%	0.003
Our performance data are routinely questioned, requiring additional feedback or follow-up**	64.9%	40.0%	0.006
There are real consequences or rewards for good, poor or improved performance*	56.8%	38.1%	0.038

*p<0.05 **p<0.01

The results indicate many differences between Citistat and non-Citistat municipal fire departments, especially related to internal accountability. Regarding middle managers, Citistat type performance management cities are more likely to report the performance measurement system increased their accountability. Citistat cities are also more likely to compare performance internally among geographic divisions and track performance over time. Finally, performance data are routinely questioned and there are real consequences or rewards for good, poor, or improved performance in Citistat cities.

Citistat and non-Citistat departments reported similar behavior regarding the comparison of performance data against other municipal fire departments (benchmarking) and the opportunities for middle managers to select problem solving strategies for high profile problems. These findings are consistent with Weisburd (2003) and indicate a system focused on top-down managerial control. Wesiburd reported district commanders or line supervisors select problem solving strategies for high profile problems in 70% of Compstat cities and 54% of non-Compstat cities. Additionally, district commanders that did not remain current on crime in their districts were reported to be replaced 68% of the time in Compstat cities and 46% of the time in non-Compstat cities. Results for non-Citistat cities are also consistent with Poister and Streib (1999). Poister and Streib found that performance measurement systems substantially or moderately increased the accountability of managers 71% of the time. That external comparison occurs usually or sometimes 69% of the time and internal comparison among departments and programs occurs 55% of the time. Lastly, agencies use performance measures to track performance over time usually or sometimes 93% of the time.

4.2.3 Communication

Communication examines the flow of information internally through the organization and externally to citizens. Technology is also considered both as a means to increase information and improve communication. Compstat and Citistat each rely on technology for data analysis; Communication questions centered on these concepts. The results are presented in Table 4.6.

Table 4.6 Communication

Behavior	Percent Agree Citistat	Percent Agree Non-Citistat	Significance
The mission and goals of the fire department are clearly articulated	97.3%	92.3%	0.276
We use computer generated information for problem identification and analysis	89.5%	78.2%	0.117
We focus on what is important to measure, rather than available data*	89.5%	72.3%	0.027
We communicate performance results to the mayor or chief administrative officer on a monthly or more frequent basis***	86.8%	46.5%	0.000
We communicate performance results to citizens on an annual or more frequent basis*	78.4%	57.4%	0.019
Our performance measurement system improved organizational communication	70.3%	61.3%	0.309
Our performance measurement system led to changes in program priorities**	94.6%	71%	0.003

*p<0.05 **p<0.01 ***p<0.001

There are several communication differences between Citistat and non-Citistat cities. Surprisingly, the answers are not different regarding the use of computer generated information for problem identification and analysis. This is probably a result of the increased use of performance measurement overall in large cities and the wide availability of computers and networks. Weisburd (2003) also found database or statistical analysis software for crime analysis was used by 89% of Compstat cities and 76% of non-Compstat cities. In addition, mission clarification is an important component of Citistat, yet there is no statistical difference in responses between Citistat and non-Citistat cities. This is most likely unique to the study population; fire departments fulfill a very traditional mission related to fire suppression and prevention.

However, Citistat cites are more likely to focus on what is important to measure, rather than available data and change program priorities as a result of their performance measurement system. Poister and Streib (1999) found 95% of agencies that responded to their survey reported focusing on what is important to measure usually or sometimes and that performance measures led to changes in program priorities substantially or moderately 57% of the time. Additionally,

Citistat cities are more likely to communicate performance results to the mayor or chief administrative officer on a monthly or more frequent basis and to citizens on an annual or more frequent basis. However, respondents among Citistat and non-Citistat municipal fire departments answered similarly when asked whether their performance measurement system improved organizational communication.

4.2.4 Overall Impact

Another important feature to consider is the overall effect a performance measurement system has on an organization. These overarching benefits include improved relations, enhanced service and better decision-making. Table 4.7 indicates the fire chief's perception of the overall impact.

Table 4.7 Overall Impact

Behavior	Percent Agree Citistat	Percent Agree Non-Citistat	Significance
Our performance measurement system improved relations between fire department administrators and city leaders*	81.1%	62.6%	0.033
Our performance measurement system improved the quality of decisions**	97.3%	70.8%	0.001
Our performance measurement system improved service quality*	94.6%	77.4%	0.017
Our performance measurement system improved employee motivation	51.4%	39.6%	0.194
Our performance measurement system reduced the cost of fire department operations**	56.8%	32.5%	0.006
Our performance measurement system increased the focus on organizational goals	73.0%	60.1%	0.147
Our performance measurement system led to an organizational focus on problem solving, experimentation, and learning	70.3%	58.4%	0.186

*p<0.05 **p<0.01

Citistat departments are more likely to report improved relations between fire department administrators and city leaders, an improvement in the quality of decisions, improved service quality, and a reduced cost of fire department operations as a result of their performance measurement system. There is no statistical difference, measured at a significance level of .05,

between Citistat and non-Citistat departments regarding improved employee motivation, employee focus on organizational goals or an organizational focus on problem solving, experimentation and learning. These findings are consistent with Wesiburd (2003) and indicate Citistat is a system focused more on top-down control rather than participative management.

Responses from non-Citistat departments continue to remain consistent, but improved from the earlier work of Poister and Streib (1999). Poister and Streib found that agencies reported a substantial or moderate impact of performance measures 44% of the time for improved relations between administrators and elected officials, 78% of the time for improved quality of decisions, 72% of the time for improved service quality, 43% of the time for improved employee motivation, 46% of the time for reduced cost of city operations and 68% of the time for increased employee focus on organizational goals.

4.2.5 Challenges

Regardless of which performance measurement system an organization chooses to use, challenges will persist. The final group of questions asked fire chiefs to rate the extent to which their organization encounters common challenges associated with performance measurement systems. The results are presented in Table 4.8.

Table 4.8 Challenges

Behavior	Percent Agree Citistat	Percent Agree Non-Citistat	Significance
We have trouble keeping our performance measures current	43.2%	47.7%	0.622
We have trouble getting middle managers to support our performance measurement system	48.6%	49.0%	0.967
We have trouble compiling and distributing the data from our performance measurement system in a timely manner*	27.0%	46.5%	0.032
Our staff lacks the analytical skills needed to effectively analyze the performance measurement data we collect	23.7%	37.2%	0.117

*p<0.05

Citistat cities are less likely to report challenges with performance measurement than non-Citistat cities. Statistically, Citistat departments are less likely to agree they have trouble

compiling and distributing the data from their performance measurement system in a timely manner than non-Citistat departments. Other challenges received similar responses and are consistent with the findings of Poister and Streib (1999). Poister and Streib found agencies usually or sometimes have trouble keeping performance measures current 60% of the time, have trouble getting managers to support performance measures 46% of the time, have trouble compiling and distributing data in a timely manner 50% of the time, and report their staff lacks the analytical skills to effectively analyze the data 45% of the time.

4.2.6 Summary

Hypothesis one states there is no difference in organizational behavior within the jurisdictional boundaries of municipal fire departments that utilize the Citistat performance measurement system and municipal fire departments that do not. The results of a survey sent to the fire chief of all municipal fire departments serving a population greater than 100,000 indicate differently. A number of questions under the broad headings of leadership, accountability and communication received statistically significant different answers when comparing Citistat and non-Citistat municipal fire departments. Hypothesis one is rejected.

On leadership, Citistat cities are more likely to report the active involvement of the mayor or city's chief administrative officer, the development of output measures and the development of efficiency measures. Accountability elicited the most questions with statistically different answers. Citistat cities are more likely to 1) report increased accountability among managers, 2) compare performance internally among geographic divisions, 3) track performance over time and regularly compare data to determine whether performance has improved, 4) routinely question data, requiring additional feedback or follow-up and 5) provide real consequences or rewards for good, poor, or improved performance. Communication is also different in Citistat cities. Citistat cities are more likely to focus on what is important to measure rather than available data, communicate performance results to the mayor or chief administrative officer on a monthly basis, communicate performance results to citizens on an annual or more frequent basis and report the

performance measurement system led to changes in program priorities. When assessing the overall impact of their performance measurement system, Citistat cities are more likely to report improved relations between fire department administrators and city leaders, improved quality of decisions, improved service quality and reduced costs of fire department operations. Finally, Citistat cities are less likely to have trouble compiling and distributing the data from their performance measurement system in a timely manner.

Behn (2005) articulated six core drivers of Citistat which were operationalized into survey questions. His core drivers include 1) the active engagement of the city's top executives, 2) the breadth, depth, disaggregation of the data plus the thoroughness of the analyses of these data, 3) the perseverance of the questioning, feedback and follow-up, 4) the consequences for both good, poor, or improved performance, 5) the focus on problem solving, continuous experimentation and learning, and 6) the institutional memory of the city's top executives. With the exception of a focus on problem solving, continuous experimentation and learning, each of these core drivers are statistically more likely in the jurisdictional boundaries of municipal fire departments that utilize a Citistat type performance management system. There is a difference in organizational behavior within the jurisdictional boundaries of municipal fire departments that utilize the Citistat performance measurement system and municipal fire departments that do not.

4.3 Effectiveness Results

Multiple regression equations are used to determine the effectiveness of municipal fire departments. Fire department effectiveness is based on an average of the number of building fires, number of civilian fire fatalities, and amount of fire loss for the three-year time period 2005-2007. Three separate models are constructed to assess each of these measures independently. The dependent variables are the average number of building fires per 10,000, the average number of civilian fire fatalities per 10,000, and the average percent of fire confined to the room of origin.

4.3.1 Building Fires

The dependent variable, number of building fires, is obtained from the National Fire Incident Reporting System (NFIRS) for 2005-2007. The Basic Module of NFIRS for each year is queried and only building fires, coded 111, are counted. Prior fire service literature identifies several variables that may cause a variation in the number of structure fire incidents. These independent variables are often categorized as socioeconomic, demographic, building stock, climate and management (Karter 1978; Munson 1983; Fahy 1989; Jennings 1996; TriData 1998).

Karter and Donner (1978) found population and housing characteristics best explained the fire rate among census tracts in five cities. These characteristics are the percentage of persons under age 18 living with both parents, the percentage of persons below the poverty level and percentage of housing that is owner occupied or vacant. Munson and Oats (1983) found median family income, colder winter temperatures, percent of families below the poverty line, percent owner-occupied housing, percent African American and percent of homes built prior to 1940 as significant variables in explaining the fire rates among 54 large U.S. cities. A report from the National Fire Data Center (Tridata 1998) was able to explain 64 percent of the variation in overall fire rate among 27 large U.S. cities with the amount of annual precipitation, percent of pre-1940 housing, and percent of the population under age 5. Jennings (1996) suggests socioeconomic and environmental variables combine which can increase the likelihood of fire ignition. Jennings (1996) found four variables which explain 63 percent of the variation in residential fire rates among census tracts in Memphis, TN. These variables are percent of vacant dwelling units, percent of households headed by single parents, percent of population less than 17 or older than 65 and median household income.

The first step to ensure the independent variables predict the variation in the average number of building fire incidents is to check for correlation, or a relationship, among the independent and dependent variables. This ensures the independent variables have some relationship with the dependent variable and not too much with each other. However, correlation

does not prove causation (Chen 2002; Pallant 2007). Appendix B displays the proposed independent variables and their correlation with each of the three dependent variables. The dependent variables are the average number of building fires, average number of civilian fire fatalities and the average percentage of enclosed building fire confined to the object or room of origin for 2005-2007. Appendix C displays the correlations of the independent variables with each other.

Several variables display a moderate correlation with the building fire dependent variable and other independent variables (Appendix B). Those variables displaying a moderate correlation with the dependent variable include the percent of population below the poverty level (% poverty), median household income (mhic), percent of children under 18 and living with both parents (% with kids), percent of female headed households (% female house), percent of population that is African American (% black), percent of housing built prior to 1940 (old housing), percent of housing that is vacant (% vacant), and the average annual precipitation (rain). These variables, along with the Citistat variable, are used to construct the initial regression equation.

Many of the independent variables are also correlated with each other (Appendix C). Each independent variable is evaluated in a standard regression equation to determine if it displays statistical significance in explaining the variation in the dependent variable. Those independent variables which do not display statistical significance or are highly correlated with other independent variables are systematically removed until the best equation remains which explain the variation in the dependent variable. Table 4.9 lists the descriptive statistics of the independent variables and dependent variable in the initial regression equation. Each variable in Table 4.9 except rain and Citistat is obtained from the 2000 U.S. Census. The mean represents the average reported to the U.S. Census in 2000. The mean for rainfall reflects the mean of a three year average from 2005-2007.

Table 4.9 Building Fire Descriptive Statistics

	Mean	Std. Deviation	N
fires/10000	7.9073	4.92701	166
%poverty	.1501	.06436	193
mhic	41281.1658	10814.70353	193
%withkids	.2265	.07864	193
%femalehouse	.1399	.04503	193
%black	.1772	.16874	193
oldhousing	.1342	.14304	193
%vacant	.0650	.03072	193
rain	32.8718	15.70989	193
citistat	.20	.399	193

According to Table 4.9, the mean for the average number of fires/10,000 for municipal fire departments serving a population greater than 100,000 from 2005-2007 is 7.9. In addition 15.0 percent of the population is below the poverty level, the median household income is $41,281.00, 22.6 percent of the population have children that live with both parents, 13.9 percent of the population have a female head of household, 17 percent of the population is African American, 13.4 percent of the housing is built prior to 1940, 6.5 percent of the housing is vacant, and the mean of the average annual rainfall for 2005-2007 is 32.8 inches.

The next step to determine how well the independent variables predict the dependent variable is to compute a standard regression equation. Variables displaying a moderate correlation with the dependent variable are used to construct the first regression equation. In addition at least one variable representing socioeconomic, demographic, building stock, climate and management characteristics is used consistent with Jennings' (1996) hypothesis that fire ignition is based on an interaction of multiple variables. Table 4.10 displays the building fire models and coefficients.

Table 4.10 Building Fire Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	12.061	4.493		2.684	.008		
	%poverty	-8.235	10.435	-.108	-.789	.431	.259	3.865
	mhic	-1.265E-4	6.69E-5	-.278	-1.892	.060	.223	4.482
	%withkids	2.025	7.702	.032	.263	.793	.318	3.144
	%femalehouse	-16.617	17.212	-.152	-.965	.336	.194	5.148
	%black	8.812	4.562	.302	1.932	.055	.197	5.078
	oldhousing	4.118	3.210	.120	1.283	.201	.553	1.807
	%vacant	31.885	15.420	.199	2.068	.040	.520	1.923
	rain	.009	.029	.029	.312	.755	.558	1.792
	citistat	-1.610	.911	-.130	-1.766	.079	.884	1.131
2	(Constant)	12.102	4.477		2.703	.008		
	%poverty	-8.054	10.381	-.105	-.776	.439	.260	3.848
	mhic	-1.189E-4	6.01E-5	-.261	-1.978	.050	.275	3.641
	%femalehouse	-14.688	15.524	-.134	-.946	.346	.237	4.213
	%black	8.280	4.078	.284	2.031	.044	.245	4.081
	oldhousing	3.648	2.658	.106	1.373	.172	.803	1.246
	%vacant	31.432	15.278	.196	2.057	.041	.527	1.899
	rain	.009	.029	.029	.309	.757	.558	1.791
	citistat	-1.627	.906	-.132	-1.795	.075	.888	1.126
3	(Constant)	12.565	4.207		2.986	.003		
	%poverty	-8.279	10.326	-.108	-.802	.424	.261	3.829
	mhic	-1.217E-4	5.92E-5	-.267	-2.055	.042	.281	3.557
	%femalehouse	-15.869	15.004	-.145	-1.058	.292	.253	3.958
	%black	8.925	3.494	.306	2.554	.012	.332	3.014
	oldhousing	3.747	2.631	.109	1.424	.156	.814	1.228
	%vacant	31.649	15.218	.197	2.080	.039	.528	1.895
	citistat	-1.597	.899	-.129	-1.777	.077	.898	1.113
4	(Constant)	10.710	3.510		3.051	.003		
	mhic	-9.245E-5	4.66E-5	-.203	-1.983	.049	.453	2.208

Table 4.10- *Continued*

	%femalehouse	-20.311	13.927	-.186	-1.458	.147	.293	3.418
	%black	9.157	3.478	.314	2.633	.009	.334	2.994
	oldhousing	3.531	2.614	.103	1.351	.179	.823	1.215
	%vacant	31.914	15.198	.199	2.100	.037	.528	1.894
	citistat	-1.612	.898	-.130	-1.796	.074	.899	1.113
5	(Constant)	11.328	3.489		3.247	.001		
	mhic	-1.031E-4	4.61E-5	-.226	-2.237	.027	.466	2.145
	%femalehouse	-18.105	13.867	-.165	-1.306	.194	.297	3.371
	%black	9.289	3.486	.318	2.665	.008	.334	2.991
	%vacant	30.937	15.220	.193	2.033	.044	.529	1.890
	citistat	-1.486	.895	-.120	-1.661	.099	.909	1.101
6	(Constant)	7.895	2.298		3.435	.001		
	mhic	-7.313E-5	4.0E-5	-.161	-1.826	.070	.620	1.614
	%black	6.223	2.582	.213	2.410	.017	.612	1.634
	%vacant	34.620	14.989	.216	2.310	.022	.548	1.825
	citistat	-1.644	.889	-.133	-1.850	.066	.925	1.081

Model 1 displays a regression equation of each of the independent variables described above and the dependent variable number of building fires/10,000 for a three year average from 2005-2007. The percent of children living with both parents displays the least amount of statistical significance (.793) and it is moderately correlated with the percent of the population African American, percent of housing owner occupied, percent of housing built prior to 1940, and percent of vacant housing. For these reasons, percent of children living with both parents is removed from the model. Model 2 finds the amount of annual precipitation displays the least amount of significance (.757) and it is removed. Model 3 finds percent of the population below the poverty level to display the least significance (.424) and to be highly correlated with median household income, percent of female headed household, and percent of housing owner occupied. Percent of population below the poverty level is removed from the equation. Model 4 finds percent of housing built before 1940 to display the least amount of significance (.179) and to be moderately correlated with median household income. Therefore, percent of housing built prior to

1940 is removed as an independent variable. Model 5 finds the percent of female headed households to display the least significance (.194) and to be highly correlated with median household income and percent of the population that is African American. Percent of female headed household is removed as an independent variable.

Model 6 best explains the variation in the number of building fires/10,000 population for municipal fire departments serving a population greater than 100,000 for 2005-2007. Model 6 finds the percent of the population that is African American and percent of vacant housing are significant variables in explaining the variation in the average number of building fires per 10,000 population. Percent African American and percent of vacant housing are both significant at $p<0.05$. Percent African American and percent of vacant housing are positively related, as they increase so do the number of building fires. The standardized coefficient reveals percent of vacant housing (.216) makes the strongest unique contribution toward explaining the number of structure fires. In addition the tolerance levels of the collinearity statistics in model 6 do not display multicollinearity with values of .620, .612, .548, and .925 for median household income, percent African American, percent vacant housing, and Citistat respectively.

Two other variables are important to the overall equation, but do not achieve statistical significance. These variables are median household income and Citistat. Median household income is negatively related; as income increases the number of building fires declines. As a management variable, Citistat is important, but does not achieve statistical significance at the .05 level.

Table 4.11 reveals the amount of variation explained by the regression equation and Table 4.12 confirms the overall significance of the equation with an F statistic of 11.985. According to Table 4.11, model 6, the best equation explains 22.9 percent of the variation in the average number of structure fire incidents from 2005-2007. According to Table 4.12, model 6, the regression equation is significant at $p< 0.001$.

Table 4.11 Building Fire Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.500[a]	.250	.207	4.38809
2	.500[b]	.250	.211	4.37506
3	.499[c]	.249	.216	4.36252
4	.496[d]	.246	.218	4.35762
5	.487[e]	.238	.214	4.36883
6	.479[f]	.229	.210	4.37838

a. Predictors: (Constant), citistat, %black, oldhousing, mhic, rain, %vacant, %withkids, %poverty, %femalehouse
b. Predictors: (Constant), citistat, %black, oldhousing, mhic, rain, %vacant, %poverty, %femalehouse
c. Predictors: (Constant), citistat, %black, oldhousing, mhic, %vacant, %poverty, %femalehouse
d. Predictors: (Constant), citistat, %black, oldhousing, mhic, %vacant, %femalehouse
e. Predictors: (Constant), citistat, %black, mhic, %vacant, %femalehouse
f. Predictors: (Constant), citistat, %black, mhic, %vacant
g. Dependent Variable: fires/10000

Table 4.12 Building Fire ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1001.610	9	111.290	5.780	.000[a]
	Residual	3003.829	156	19.255		
	Total	4005.439	165			
2	Regression	1000.279	8	125.035	6.532	.000[b]
	Residual	3005.160	157	19.141		
	Total	4005.439	165			
3	Regression	998.447	7	142.635	7.495	.000[c]
	Residual	3006.992	158	19.032		
	Total	4005.439	165			
4	Regression	986.214	6	164.369	8.656	.000[d]
	Residual	3019.225	159	18.989		
	Total	4005.439	165			
5	Regression	951.574	5	190.315	9.971	.000[e]
	Residual	3053.865	160	19.087		
	Total	4005.439	165			

Table 4.12- *Continued*

6	Regression	919.037	4	229.759	11.985	.000[f]
	Residual	3086.402	161	19.170		
	Total	4005.439	165			

a. Predictors: (Constant), citistat, %black, oldhousing, mhic, rain, %vacant, %withkids, %poverty, %femalehouse
b. Predictors: (Constant), citistat, %black, oldhousing, mhic, rain, %vacant, %poverty, %femalehouse
c. Predictors: (Constant), citistat, %black, oldhousing, mhic, %vacant, %poverty, %femalehouse
d. Predictors: (Constant), citistat, %black, oldhousing, mhic, %vacant, %femalehouse
e. Predictors: (Constant), citistat, %black, mhic, %vacant, %femalehouse
f. Predictors: (Constant), citistat, %black, mhic, %vacant
g. Dependent Variable: fires/10000

These findings are consistent with prior research. Munson and Oates (1983) found median household income and percent of the population that is African American as significant variables in separate equations that help explain 23 percent and 29 percent, respectively, of the variation in fire rates in 54 large U.S. cities. In addition, Gunther (1981) and Jennings (1996) found median household income to be negatively related to fire rates and Karter and Donner (1978) found percent of vacant housing to be a significant variable in their study of Kansas City, MO as did Jennings (1996) in Memphis, TN.

Finally, a normal probability plot indicates residuals are normal and a scatter plot indicates no heteroskedasticity. In addition, two cases were identified as outliers but the maximum distance for Cook's distance was less than one, indicating they did not have any adverse influence on the results of the regression model.

Hypothesis number two states there is no difference in the number of structure fires within the jurisdictional boundaries of municipal fire departments that utilize the Citistat performance measurement system and municipal fire departments that do not. Although some variables are found to be significant and explain the variation in the average number of building fires, Citistat is not one of them. This hypothesis cannot be rejected.

4.3.2 Civilian Casualties

The number of civilian fire casualties is obtained from the National Fire Incident Reporting System (NFIRS) for 2005-2007. The Civilian Fire Casualty Module of NFIRS for each year is

queried and only non-fire service casualties with a severity of “5”, death, are counted. Much of the literature concerning civilian fire casualties finds poverty, the extremes of age (young and old), alcohol, and race (African American) to be factors which increase risk (Mierley 1983; Patetta 1990; Barillo 1996; Hannon 2003; Hall 2008). Appendix B displays the correlation between the proposed independent variables and dependent variable. The independent variables are chosen based on their reliability in related literature and to represent socioeconomic, demographic, building stock, climate and management.

Once again, Appendix C illustrates many of the independent variables are significantly correlated with each other. Wilson (1987) suggests a certain combination of race, poverty, and family structure leads to a societal “underclass” which is outside of mainstream society. This group is at an extremely high risk for fire fatality (Fahy and Norton 1989; Hannon and Shai 2003). Variables that display a moderate correlation with the dependent variable are used to build the initial regression equation. These variables include percent of the population that is African American (% black), percent of the population greater than age 65 (% >65), the ISO rating of a city (ISO), the average annual rainfall (rain), percent of property that is vacant (% vacant), percent of the population below the poverty level (% poverty), percent of female headed households (% female house), percent of the population with children living with both parents (% with kids), median household income (mhic), and population density (density). Citistat is also included as a management variable. The descriptive statistics for the moderately correlated independent variables and dependent variable are displayed in Table 4.13. All variables in Table 4.13 except the number of fatalities per 10,000 (deaths/10,000), ISO, Citistat, and rain are obtained from the 2000 U.S. Census. The mean represents the average reported to the U.S. Census unless noted otherwise.

4.13 Civilian Fire Fatality Descriptive Statistics

	Mean	Std. Deviation	N
deaths/10000	.0758	.08119	171
%black	.1772	.16874	193
%>65	.1083	.03098	193
iso	2.5227	.84822	176
citistat	.20	.399	193
rain	32.8718	15.70989	193
%vacant	.0650	.03072	193
%poverty	.1501	.06436	193
%femalehouse	.1399	.04503	193
%withkids	.2265	.07864	193
mhic	41281.1658	10814.70353	193
density	3990.8083	3138.21920	193

According to Table 4.13 the mean for the average rate of civilian fire fatality among cities with a population greater than 100,000 for 2005-2007 is .07/10,000, or 7 per million population. On average, 11 percent of the population is greater than 65 and the average ISO rating for fire departments is 2.5 on a scale of 1-10. The mean of the average annual rainfall for 2005-2007 is 32.8 inches, 6.5 percent of property is vacant, 15 percent of the population is below the poverty level, 14 percent of households are headed by a female, 23 percent of children live with both parents, the average median household income is $41, 281., and the average number of persons per square mile is 3,990. These variables are used to construct the initial regression equation with the dependent variable average number of civilian fire fatalities for 2005-2007.

The initial regression equation with the average number of civilian fire fatalities demonstrated evidence of heteroskedasticity and an alternate log-linear equation was constructed. Table 4.14 contains the models, coefficients, and collinearity statistics for the log of the average number of civilian fire fatalities.

Table 4.14 Civilian Fire Fatality Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	-2.798	1.168		-2.396	.018		
	%black	1.676	1.069	.336	1.568	.120	.158	6.334
	%>65	2.862	3.461	.105	.827	.410	.447	2.238
	iso	.173	.092	.174	1.871	.064	.839	1.191
	citistat	-.130	.192	-.061	-.676	.500	.880	1.137
	rain	.006	.006	.110	.950	.344	.537	1.861
	%vacant	-2.261	3.573	-.083	-.633	.528	.426	2.345
	%poverty	-2.724	2.412	-.208	-1.130	.261	.213	4.691
	%femalehouse	.348	3.806	.019	.092	.927	.175	5.720
	%withkids	2.086	1.754	.195	1.189	.237	.270	3.707
	mhic	-2.335E-5	1.54E-5	-.300	-1.519	.132	.186	5.378
	density	-1.555E-5	2.81E-5	-.058	-.553	.582	.659	1.518
2	(Constant)	-2.770	1.124		-2.464	.015		
	%black	1.750	.698	.351	2.506	.014	.367	2.728
	%>65	2.939	3.341	.108	.880	.381	.475	2.105
	iso	.171	.091	.173	1.888	.062	.861	1.162
	citistat	-.127	.189	-.060	-.673	.502	.895	1.117
	rain	.006	.006	.108	.960	.339	.569	1.757
	%vacant	-2.297	3.536	-.084	-.650	.517	.431	2.318
	%poverty	-2.671	2.330	-.204	-1.146	.254	.226	4.417
	%withkids	2.165	1.523	.202	1.422	.158	.355	2.817
	mhic	-2.381E-5	1.44E-5	-.306	-1.650	.102	.209	4.789
	density	-1.474E-5	2.66E-5	-.055	-.555	.580	.732	1.366
3	(Constant)	-2.715	1.117		-2.432	.017		
	%black	1.783	.694	.358	2.570	.011	.369	2.708
	%>65	2.719	3.307	.100	.822	.413	.482	2.075
	iso	.174	.090	.176	1.935	.056	.864	1.157
	citistat	-.138	.187	-.066	-.738	.462	.905	1.104
	rain	.006	.006	.108	.959	.340	.569	1.757

Table 4.14- *Continued*

	%vacant	-1.818	3.418	-.066	-.532	.596	.459	2.179
	%poverty	-3.156	2.153	-.242	-1.466	.145	.264	3.794
	%withkids	2.362	1.476	.221	1.601	.112	.375	2.664
	mhic	-2.635E-5	1.37E-5	-.339	-1.929	.056	.232	4.311
4	(Constant)	-2.745	1.112		-2.469	.015		
	%black	1.643	.640	.330	2.568	.012	.431	2.320
	%>65	2.114	3.096	.078	.683	.496	.547	1.830
	iso	.168	.089	.169	1.884	.062	.883	1.133
	citistat	-.151	.185	-.072	-.815	.417	.920	1.087
	rain	.006	.006	.108	.966	.336	.569	1.757
	%poverty	-3.221	2.142	-.246	-1.503	.136	.264	3.782
	%withkids	2.325	1.470	.217	1.582	.116	.376	2.658
	mhic	-2.540E-5	1.35E-5	-.327	-1.882	.062	.236	4.238
5	(Constant)	-2.261	.855		-2.646	.009		
	%black	1.534	.618	.308	2.481	.015	.460	2.174
	iso	.171	.089	.173	1.932	.056	.886	1.129
	citistat	-.144	.185	-.068	-.780	.437	.923	1.083
	rain	.006	.006	.119	1.075	.285	.581	1.722
	%poverty	-3.567	2.077	-.273	-1.717	.089	.280	3.570
	%withkids	1.831	1.276	.171	1.434	.154	.497	2.013
	mhic	-2.785E-5	1.3E-5	-.358	-2.145	.034	.254	3.939
6	(Constant)	-2.287	.853		-2.683	.008		
	%black	1.546	.617	.310	2.506	.014	.460	2.173
	iso	.174	.088	.176	1.969	.051	.887	1.127
	rain	.006	.006	.111	1.010	.315	.586	1.708
	%poverty	-3.694	2.067	-.283	-1.787	.077	.282	3.548
	%withkids	1.894	1.271	.177	1.490	.139	.499	2.005
	mhic	-2.768E-5	1.3E-5	-.356	-2.137	.035	.254	3.938
7	(Constant)	-2.050	.820		-2.501	.014		
	%black	1.841	.543	.369	3.388	.001	.593	1.685
	iso	.184	.088	.185	2.091	.039	.898	1.114
	%poverty	-3.904	2.056	-.299	-1.899	.060	.285	3.512
	%withkids	1.652	1.249	.155	1.323	.188	.517	1.934
	mhic	-2.846E-5	1.29E-5	-.366	-2.200	.030	.255	3.924

Table 4.14-*Continued*

8	(Constant)	-2.066	.822		-2.513	.013		
	%black	1.559	.502	.313	3.109	.002	.701	1.427
	iso	.207	.086	.209	2.398	.018	.935	1.069
	%poverty	-3.393	2.026	-.260	-1.675	.097	.295	3.388
	mhic	-2.108E-5	1.17E-5	-.271	-1.800	.074	.313	3.196

a. Dependent Variable: ldeaths

Model 1 presents the results of the initial regression equation for all independent variables that display a moderate correlation with the dependent variable. The variable in model 1 that displays the least amount of significance in explaining the variation in the log of the number of civilian fire fatalities is percent of female headed household (.927). This variable is also highly correlated with percent of population that is African American and percent of population below the poverty level. This variable is removed. Density (.580) is the least significant variable in model 2 and is eliminated. Density is also moderately correlated with other housing characteristics including percent of housing built before 1940, percent of rental property, and percent of property owner occupied. Percent of property that is vacant (.596) is the least significant variable in model 3 and is eliminated. Percent of vacant property is also moderately correlated with percent African American and median household income. Percent of the population greater that age 65 (.496) is the least significant variable in model 4 and is eliminated. Citistat (.437) is the least significant in model 5 and is eliminated. Average annual rainfall (.315) is the least significant variable in model 6 and is eliminated. Percent of children living with both parents (.188) is the least significant variable in model 7 and is eliminated. This variable is moderately correlated with percent African American and median household income. Model 8 demonstrates that percent of the population that is African American and a fire department's ISO rating are significant variables in explaining the percent change in civilian fire fatalities for municipal fire departments that serve a population greater than 100,000 for 2005-2007. Variables which are not found to be significant but

contribute to the overall equation are percent of the population below the poverty level and median household income. Citistat was not found to be significant.

According to model 8, percent African American is significant at $p<0.01$ and a fire department's ISO rating is significant at $p<0.05$. According to the standardized coefficient in model 8, the absolute value of the percent of the population that is African American (.313) makes the largest unique contribution toward explaining the log of civilian fire fatalities in this equation. The tolerance levels of the collinearity statistics in model 8 do not display multicollinearity with values of .701 and .935 for percent African American and ISO respectively.

Percent African American and ISO rating are found to be positively related to civilian fire fatalities, as the percent African American or ISO rating increases so does the number of civilian fire fatalities. Median household income and the percent below the poverty level are negatively related to fire fatalities, as income increases the number of fire fatalities decreases. As the percent below the poverty level increases, the number of fire fatalities also decreases.

Table 4.15 contains the model summary which reveals the amount of variation explained by the regression equation and Table 4.16 confirms the overall significance of the equation with an F statistic of 5.973 in model 8. According to Table 4.15, model 8, the equation explains 17.0 percent of the variation in the log of average number of civilian fire fatalities from 2005-2007. According to Table 4.16 the regression equation is significant at $p<0.001$. A normal probability plot of the log of civilian fire fatalities indicates residuals are normal and a scatter plot indicates no heteroskedasticity. One variable is identified as an outlier but the maximum distance for Cook's distance is less than one, indicating no adverse influence on the results of the regression model.

Table 4.15 Civilian Fire Fatality Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.448[a]	.201	.121	.78832
2	.448[b]	.201	.129	.78479
3	.446[c]	.199	.134	.78236

Table 4.15- *Continued*

4	.444[d]	.197	.140	.77987
5	.440[e]	.193	.144	.77804
6	.435[f]	.189	.147	.77672
7	.427[g]	.182	.147	.77678
8	.412[h]	.170	.141	.77927

a. Predictors: (Constant), density, rain, citistat, iso, %>65, %poverty, %vacant, %withkids, %femalehouse, mhic, %black
b. Predictors: (Constant), density, rain, citistat, iso, %>65, %poverty, %vacant, %withkids, mhic, %black
c. Predictors: (Constant), rain, citistat, iso, %>65, %poverty, %vacant, %withkids, mhic, %black
d. Predictors: (Constant), rain, citistat, iso, %>65, %poverty, %withkids, mhic, %black
e. Predictors: (Constant), rain, citistat, iso, %poverty, %withkids, mhic, %black
f. Predictors: (Constant), rain, iso, %poverty, %withkids, mhic, %black
g. Predictors: (Constant), iso, %poverty, %withkids, mhic, %black
h. Predictors: (Constant), iso, %poverty, mhic, %black
i. Dependent Variable: ldeaths

Table 4.16 Civilian Fire Fatality ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	17.200	11	1.564	2.516	.007[a]
	Residual	68.359	110	.621		
	Total	85.559	121			
2	Regression	17.195	10	1.720	2.792	.004[b]
	Residual	68.364	111	.616		
	Total	85.559	121			
3	Regression	17.006	9	1.890	3.087	.002[c]
	Residual	68.553	112	.612		
	Total	85.559	121			
4	Regression	16.832	8	2.104	3.459	.001[d]
	Residual	68.726	113	.608		
	Total	85.559	121			
5	Regression	16.549	7	2.364	3.905	.001[e]
	Residual	69.010	114	.605		
	Total	85.559	121			
6	Regression	16.181	6	2.697	4.470	.000[f]
	Residual	69.378	115	.603		
	Total	85.559	121			
7	Regression	15.566	5	3.113	5.159	.000[g]

Table 4.16- *Continued*

	Residual	69.993	116	.603		
	Total	85.559	121			
8	Regression	14.510	4	3.627	5.973	.000[h]
	Residual	71.049	117	.607		
	Total	85.559	121			

a. Predictors: (Constant), density, rain, citistat, iso, %>65, %poverty, %vacant, %withkids, %femalehouse, mhic, %black
b. Predictors: (Constant), density, rain, citistat, iso, %>65, %poverty, %vacant, %withkids, mhic, %black
c. Predictors: (Constant), rain, citistat, iso, %>65, %poverty, %vacant, %withkids, mhic, %black
d. Predictors: (Constant), rain, citistat, iso, %>65, %poverty, %withkids, mhic, %black
e. Predictors: (Constant), rain, citistat, iso, %poverty, %withkids, mhic, %black
f. Predictors: (Constant), rain, iso, %poverty, %withkids, mhic, %black
g. Predictors: (Constant), iso, %poverty, %withkids, mhic, %black
h. Predictors: (Constant), iso, %poverty, mhic, %black
i. Dependent Variable: ldeaths

These results are consistent with previous literature (Fahy and Norton 1989; Hannon and Shai 2003; Mierley 1983) which indicates low income is often a predictor of the variation in the rate of civilian fire fatalities and that fatalities are disproportionately spread among African Americans. Unexpectedly, the percent below the poverty level is negatively related to civilian fire fatalities. Difficulty with a "poverty" variable appeared once before in an inter-city study conducted by Tridata (1998). The authors of that study did not find poverty to be a significant variable and suggested it was a result of the specific data set which included multiple southern cities with high poverty rates, but low fire rates and few northern cities with low poverty rates and high fire rates. Whereas all census regions are adequately represented, 74 percent of the sample populations for this study are cities in the southern and western census regions. It is possible that these cities have higher poverty rates and lower fire rates than cities in the northeast region which affect the results in unexpected ways.

Hypothesis number three states there is no difference in the number of civilian fire fatalities within the jurisdictional boundaries of municipal fire departments that utilize the Citistat performance measurement system and municipal fire departments that do not. Although some variables are found to be significant and explain the variation in the average number of civilian fire fatalities, Citistat is not one of them. This hypothesis cannot be rejected.

4.3.3 Fire Loss

The percent of fires confined to the room of origin for a building fire is the dependent variable selected for fire loss. Monetary loss is not used because of inaccurate reporting and variation in values across the United States (Hasofer 2006). The percent of fire confined to the room of origin is obtained from the National Fire Incident Reporting System (NFIRS) for 2005-2007. The Structure Fire Module of NFIRS for each year is queried and only enclosed buildings are counted. The percent of fire confined to the room of origin variable includes the percent of enclosed building fires that are either confined to the object or room of origin. Using only enclosed building fires reported within the structure fire module enhances reliability by mitigating the opportunity for reporting errors and omissions across modules.

The literature on fire loss is sparse; however, several key independent variables can be identified. First, the greatest amount of fire loss occurs to commercial (business) structures, and a large percentage of those fires are intentionally set (Tridata 2007). In their analysis of arson fire rates, Tridata (1998) identified median income and the percent of rental housing as significant variables. Next, Hasofer (2006) determined that the extent of fire damage has a significant effect of the danger to occupants. He also determined the worst ignition factors are children playing with fire and cigarettes. Tridata (1998) found the percent of population under age 5 is a significant variable in explaining the variation in the children playing with fire rate. Finally, other independent variables are selected which have been significant in the previous two equations and to represent socioeconomic, demographic, housing stock, climate and management. Appendix B displays the correlation between the dependent variable and proposed independent variables.

Several of the variables display a moderate or significant relationship with the dependent variable including percent of the population African American (% black), age (% <5, % <17, and % >65) a department's ISO rating (ISO), percent of property that is vacant (% vacant), median household income (mhic), and population density (density). Those variables which display significant relationship are used to build the initial regression equation. Table 4.17 displays the

descriptive statistics of those variables. Each of the variables in Table 4.17 is obtained from the 2000 U.S. Census except the percent of fires confined to the room or object of origin (% confined), ISO rating, and Citistat. The mean represents the average reported to the 2000 U.S. Census unless otherwise noted.

4.17 Fire Loss Descriptive Statistics

	Mean	Std. Deviation	N
%confined	.5909	.12563	162
%black	.1772	.16874	193
%<5	.0727	.01289	193
%<17	.2446	.04070	193
%>65	.1083	.03098	193
iso	2.5227	.84822	176
citistat	.20	.399	193
%vacant	.0650	.03072	193
mhic	41281.1658	10814.70353	193
density	3990.8083	3138.21920	193

According to Table 4.17, the mean of the three year average from 2005-2007 indicates 59 percent of enclosed building fires are confined to the object or room of origin in the jurisdiction of municipal fire departments which serve a population greater than 100,000. In addition, 17.7 percent of the population is African American, 7 percent of the population are under age 5, 24 percent of the population under age 17, and 11 percent of the population over age 65. The average ISO rating is 2.5 on a scale of “one” the best, and “ten” the worst. 6.5 percent of the property is vacant, the average median household income is $41,281., and the amount of population per square mile is 3990. Table 4.18 presents the models, coefficients and collinearity statistics for the percent of fire confined to the room of origin.

Table 4.18 Fire Loss Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	.627	.134		4.687	.000		
	%black	-.087	.079	-.117	-1.102	.272	.552	1.813
	%<5	-2.615	2.052	-.268	-1.274	.205	.140	7.122
	%<17	.493	.602	.160	.819	.414	.163	6.119
	%>65	.377	.461	.093	.818	.415	.481	2.081
	iso	-.022	.012	-.148	-1.809	.073	.924	1.082
	citistat	.030	.026	.095	1.139	.257	.886	1.129
	%vacant	-.193	.491	-.047	-.393	.695	.432	2.314
	mhic	1.138E-6	1.22E-6	.098	.935	.351	.567	1.763
	density	5.890E-6	3.42E-6	.147	1.725	.087	.855	1.170
2	(Constant)	.623	.133		4.686	.000		
	%black	-.102	.069	-.137	-1.468	.144	.712	1.405
	%<5	-2.711	2.032	-.278	-1.334	.184	.142	7.021
	%<17	.510	.599	.165	.852	.396	.164	6.087
	%>65	.306	.423	.075	.723	.471	.569	1.756
	iso	-.022	.012	-.151	-1.857	.065	.931	1.074
	citistat	.028	.026	.090	1.093	.276	.910	1.099
	mhic	1.248E-6	1.18E-6	.107	1.057	.293	.599	1.670
	density	6.143E-6	3.34E-6	.153	1.838	.068	.887	1.128
3	(Constant)	.695	.088		7.907	.000		
	%black	-.108	.069	-.145	-1.572	.118	.723	1.383
	%<5	-3.273	1.874	-.336	-1.746	.083	.167	5.996
	%<17	.572	.592	.185	.967	.335	.168	5.962
	iso	-.022	.012	-.146	-1.804	.073	.938	1.066
	citistat	.029	.026	.093	1.131	.260	.912	1.097
	mhic	9.120E-7	1.08E-6	.079	.841	.402	.708	1.413
	density	6.011E-6	3.33E-6	.150	1.804	.073	.889	1.124
4	(Constant)	.732	.076		9.638	.000		
	%black	-.136	.060	-.183	-2.264	.025	.944	1.060

Table 4.18-*Continued*

	%<5	-3.367	1.869	-.345	-1.802	.074	.167	5.974
	%<17	.622	.588	.201	1.057	.292	.169	5.903
	iso	-.021	.012	-.144	-1.783	.077	.939	1.065
	citistat	.026	.026	.081	1.006	.316	.938	1.066
	density	6.093E-6	3.33E-6	.152	1.831	.069	.890	1.123
5	(Constant)	.735	.076		9.680	.000		
	%black	-.126	.059	-.169	-2.126	.035	.970	1.031
	%<5	-3.599	1.855	-.369	-1.940	.054	.170	5.884
	%<17	.692	.584	.224	1.184	.238	.172	5.821
	iso	-.022	.012	-.147	-1.822	.071	.940	1.063
	density	6.442E-6	3.31E-6	.161	1.946	.054	.900	1.111
6	(Constant)	.762	.073		10.472	.000		
	%black	-.123	.059	-.166	-2.081	.039	.972	1.029
	%<5	-1.615	.796	-.166	-2.028	.044	.925	1.081
	iso	-.022	.012	-.151	-1.861	.065	.941	1.062
	density	6.257E-6	3.31E-6	.156	1.890	.061	.902	1.109

a. Dependent Variable: %confined

Model 1 in Table 4.18 identifies the percent of vacant property (.695) as the variable with the least amount of significance in explaining the variation in the percent of fire confined to the room or origin and it is eliminated. Percent of vacant property is also moderately correlated with percent African American and median household income. Percent of the population greater than age 65 (.471) is the least significant variable in model 2 and it is eliminated. This variable is moderately correlated with the other age groups, those less than age five or less than age 17. Median household income is the least significant variable in model 3 (.402) and it is eliminated. Median household income is highly correlated with the poverty level. Citistat (.316) is the least significant variable in model 4 and it is eliminated. Percent of the population under age 17 (.238) is the least significant variable in model 5 and it is eliminated. It is also correlated with those greater than age 65 or less than age 5. Model 6 finds the percent African American and percent of the population less than 5 years of age are significant variables in explaining the variation in

the percent of fires confined to the room of origin in municipal fire departments which serve a population greater than 100,000 for the time period 2005-2007. A fire department's ISO rating and population density contribute to the overall equation but do not achieve statistical significance at the .05 level. Percent African American, percent of the population less than age five and ISO rating are negatively related to fire loss, as each increase the percent of fire confined to the room of origin decreases. As the population density increases, the percent of fire confined to the room of origin increases. This may reflect enhanced building codes in larger, denser cities. Percent African American and percent of population less than age five are significant at $p<0.05$ in model 6. According to the standardized coefficient in model 6, both percent of the population less than age five and percent African American (0.166) make the largest unique absolute value contribution toward explaining the percent of fire confined to the room of origin in this equation. The tolerance levels of the collinearity statistics in model 6 do not display multicollinearity with values of .972, .925, .941 and .902 for percent African American, percent under age 5, ISO rating and population density respectively.

Table 4.19 contains the model summary which reveals the amount of variation explained by the regression equation and Table 4.20 confirms the overall significance of the equation with an F statistic of 4.783. According to Table 4.19, model 6, the equation explains 11.8 percent of the variation in the average percent of fires confined to the room of origin from 2005-2007. According to Table 4.20, model 6, the regression equation is significant at $p<0.01$. A normal probability plot indicates residuals are normal and a scatter plot indicates no heteroskedasticity. One variable is identified as an outlier but the maximum distance for cook's distance is less than one, indicating no adverse influence on the results of the regression model.

4.19 Fire Loss Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.376[a]	.141	.085	.12015
2	.375[b]	.140	.091	.11978

Table 4.19- *Continued*

3	.370[c]	.137	.094	.11958
4	.364[d]	.133	.096	.11945
5	.356[e]	.127	.096	.11946
6	.344[f]	.118	.093	.11963

a. Predictors:(Constant),den,mhic iso,citistat,%<17,%black,%>65,%vac%<5
b. Predictors: (Constant),density,mhic,iso,citistat,%<17,%black,%>65,%<5
c. Predictors: (Constant), density, mhic, iso, citistat, %<17, %black, %<5
d. Predictors: (Constant), density, iso, citistat, %<17, %black, %<5
e. Predictors: (Constant), density, iso, %<17, %black, %<5
f. Predictors: (Constant), density, iso, %black, %<5
g. Dependent Variable: %confined

4.20 Fire Loss ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.328	9	.036	2.525	.010[a]
	Residual	1.992	138	.014		
	Total	2.320	147			
2	Regression	.326	8	.041	2.839	.006[b]
	Residual	1.994	139	.014		
	Total	2.320	147			
3	Regression	.318	7	.045	3.181	.004[c]
	Residual	2.002	140	.014		
	Total	2.320	147			
4	Regression	.308	6	.051	3.600	.002[d]
	Residual	2.012	141	.014		
	Total	2.320	147			
5	Regression	.294	5	.059	4.117	.002[e]
	Residual	2.026	142	.014		
	Total	2.320	147			
6	Regression	.274	4	.068	4.783	.001[f]
	Residual	2.046	143	.014		
	Total	2.320	147			

a. Predictors: (Constant), density, mhic, iso, citistat, %<17, %black, %>65, %vacant, %<5
b. Predictors: (Constant), density, mhic, iso, citistat, %<17, %black, %>65, %<5
c. Predictors: (Constant), density, mhic, iso, citistat, %<17, %black, %<5
d. Predictors: (Constant), density, iso, citistat, %<17, %black, %<5
e. Predictors: (Constant), density, iso, %<17, %black, %<5
f. Predictors: (Constant), density, iso, %black, %<5
g. Dependent Variable: %confined

Hypothesis number four states there is no difference in the percent of fire confined to the room of origin within the jurisdictional boundaries of municipal fire departments that utilize a

Citistat type performance management system and municipal fire departments that do not. Although some variables are found to be significant and explain the variation in percent of fire confined to the room of origin, Citistat is not one of them. This hypothesis cannot be rejected.

4.3.4 Summary

The effectiveness of municipal fire departments serving a population greater than 100,000 is evaluated on the basis of the number of structure fire incidents, number of civilian fire fatalities, and percent of fire confined to the room of origin for the years 2005-2007. Hypothesis number two states there is no difference in the number of structure fires within the jurisdictional boundaries of municipal fire departments that utilize the Citistat performance measurement system and municipal fire departments that do not. Hypothesis number three states there is no difference in the number of civilian fire casualties within the jurisdictional boundaries of municipal fire departments that utilize the Citistat performance measurement system and municipal fire departments that do not. Finally, hypothesis number four states there is no difference in the percent of fire confined to the room of origin within the jurisdictional boundaries of municipal fire departments that utilize the Citistat performance measurement system and municipal fire departments that do not. According to this research, Citistat is not a significant variable in explaining the variation in number of fires, number of civilian fire casualties, or percent of fire confined to the room of origin. Hypotheses two, three, and four cannot be rejected.

This research did identify several variables that explain the variation in number of fires, number of civilian fire casualties and percent of fire confined to the room of origin in municipal fire departments that serve a population greater than 100,000. The variation in number of building fires is explained by the percent of the population that is African American, percent of vacant housing, median household income and Citistat. Only percent African American and percent of vacant housing achieved statistical significance. These findings are consistent with prior research (Karter 1978; Gunther 1981; Munson 1983; Fahy 1989).

The percent change in number of civilian fire casualties is explained by the percent of the population that is African American, a fire department's ISO rating, median household income and percent of the population below the poverty level. Percent African American, poverty, and median household income are consistent with earlier research by Mierley (1983), Barillo and Goode (1996), Hannon and Shai (2003) and Hall (2008).

The variation in percent of fires confined to the room of origin is explained by the percent of the population that is African American, percent of the population less than age 5, a fire department's ISO rating, and population density. Percent African American and the percent of population less than five are recurring explanatory variables in the fire service literature (Mierley 1983; Munson 1983; Barillo 1996; Hannon 2003). In addition, percent of population that is African American and percent of the population less than age five are important independent variables in explaining the variation in monetary fire loss. Consistent with Hasofer and Thomas (2006) it appears monetary fire loss and fire spread can be used interchangeably.

4.4 Efficiency Results

Previous attempts to measure municipal fire department efficiency use a variety of techniques and measures to interpret productivity (Wallace 1977; Coulter 1979). More recently, data envelopment analysis (DEA) has become an accepted technique to compare the efficiency of similar organizations, also termed decision-making units (DMU). DEA is a form of linear programming which evaluates the inputs and outputs of decision-making units and assesses their relative efficiency. DEA's primary advantage over simple ratio analysis and regression analysis is that it optimizes results instead of averaging them; however, it has three additional benefits making it well suited for the comparison of organizations and their performance (Nyhan 1999).

4.4.1 Data Envelopment Analysis

First, DEA does not require the assignment of weights to inputs or outputs as all decision-making units are homogenous and compared only to each other. This results in a relative efficiency score. Second, DEA can compare several measures at once including multiple inputs

and multiple outputs. Additionally, outputs can be broadly defined as outcome and quality measures. In addition, DEA allows for the use of non-discretionary variables which are beyond the control of managers. Such environmental variables can include socioeconomic indicators which are held constant during the analysis. Third, DEA is estimates the amount of resources which must be produced or minimized in order for each decision-making unit to become as efficient as the most efficient firm and reach the efficiency frontier.

Golany and Roll (1989) recommend a three step process for conducting efficiency studies with DEA. This process includes steps for the selection of decision-making units, the selection of input and output variables and the application of the appropriate DEA model. In addition, Dyson (2001) reviews common problems associated with DEA and makes several suggestions to reduce errors.

The first step is the selection of decision-making units. Selected groups must be homogenous groups performing similar activities and operating under similar circumstances. Examples of homogenous groups include hospitals and schools. However, one would not develop a group consisting of primary and secondary schools. Inputs and outputs selected for comparison should differ only in intensity or magnitude. Additionally, the size of the group must be at least twice the number of inputs and outputs combined (Golany 1989; Dyson 2001). DEA is less able to discriminate with smaller groups causing more firms to appear on the efficiency frontier. For this study the decision-making units are municipal fire departments which serve a population greater than 100,000. This group is characterized as urban fire departments comprised of career (paid) personnel as opposed to rural departments or volunteer departments. Initially, 254 municipal fire departments were surveyed with a response rate of 76%. Of those 194 returns, sufficient input and output data existed for 108 municipal fire departments.

The second step consists of the selection of inputs and outputs. Choi (2005) and Moore, Nolan and Segal (2005) both use data envelopment analysis to measure the relative efficiency of fire departments. Choi evaluates fire and emergency services in Florida counties with six

expenditure inputs including personnel services, operating expenses, capital outlay, other expenditures, emergency and disaster relief costs and ambulance costs. Choi's outputs include total fire responses, emergency medical service responses, other emergency service responses, dollar loss and the rate of injuries and deaths for civilians and firefighters. Moore selects the budget and number of staff as fire department inputs and number of civilian deaths and total fire losses as outputs for fire departments in eighteen large U.S. cities. Notably, Golany (1989) cautions against using too many measures as they may dilute the differences between decision-making units and place more firms on the efficiency frontier. The suggested practice is to select twice as many input measures as output measures (Dyson 2001).

Informed by the literature, this research continues with a focus on societal outcomes produced by fire departments and uses the average number of structure fires and average number of civilian fire casualties from 2005-2007 as output measures. Input measures consist of average expenditures and average number of staff from 2005-2007. The number of structure fires and number of civilian fire casualties are obtained from the National Fire Incident Reporting System (NFIRS) and expenditure and staff information is obtained from the International City Management Association annual budget and expenditure surveys for 2005-2007.

Two additional environmental variables are also selected as inputs. Environmental variables are those non-discretionary variables beyond the control of managers which may also affect outputs. This equation considers the percent of the population that is African American and median household income as environmental variables based on their significance in earlier regression equations explaining the variation in the number of structure fires and the number of civilian fire casualties for municipal fire departments serving a population greater than 100,000. These additional inputs also help satisfy the requirement for twice the number of input variables as output variables.

The final step is to select the appropriate DEA model. An input-oriented DEA model attempts to minimize inputs while producing the given output level. Output-oriented DEA models

are used when a particular DMU attempts to maximize outputs (Cooper 2007). Because municipal fire departments do not attempt to maximize the number of fires or civilian fatalities, an input-oriented model is chosen for analysis. A measure specific input-oriented model allows the researcher to specify which inputs are to be minimized and which inputs are environmental variables and held constant. Finally, a constant return to scale (CRS), which is stricter, is utilized rather than a variable return to scale (VRS). An input-oriented CRS model is the strictest model assuming one increment of input equals one increment of output. DEA Frontier software is used to calculate the measure specific input-oriented CRS model. The results are presented in Table 4.21.

Table 4.21 DEA Results

DMU Name	Input-Oriented CRS Measure-Specific Efficiency
Anchorage, Alaska	0.53507
Little Rock, Arkansas	0.50844
Chandler, Arizona	0.28862
Glendale, Arizona	0.21385
Mesa, Arizona	0.29367
Peoria, Arizona	0.11177
Phoenix, Arizona	1.00000
Tempe, Arizona	0.39304
Bakersfield, California	0.05357
Berkeley, California	0.46676
Chula Vista, California	0.25877
Corona, California	0.09333
Downey, California	0.37143
Fremont, California	0.22133
Fresno, California	0.88886
Fullerton, California	0.26375
Long Beach, California	0.49528
Ontario, California	1.00000
Pasadena, California	0.24164

Table 4.21- *Continued*

DMU Name	Input-Oriented CRS Measure-Specific Efficiency
Richmond, California	0.98477
Riverside, California	0.39819
Salinas, California	0.51471
San Diego, California	0.29516
Santa Rosa, California	0.52603
Torrance, California	0.12007
Visalia, California	1.00000
West Covina, California	0.32890
Aurora, Colorado	0.05743
Denver, Colorado	0.33391
Westminster, Colorado	1.00000
Stamford, Connecticut	0.13355
Cape Coral, Florida	0.50552
Coral Springs, Florida	0.26752
Jacksonville, Florida	0.63289
Orlando, Florida	0.52664
St. Petersburg, Florida	0.60230
Tallahassee, Florida	0.97918
Atlanta, Georgia	0.32628
Columbus (balance), Georgia	0.22398
Honolulu CDP, Hawaii	1.00000
Cedar Rapids, Iowa	0.36358
Des Moines, Iowa	0.51532
Elgin, Illinois	0.33514
Joliet, Illinois	0.22081
Naperville, Illinois	0.22738
Peoria, Illinois	0.62314
Rockford, Illinois	0.32045
Fort Wayne, Indiana	0.60921
Olathe, Kansas	0.42781
Topeka, Kansas	0.79716
Wichita, Kansas	1.00000
Baton Rouge, Louisiana	0.12050
Lafayette, Louisiana	0.28741

Table 4.21- *Continued*

DMU Name	Input-Oriented CRS Measure-Specific Efficiency
New Orleans, Louisiana	1.00000
Cambridge, Massachusetts	0.32208
Baltimore, Maryland	1.00000
Ann Arbor, Michigan	0.01717
Sterling Heights, Michigan	1.00000
Minneapolis, Minnesota	0.83961
Durham, North Carolina	0.41040
Greensboro, North Carolina	0.47094
Winston-Salem, North Carolina	0.98447
Albuquerque, New Mexico	0.15567
Las Vegas, Nevada	0.26159
North Las Vegas, Nevada	0.32528
Reno, Nevada	0.18336
Rochester, New York	0.88921
Yonkers, New York	0.11787
Cleveland, Ohio	1.00000
Columbus, Ohio	0.42105
Oklahoma City, Oklahoma	1.00000
Portland, Oregon	1.00000
Salem, Oregon	0.94581
Columbia, South Carolina	0.93689
Sioux Falls, South Dakota	1.00000
Memphis, Tennessee	0.86258
Nashville-Davidson, Tennessee	0.43872
Amarillo, Texas	1.00000
Austin, Texas	0.30109
Beaumont, Texas	0.68184
Brownsville, Texas	1.00000
Carrollton, Texas	0.41469
Dallas, Texas	0.02607
Denton, Texas	0.18375
El Paso, Texas	0.21060
Fort Worth, Texas	0.86969
Houston, Texas	1.00000

Table 4.21- *Continued*

DMU Name	Input-Oriented CRS Measure-Specific Efficiency
Irving, Texas	0.40814
Killeen, Texas	0.72950
Laredo, Texas	0.44982
Mesquite, Texas	0.58346
Midland, Texas	0.72240
Plano, Texas	0.27910
Waco, Texas	1.00000
Salt Lake City, Utah	1.00000
West Valley City, Utah	0.72739
Alexandria, Virginia	0.16126
Chesapeake, Virginia	0.39796
Norfolk, Virginia	0.17945
Virginia Beach, Virginia	0.51382
Bellevue, Washington	0.31701
Seattle, Washington	0.15647
Vancouver, Washington	0.17882
Green Bay, Wisconsin	0.69439

DEA results place eighteen cities on the efficiency frontier. These cities are Phoenix AZ, Ontario CA, Visalia CA, Westminster CO, Honolulu HI, Wichita KS, New Orleans LA, Baltimore MD, Sterling Heights MI, Cleveland OH, Oklahoma City OK, Portland OR, Sioux Falls SD, Amarillo TX, Brownsville TX, Houston TX, Waco TX, and Salt Lake City UT. Of these cities, three report the use of a Citistat type performance management system in the survey. These cities are Baltimore MD, Oklahoma City OK, and Houston TX.

Twelve additional cities included in the DEA analysis indicated the use of a Citistat type performance management system but did not place on the efficiency frontier. Furthermore, El Paso TX, San Diego CA, and Seattle WA, which Moore (2005) found as the most efficient fire departments, did not place on the efficiency frontier. However, Moore uses an output-oriented DEA model and does not account for non-discretionary environmental variables. Phoenix AZ,

which Moore recognized as the most efficient city overall did place on the efficiency frontier. In this analysis the most efficient municipal fire department, the city most often listed as a target for other cities to benchmark, is Ontario CA. Ontario is located 35 miles East of Los Angeles and is home to approximately 175,000 people.

4.4.2 Fire Department Expenditure Regression

Regression analysis is also used to complement data envelopment analysis and determine if Citistat is a significant variable in explaining the variation in municipal fire department expenditures. For this equation the dependent variable is represented by municipal fire department expenditures per capita. This data is obtained from the ICMA annual budgeting and personnel surveys for 2005-2007. The independent variables consist of the number of firefighters per 10,000 population (ff/10,000), median household income (mhic), percent African American (% black), and Citistat. All variables except Citistat are expected to positively influence municipal fire department expenditures per capita. Table 4.22 contains the descriptive statistics of the independent and dependent variables.

Table 4.22 Fire Expenditure Descriptive Statistics

	Mean	Std. Deviation	N
budget/capita	160.5822	56.54379	121
ff/10000	14.7228	5.76349	137
mhic	41281.1658	10814.70353	193
%black	.1772	.16874	193
citistat	.20	.399	193

According to Table 4.22, the mean spending (budget/capita) for municipal fire departments serving a population greater than 100,000 for the 2005-2007 average is $160 per citizen for fire protection services. The mean number of firefighters for the 2005-2007 average is 14.7 firefighters/10,000 population. The median household income is $41,281 and 17.7 percent

of the population is African American. Table 4.23 contains the models, coefficients and collinearity statistics for the fire department expenditures per capita regression equation.

Table 4.23 Fire Expenditures Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	18.248	28.020		.651	.516		
	ff/10000	6.049	.990	.617	6.111	.000	.617	1.621
	mhic	.001	4.94E-4	.275	2.909	.004	.704	1.420
	%black	-41.788	35.715	-.125	-1.170	.244	.553	1.809
	citistat	6.998	11.601	.049	.603	.548	.939	1.065
2	(Constant)	20.696	27.649		.749	.456		
	ff/10000	6.093	.985	.621	6.188	.000	.620	1.613
	mhic	.001	4.87E-4	.266	2.859	.005	.720	1.389
	%black	-41.193	35.604	-.123	-1.157	.250	.553	1.808
3	(Constant)	13.413	26.962		.497	.620		
	ff/10000	5.523	.854	.563	6.469	.000	.827	1.209
	mhic	.002	4.55E-4	.305	3.506	.001	.827	1.209

a. Dependent Variable: budget/capita

Citistat and percent African American are the least significant variables in models 1 and 2 and do not contribute to explaining the variation in fire department expenditures. Model 3 finds the number of firefighters/10,000 and median household income as significant variables in explaining the variation in fire department expenditures. Both variables are significant at $p \leq 0.001$. The standardized coefficient in model 3 reveals the number of firefighters per 10,000 (.563) makes the greatest contribution toward explaining the variation in fire department expenditures per capita. The tolerance levels of the collinearity statistics in model 3 do not display multicollinearity with values of .827 and .827 for the number of firefighters per 10,000 and median household income respectively.

Table 4.24 reveals the amount of variation explained by the regression equation and Table 4.25 confirms the overall significance of the equation with an F statistic of 21.329. According to Table 4.24, model 3, the equation explains 26.7 percent of the variation in the budget per capita of municipal fire departments from 2005-2007. According to Table 4.25, model 3, the regression equation is significant at $p<0.001$.

Table 4.24 Fire Expenditure Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.527[a]	.278	.253	48.87993
2	.525[b]	.276	.257	48.74574
3	.517[c]	.267	.255	48.81623

a. Predictors: (Constant), citistat, %black, mhic, ff/10000
b. Predictors: (Constant), %black, mhic, ff/10000
c. Predictors: (Constant), mhic, ff/10000
d. Dependent Variable: budget/capita

Table 4.25 Fire Expenditure ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	105703.304	4	26425.826	11.060	.000[a]
	Residual	274763.479	115	2389.248		
	Total	380466.784	119			
2	Regression	104833.756	3	34944.585	14.706	.000[b]
	Residual	275633.028	116	2376.147		
	Total	380466.784	119			
3	Regression	101652.950	2	50826.475	21.329	.000[c]
	Residual	278813.834	117	2383.024		
	Total	380466.784	119			

a. Predictors: (Constant), citistat, %black, mhic, ff/10000
b. Predictors: (Constant), %black, mhic, ff/10000
c. Predictors: (Constant), mhic, ff/10000
d. Dependent Variable: budget/capita

A normal probability plot indicates residuals are normal and a scatter plot indicates no heteroskedasticity. In addition, three cases were identified as outliers but the maximum distance

for Cook's distance is less than one, indicating they did not have any adverse influence on the results of the regression model.

Hypothesis number five states there is no difference in relative efficiency within the jurisdictional boundaries of municipal fire departments that utilize the Citistat performance measurement system and those that do not. Although a few municipal fire departments which indicated in the survey the use of a Citistat type performance management system did achieve maximum efficiency, many others did not. In addition, Citistat is not a significant variable in explaining the variation in municipal fire department expenditures per capita. This hypothesis cannot be rejected.

4.4.3 Summary

The efficiency of municipal fire departments serving a population greater than 100,000 is evaluated on the basis of two inputs, budget and number of staff and two outputs including the number of building fires and number of civilian fire fatalities.. In addition, non-discretionary environmental variables such as percent African American and median household income are taken into account. Using data envelopment analysis it is possible to attain an efficiency frontier and identify the most efficient fire departments. The efficiency frontier does not mean that one department is better than another, only that under these variables certain departments are able to use minimum resources given the same level of output. Data envelopment analysis provides a starting point for departments to evaluate their efficiency. Data envelopment analysis provides a benchmarking tool which allows fire departments and researchers to identify top performers.

More in-depth analysis can also provide output targets and input slacks for each department as a starting point for efficiency study.Regression analysis using the dependent variable budget per capita augments data envelopment analysis and allows researchers to identify those significant independent variables which explain the variation in budget per capita. This research identified the number of firefighters per 10,000 and median household income as significant variables in explaining the variation in budget per capita.

CHAPTER 5

DISCUSSION

5.1 Introduction

As cities endure difficult times following the recent economic recession, performance management programs are even more important. Cities facing shrinking budgets are tasked with prioritizing programs, reducing services, and reductions in force. Performance management systems provide the basis for timely, accurate information in order to improve decision-making and correctly deploy limited resources for the efficient and effective operation of local government. Citistat is a type of performance management system, developed in Baltimore MD, which promises to improve local government management.

The purpose of this research is to examine the applicability of the Citistat performance management system to municipal fire departments and determine whether a Citistat type performance management system has any effect on organizational behavior, organizational efficiency and organizational effectiveness. Surveys completed by fire chiefs of the nation's largest municipal fire departments confirm a difference in organizational behavior in departments using a Citistat type performance management system. However, regression analysis and data envelopment analysis indicate there is no difference in organizational effectiveness or organizational efficiency among departments that utilize a Citistat type performance management system and those that do not concerning the number of building fires, number of civilian fire fatalities, property loss and expenditures. This chapter is devoted to a discussion of key findings. In addition, the significance, limitations and suggestions for future research are discussed.

5.2 Organizational Behavior

Hypothesis one states there is no difference in organizational behavior within the jurisdiction boundaries of municipal fire departments that utilize a Citistat performance

management system and those that do not. Organizational behavior is assessed in three primary areas which include leadership, communication and accountability. Survey results from fire chiefs of the nation's largest municipal fire departments which serve a population greater than 100,000 indicate there is a difference between Citistat and non-Citistat departments; this hypothesis is rejected.

5.2.1 Leadership

According to the survey, Citistat agencies are significantly more likely to have the mayor or city's chief administrative officer centrally involved and actively participate in performance measurement systems, develop performance measures to track outputs and develop performance measures to track unit costs (efficiency). However, Citistat agencies do not distinguish themselves from other agencies in their ability to develop performance measures for measuring outcomes (effectiveness), service quality, citizen satisfaction, or setting specific performance targets.

Cities which choose to use a Citistat performance management system should utilize a variety of performance measures. According to Edwards and Thomas (2005, p. 371), "One can generally discern how an organization views its key to success by the attributes it chooses to measure." In the case of municipal fire departments which utilize a Citistat type performance management system it appears they rely most on efficiency measures. Even though efficiency is important, public managers must also evaluate effectiveness, service quality and citizen satisfaction. An organization that measures one type of measure to the exclusion of the others creates a distorted picture of the organization. A narrow focus on a singular type of performance measure can affect decision-making (Nicholson-Crotty 2006). According to Behn (2003), output measures cause people to focus on internal processes, while outcome measures cause people to look externally for solutions. Local government leaders must determine which outcomes are the most important, which outputs lead to those outcomes, then choose a variety of measures and relentlessly measure them.

As NYPD Commissioner, William Bratton was very specific in his purpose to reduce crime in New York City. By focusing on misdemeanor crime and quality of life offenses, major crime was reduced in New York City. Furthermore, he was able to replicate the process and reduce crime in Los Angeles, California. During his first five years in Los Angeles, major crime was reduced 34 percent. In 2007 he became the first chief appointed to a second five year term since the 1992 Rodney King incident and subsequent riots.

Citistat grew from the effort of former Baltimore Mayor O'Malley's attempt to better manage the city. Because O'Malley found the city of Baltimore to be inefficient and wasteful it is reasonable that Citistat measures were more concerned with outputs and efficiency. O'Malley successfully improved city services and was subsequently elected Governor of Maryland. As word of Baltimore's initial cost savings spread, other municipalities attempted to emulate O'Malley's work. However, his successors have not provided the same enthusiastic leadership. The first mayoral successor, Shelia Dixon, was indicted in 2009 for perjury and theft of gift cards donated to the city of Baltimore for needy families. She was subsequently found guilty and resigned. Current Mayor Stephanie Rawlings-Blake continues to utilize a Citistat performance management system but faces a $121 million budget gap and the prospect of 200 layoffs in 2010. Ridley and Simon (1938, p 21) advise the task of defining objectives constitutes one of the most difficult tasks in the whole field of measurement.

5.2.2 Accountability

Accountability is concerned with responsibility and follow-up in addition to sanctions for non-performance. Respondents utilizing a Citistat type performance management system report a significant difference regarding increased accountability among middle managers, comparison of performance internally among geographic divisions, that performance is tracked over time, performance data is routinely questioned, and there are real consequences for good, poor, or improved performance. However, Citistat and non-Citistat departments reported similar behavior

regarding the comparison of performance data externally (benchmarking) and the opportunities for middle managers to select problem solving strategies.

Accountability is essential to performance management. However, both Compstat and Citistat are criticized for the harshness of their performance meetings and top-down approach (Weisburd 2003). Accountability for Citistat or any other performance measurement system need not come in the form of shouting matches as popularized by television shows such as "The Wire." deHaven-Smith (2006) characterizes Citistat meetings as an inquisition. Behn (2007) observes the majority of Citistat meetings he has attended are more collegial than confrontational. The goal of a Citistat session is to discuss past performance and set expectations for future performance, not to belittle managers.

Even though Citistat is characterized as a top-down accountability holding process, it does not mean that it cannot encourage participative management. Advocates of Citistat encourage more than increased accountability for middle managers, they also encourage increased decision-making capability. If an organization expects to be flexible and rapidly deploy resources, it must empower those closest to the resources with the authority to make decisions. Kim (2002) reports participative management correlates with improved job satisfaction. Folz (1986) found a "consultative" balance between managers and employees creates a better environment for increased productivity. Although job satisfaction and a commitment to the job are very high among firefighters (Lee 2002), a high pressure performance management system such as Citistat could encourage unethical practices in the absence of participative management.

For instance, NYPD is currently under scrutiny for reducing crime categories from felony to misdemeanor and not reporting criminal acts in order to keep Compstat crime numbers low (Eterno 2010). Eterno's research indicates crime statistics are unethically changed because of intense pressure to reduce crime and increased promotional opportunities for those precinct commanders with low crime rates. Bohte (2000) refers to this as organizational cheating. According to Bohte, counting outputs becomes more important than outcomes, and managers

attempt to manipulate the system in their favor. In any high performance management system the amount of stress, or voltage is controlled by the managers (Moore 2003). When this stress causes undesirable behaviors, it is worse than not having a performance management system.

5.2.3 Communication

Communication examines the flow of information internally through the organization and externally to citizens. Technology is also considered both as a means to increase information and improve communication. Citistat agencies are significantly more likely to focus on what is important to measure rather than available data, communicate with the mayor or chief administrative officer on a monthly or more frequent basis, communicate performance results to citizens on an annual or more frequent basis, and report performance measurement systems led to changes in program priorities. Both groups had similar responses when asked whether their performance measurement system improved organizational communication and whether they use computer generated information for problem identification and analysis.

Citistat changed communication in organizations in two ways. First, the frequency of communicating performance results is increased. Whereas many agencies meet to discuss performance on an annual or quarterly basis at best, Citistat demands attention to performance on a monthly or more frequent basis. Behn (2005) believes the constant pressure of knowing one must answer at another, not to distant meeting, compels individuals to perform. The lack of a perceived improvement in overall communication within the organization may be a function of the type of measures used. Melkers (2006) found governments that report the use of more developed outcome measures as part of the performance measurement system also report much stronger improved communication.

Second, Citistat introduced innovative technology as a form of communicating with citizens. Citistat and the non-emergency 311 system provide a mechanism for citizens to communicate needs directly to local government. Performance measurement systems can provide a mechanism for building trust with citizens through a participatory process. 311 systems

provide an alternative to traditional feedback received from customer surveys as a form of citizen participation. A 311 system provides a mechanism for communication from the citizen to municipal government and then back to the citizen (Moulder 2007). If municipal governments do not regularly provide performance information, then citizens must rely on other sources (Yang 2006). Information generated by 311 is then used by agency leaders to make informed decisions regarding resources and activities; ultimately providing better service and citizen satisfaction.

5.2.4 Overall Impact and Challenges

Citistat departments are more likely to report improved relations between fire department administrators and city leaders, an improvement in the quality of decisions, improved service quality, and a reduced cost of fire department operations as a result of their performance management system. Citistat departments are less likely to report trouble compiling and distributing the data from their performance measurement system in a timely manner. There is no difference between Citistat and non-Citistat agencies regarding improved employee motivation, employee focus on organizational goals or an organizational focus on problem, solving, experimentation and learning.

Citistat is a time intensive performance management system. However, the time invested is well spent. According to municipal fire chiefs that utilize a Citistat type system, there are many benefits. Unfortunately many of these improvements have not “cascaded” down to employees. Stat systems are often criticized for top-down, one way communication (Wesiburd 2003). Recently, (Dabney 2010, p. 44) conducted a qualitative study of a large metropolitan police department. After interviewing officers he made the following conclusion “There was a wealth of information suggesting that officers misunderstood or dismissed the overarching direction of Compstat and also the core set of four management principles that serve to guide this direction. They saw the computer-generated statistics and corresponding crime analysis function as serving an auditing function rather than that of precision diagnosis of crime patterns.”

Citistat provides an opportunity to increase employee motivation through participation and goal setting. According to Perry (2006), participation improves decision-making and goal setting improves performance. Agency leaders must establish clear goals and use performance management systems as a tool to create a learning organization. Performance measurement, when used as a learning tool, helps managers move from "what" we are doing to "why" we are doing (Behn 2003). Mausolff (2004) provides a framework of organizational learning and performance measurement which includes identifying performance gaps, integrating interpretations, searching for answers and implementing solutions. Accounting for each of these phases within a Citistat performance management system can help increase organizational learning.

5.3 Effectiveness

The next three hypotheses are concerned with the effectiveness of municipal fire departments. Effectiveness is measured by the number of building fires, civilian fire fatalities, and amount of property loss. Hypothesis two states there is no difference in the number of building fires within the jurisdictional boundaries of municipal fire departments that utilize a Citistat performance measurement system and those that do not. Hypothesis three states there is no difference in the number of civilian fire fatalities within the jurisdictional boundaries of municipal fire departments that utilize a Citistat performance measurement system and those that do not. Hypothesis four states there is no difference in the amount of property loss within the jurisdictional boundaries of municipal fire departments that utilize a Citistat performance measurement system and those that do not. Using standard regression for each hypothesis, Citistat was not found to be a significant explanatory variable. Hypotheses two, three and four could not be rejected.

This study found the percent of the population that is African American and percent of vacant housing are significant variables in explaining the variation in number of building fires. The percent of the population that is African American and a fire department's ISO rating are

significant variables in explaining the change in number of civilian fire fatalities. The percent of population that is African American and percent of the population less than age five are significant variables in explaining the variation in percent of fire confined to the room of origin.

Citistat is not found to be a significant variable in explaining the number of building fires, number of civilian fire fatalities or percent of the fire confined to the room of origin. Whereas Compstat is praised for its role in crime reduction, Citistat is more often praised for budgetary savings. In the case of municipal fire departments, it appears Citistat is not directed toward reducing building fires, civilian fatalities or property loss. This conclusion is also supported by survey responses indicating greater use of output measures as opposed to outcome measures. Herman Goldstein (1979, p. 236) once warned "all bureaucracies risk becoming so preoccupied with running their organization and getting so involved in their methods of operating that they lose sight of the primary purposes for which they were created." Agency leaders must incorporate effectiveness measures into the Citistat performance management system.

5.4 Efficiency

The fifth hypothesis states there is no difference in relative efficiency within the jurisdictional boundaries of municipal fire departments that utilize the Citistat performance measurement system and those that do not. Efficiency is measured as a ratio of budget and staff to number of fires and civilian fire fatalities. Data envelopment analysis is used to determine the relative efficiency of all departments. Only three of the eighteen most efficient cities report the use of a Citistat type performance management system. Furthermore, standard regression reveals Citistat is not a significant variable in explaining the variation in fire department expenditures. Hypothesis five could not be rejected.

Using data envelopment analysis, the efficiency of municipal fire departments is evaluated on the basis of two input measures and two output measures. The inputs are budget and number of staff, and the outputs are number of building fires and number of civilian fire fatalities. Two additional non-discretionary variables are added to the input side of the equation to account for

the external environment of each municipal fire department. The environmental variables, chosen based on earlier regression equations, are percent of the population that is African American and median household income. A separate regression analysis using a three-year average of fire department expenditures also found the number of firefighters and median household income are significant variables in explaining fire department expenditures, but Citistat is not.

Data envelopment analysis is a useful tool for public managers to compare their department among others and identify top performers. In this study, the most efficient municipal fire departments are a combination of Citistat and non-Citistat agencies. One possible explanation is that as additional agencies adopt and implement a Citistat performance management system, they do not fully understand all the elements or simply choose to disregard them. These organizations adopt the elements which fit their agency and exclude the rest. Silverman (2006) and Behn (2008) would refer to these agencies as "Citistat Lite."

5.5 Significance

Behn (1995) suggests three big questions in public management which include: 1) How can public managers break the micromanagement cycle? 2) How can public managers motivate people to work energetically and intelligently towards achieving public purposes? 3) How can public managers measure the achievement of their agencies in ways that help to increase those achievements? Although he cautions it is futile to search for the "one best" answer to these questions, Citistat offers a performance management system that establishes clear objectives, motivates employees to improve performance, and relentlessly measures achievements. Citistat may not represent a new paradigm in public performance management, but it does provide a large "incremental" step forward and succinctly answers the "how" of three big questions in public management.

This study provides an examination of the applicability of the Citistat performance management system to municipal fire departments. Information from this research is pertinent to

any public manager or elected official interested in implementing a Citistat performance management system because it contributes to the scholarly debate regarding the public administration values of efficiency and effectiveness, informs the reader of the theoretical basis underlying a popular new performance management system, and answers the practical question of whether or not a Citistat performance management system increases organizational efficiency or effectiveness in the local government setting. This study provides an inter-city comparison of performance measurement systems in municipal fire departments and evaluates select outcomes. The results of this research indicate Citistat is primarily focused on efficiency and accountability but falls short on effectiveness and managing for results outside of a few select cities.

A more thorough understanding of Citistat is required before agencies attempt to implement it as an innovative, new, performance management system. Underlying all the technology, meetings and maps that have come to be associated with Citistat is a principal-agent system, and a renewed twenty-first century version of management by objectives (MBO). MBO, like Citistat is criticized for centralizing organizations and focusing too much on outputs (Poister and Streib 1995). Because of its similarity to management by objectives, Citistat's success will similarly depend on the amount of top management support and their abilities in goal setting, participative management and objective feedback (Rodgers 1992).

As performance measurement continues to evolve into performance management, Citistat will surely lead the way. Citistat provides technologically enhanced decision-making and a level of transparency not seen in other performance management systems. When fully implemented, Citistat proves appealing to rational choice theorists interested in making better decisions and deliberative democratic theorists interested in increased access to information (Weitzman 2006).

Public managers need to be aware of Citistat's ability to effect organizational behavior and seek ways to appropriately balance accountability and participation. In addition, leaders must facilitate a delicate balance between efficiency and effectiveness in regards to goal setting.

5.6 Limitations

Two primary limitations of this study include generalizability and data reliability. The population for this study is municipal fire departments which serve a population greater than 100,000. These are primarily suburban and urban fire departments. Because of population size, this study may not be generalizable to all cities in the United States. In addition, cities which have implemented a Citistat type performance management system are larger, more diverse, and have a lower median household income on average. Furthermore, a majority of the respondent cities are from the South and West census regions.

The primary source of data for this study is obtained from the U.S. Fire Administration's National Fire Incident Reporting System. Because this is a voluntary reporting system, some of the data may be incomplete or underrepresented. To reduce the likelihood of an error, data is collected from a three-year time period of 2005-2007.

5.7 Suggestions for Future Research

The fire service and Citistat provide ample opportunity for future research. The fire service should continue and expand its in-depth analysis of specific topics and their relationship to fire incidents such as dormitory fires, children and the elderly. One area in need of further study is minority groups and their relationship to fire incidents, especially in the growing Hispanic culture. Collaboration between the NFPA, ICMA, and NFIRS is essential to providing up to date information for researchers and interested citizens.

Two aspects of Citistat in need of further study are citizen satisfaction and decision-making. Citizen satisfaction studies must take into account non-emergency 311 systems and the interaction between citizens and local government. Another area of study is the interface between Citistat's mapping technology and decision-making. Furthermore, additional in-depth case studies of Citistat adoption and implementation would provide useful information to jurisdictions considering a Citistat type performance management system.

APPENDIX A

SURVEY INSTRUMENT

James Horton
2813 Los Alamos Trail
Fort Worth, TX 76131
August 22, 2008

Dear Fire Chief:

I am writing to request your participation in a research project to study performance measurement systems in municipal fire departments. As a professional firefighter for the Fort Worth Fire Department and a doctoral candidate I find this topic both interesting and important to the fire service. Along with this letter is a brief survey that asks questions about department characteristics and opinions regarding your current performance measurement system. Please review the survey, and if you choose, complete it via the Internet with the link provided below on the attached label. You may also complete the survey and return it to me in the enclosed self-addressed stamped envelope. It should take approximately ten minutes to complete.

The purpose of this study is to evaluate the applicability of a particular performance measurement system to municipal fire departments. Your participation will help me understand how performance measurement systems might affect organizational behavior in the fire service. I am optimistic that the results will be beneficial to other fire chiefs and the entire firefighting community. Eventually I hope to have the results published in a professional fire service journal.

I am not aware of any risks to you or your department should you decide to voluntarily participate. Your responses will not be identified with you personally and published only in summary format. Any data will remain confidential as far as possible within state and federal law. This research has been approved by the University of Texas at Arlington Institutional Review Board. Results will be shared in anonymously tabulated form with all respondents at the conclusion of the study. The survey should take you ten minutes to complete.

If you have any questions or concerns about the questionnaire, being a part of the research, or wish to discuss it further, please contact me at 817-312-4515 or james.horton@mavs.uta.edu.

Sincerely,

James Horton

Doctoral Candidate

Dear Fire Chief,

As future, current, and former students of the executive fire officer program, many of us understand the importance and work associated with a survey. Please take a few minutes to assist James in his pursuit of academic and research excellence. Your brief effort will make a much larger contribution to the study of our profession. Thank you in advance.

Rudy Jackson, Fire Chief

City of Fort Worth, TX

	Strongly Disagree	Somewhat Disagree	Somewhat Agree	Strongly Agree
The following questions concern your opinion regarding the specific performance measurement system currently in use by your department				
The fire department has developed performance measures to track outputs (workload)	☐	☐	☐	☐
The fire department has developed performance measures to track outcomes (effectiveness)	☐	☐	☐	☐
The fire department has developed performance measures to track unit cost (efficiency)	☐	☐	☐	☐
The fire department has developed performance measures to track service quality	☐	☐	☐	☐
The fire department has developed performance measures to track citizen satisfaction	☐	☐	☐	☐
The mayor or city's chief administrative officer are centrally involved and actively participate in our performance measurement system	☐	☐	☐	☐
The mission and goals of the fire department are clearly articulated	☐	☐	☐	☐
We establish targets for our performance goals with specific numbers or percentages	☐	☐	☐	☐
We use computer generated information for problem identification and analysis	☐	☐	☐	☐
We focus on what is important to measure, rather than available data	☐	☐	☐	☐
We compare our performance against other municipal fire departments	☐	☐	☐	☐
We compare our performance internally among geographic divisions	☐	☐	☐	☐
Our middle managers select problem solving strategies for high profile problems	☐	☐	☐	☐
We track performance over time and regularly compare data to determine whether performance has improved	☐	☐	☐	☐
We communicate performance results to the mayor or city's chief administrative officer on a monthly or more frequent basis	☐	☐	☐	☐
Our performance data are routinely questioned, requiring additional feedback or follow-up	☐	☐	☐	☐
We communicate performance results to citizens on an annual or more frequent basis	☐	☐	☐	☐

Our performance measurement system improved the quality of decisions	☐	☐	☐	☐
Our performance measurement system led to changes in program priorities	☐	☐	☐	☐
Our performance measurement system improved service quality	☐	☐	☐	☐
Our performance measurement system reduced the cost of fire department operations	☐	☐	☐	☐
Our performance measurement system increased the accountability of managers	☐	☐	☐	☐
There are real consequences or rewards for good, poor or improved performance	☐	☐	☐	☐
Our performance measurement system improved employee motivation	☐	☐	☐	☐
Our performance measurement system increased employee focus on organizational goals	☐	☐	☐	☐
Our performance measurement system improved organizational communication	☐	☐	☐	☐
Our performance measurement system improved relations between fire department administrators and city leaders	☐	☐	☐	☐
Our performance measurement system led to an organizational focus on problem solving, experimentation and learning	☐	☐	☐	☐
We have trouble keeping our performance measures current	☐	☐	☐	☐
We have trouble getting middle managers to support our performance measurement system	☐	☐	☐	☐
We have trouble compiling and distributing the data from our performance measurement system in a timely manner	☐	☐	☐	☐
Our staff lacks the analytical skills needed to effectively analyze the performance measurement data we collect	☐	☐	☐	☐

The following questions concern department characteristics that may influence expenditures, fire suppression and fire prevention efforts

The total number of uniform fire service personnel in FY 06 _____

The total number of uniform personnel assigned to an administrative support position (all non-suppression) in FY 06 _____

The total number of fire suppression stations is _____

Does the fire department assign a constant standard (as opposed to varying) number of firefighters per apparatus (minimum staffing) ☐ YES ☐ NO

The most recent Insurance Service Office (ISO) rating of the fire department is	_____	
The fire department is currently accreditited by the Commission on Fire Accreditation International	☐ YES	☐ NO
The fire department has implemented a Citistat like performance measurement system	☐ YES	☐ NO
Full time fire inspectors are required to obtain at minimum a specific state level certification and must complete annual continuing education requirements	☐ YES	☐ NO
Uniformed fire service personnel drive and staff ambulances	☐ YES	☐ NO

APPENDIX B

DEPENDENT VARIABLES CORRELATION

Dependent Variables Correlations

		fires/10000	deaths/10000	%confined
%black	Pearson Correlation	**.398****	**.317****	**-.132**
	Sig. (2-tailed)	**.000**	**.000**	**.095**
	N	**166**	**171**	**162**
%<5>64	Pearson Correlation	**.128**	**.149**	**.032**
	Sig. (2-tailed)	**.101**	**.051**	**.682**
	N	**166**	**171**	**162**
%<5	Pearson Correlation	**-.110**	**-.110**	**-.194***
	Sig. (2-tailed)	**.157**	**.151**	**.013**
	N	**166**	**171**	**162**
%<17	Pearson Correlation	**-.111**	**-.066**	**-.142**
	Sig. (2-tailed)	**.155**	**.388**	**.072**
	N	**166**	**171**	**162**
%>65	Pearson Correlation	**.154***	**.173***	**.110**
	Sig. (2-tailed)	**.047**	**.024**	**.162**
	N	**166**	**171**	**162**
cfai	Pearson Correlation	**-.011**	**.139**	**.037**
	Sig. (2-tailed)	**.886**	**.070**	**.641**
	N	**165**	**170**	**161**
iso	Pearson Correlation	**-.089**	**.138**	**-.186***
	Sig. (2-tailed)	**.273**	**.085**	**.023**
	N	**153**	**157**	**148**
citistat	Pearson Correlation	**-.004**	**-.018**	**.103**
	Sig. (2-tailed)	**.959**	**.817**	**.191**
	N	**166**	**171**	**162**
rain	Pearson Correlation	**.303****	**.221****	**.040**
	Sig. (2-tailed)	**.000**	**.004**	**.617**
	N	**166**	**171**	**162**
%unemp	Pearson Correlation	**.158***	**.079**	**.006**
	Sig. (2-tailed)	**.042**	**.307**	**.944**
	N	**166**	**171**	**162**
oldhousing	Pearson Correlation	**.218****	**.065**	**-.058**

	Sig. (2-tailed)	**.005**	**.400**	**.466**
	N	**166**	**171**	**162**
%rent	Pearson Correlation	**.123**	**.012**	**.055**
	Sig. (2-tailed)	**.115**	**.876**	**.488**
	N	**166**	**171**	**162**
%owner	Pearson Correlation	**-.123**	**-.012**	**-.055**
	Sig. (2-tailed)	**.115**	**.876**	**.488**
	N	**166**	**171**	**162**
%vacant	Pearson Correlation	**.398****	**.269****	**-.109**
	Sig. (2-tailed)	**.000**	**.000**	**.168**
	N	**166**	**171**	**162**
%poverty	Pearson Correlation	**.274****	**.175***	**-.079**
	Sig. (2-tailed)	**.000**	**.022**	**.317**
	N	**166**	**171**	**162**
%femalehouse	Pearson Correlation	**.292****	**.213****	**-.083**
	Sig. (2-tailed)	**.000**	**.005**	**.296**
	N	**166**	**171**	**162**
%withkids	Pearson Correlation	**-.352****	**-.226****	**-.006**
	Sig. (2-tailed)	**.000**	**.003**	**.936**
	N	**166**	**171**	**162**
mhic	Pearson Correlation	**-.363****	**-.308****	**.100**
	Sig. (2-tailed)	**.000**	**.000**	**.205**
	N	**166**	**171**	**162**
density	Pearson Correlation	**-.106**	**-.208****	**.230****
	Sig. (2-tailed)	**.174**	**.006**	**.003**
	N	**166**	**171**	**162**

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

APPENDIX C

INDEPENDENT VARIABLES CORRELATION

Independent Variables Correlations

		%black	%<5>64	%<5	%<17	%>65	cfai	iso	citistat	rain	%unemp	oldhousing	%rent	%owner	%vacant	%poverty	%femalehouse	%withkids	mhic	density
%black	Pearson Correlation	1	.125	-.137	-.107	.163*	-.024	-.089	.178*	.609**	.355**	.295**	.327**	-.327**	.584**	.530**	.770**	-.559**	-.512**	-.012
	Sig. (2-tailed)		.084	.057	.137	.024	.740	.242	.014	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.867
	N	193	193	193	193	193	191	176	193	193	193	193	193	193	193	193	193	193	193	193
%<5>64	Pearson Correlation	.125	1	-.152*	-.092	.912**	-.002	.050	.138	.188**	.039	.173*	-.098	.098	.476**	.167*	.250**	-.345**	-.399**	-.036
	Sig. (2-tailed)	.084		.035	.203	.000	.975	.510	.056	.009	.591	.016	.176	.176	.000	.020	.000	.000	.000	.624
	N	193	193	193	193	193	191	176	193	193	193	193	193	193	193	193	193	193	193	193
%<5	Pearson Correlation	-.137	-.152*	1	.910**	-.545**	.036	.096	-.090	-.343**	.030	-.300**	-.340**	.340**	-.159*	-.050	.124	.701**	.136	-.233**
	Sig. (2-tailed)	.057	.035		.000	.000	.621	.207	.215	.000	.677	.000	.000	.000	.027	.494	.086	.000	.059	.001
	N	193	193	193	193	193	191	176	193	193	193	193	193	193	193	193	193	193	193	193
%<17	Pearson Correlation	-.107	-.092	.910**	1	-.456**	.028	.075	-.032	-.344**	.077	-.339**	-.433**	.433**	-.140	-.053	.225**	.731**	.143*	-.229**
	Sig. (2-tailed)	.137	.203	.000		.000	.699	.320	.657	.000	.284	.000	.000	.000	.052	.464	.002	.000	.047	.001

	N	193	193	193	193	193	191	176	193	193	193	193	193	193	193	193	193	193	193	193
%>65	Pearson Correlation	.163*	.912**	-.545**	-.456**	1	-.017	.003	.154*	.302**	.020	.272**	.059	-.059	.470**	.163*	.160*	-.584**	-.396**	.067
	Sig. (2-tailed)	.024	.000	.000	.000		.817	.973	.032	.000	.778	.000	.418	.418	.000	.024	.026	.000	.000	.356
	N	193	193	193	193	193	191	176	193	193	193	193	193	193	193	193	193	193	193	193
cfai	Pearson Correlation	-.024	-.002	.036	.028	-.017	1	.143	-.196**	.003	.054	.092	.082	-.082	-.141	.038	.029	.040	-.026	.119
	Sig. (2-tailed)	.740	.975	.621	.699	.817		.060	.007	.967	.459	.207	.257	.257	.051	.604	.687	.582	.721	.100
	N	191	191	191	191	191	191	174	191	191	191	191	191	191	191	191	191	191	191	191
iso	Pearson Correlation	-.089	.050	.096	.075	.003	.143	1	-.082	.026	-.193*	-.135	-.323**	.323**	.041	-.201**	-.186*	.181*	.076	-.222**
	Sig. (2-tailed)	.242	.510	.207	.320	.973	.060		.277	.731	.010	.074	.000	.000	.589	.007	.013	.016	.317	.003
	N	176	176	176	176	176	174	176	176	176	176	176	176	176	176	176	176	176	176	176
citistat	Pearson Correlation	.178*	.138	-.090	-.032	.154*	-.196**	-.082	1	.185**	.108	.192**	.149*	-.149*	.254**	.232**	.244**	-.215**	-.226**	.117
	Sig. (2-tailed)	.014	.056	.215	.657	.032	.007	.277		.010	.135	.008	.038	.038	.000	.001	.001	.003	.002	.105
	N	193	193	193	193	193	191	176	193	193	193	193	193	193	193	193	193	193	193	193
rain	Pearson Correlation	.609**	.188**	-.343**	-.344**	.302**	.003	.026	.185**	1	.151*	.251**	.240**	-.240**	.435**	.290**	.366**	-.472**	-.361**	-.003
	Sig. (2-tailed)	.000	.009	.000	.000	.000	.967	.731	.010		.036	.000	.001	.001	.000	.000	.000	.000	.000	.972
	N	193	193	193	193	193	191	176	193	193	193	193	193	193	193	193	193	193	193	193
%unemp	Pearson Correlation	.355**	.039	.030	.077	.020	.054	-.193*	.108	.151*	1	.310**	.451**	-.451**	.272**	.675**	.558**	-.256**	-.530**	.201**
	Sig. (2-tailed)	.000	.591	.677	.284	.778	.459	.010	.135	.036		.000	.000	.000	.000	.000	.000	.000	.000	.005
	N	193	193	193	193	193	191	176	193	193	193	193	193	193	193	193	193	193	193	193
oldhousing	Pearson Correlation	.295**	.173*	-.300**	-.339**	.272**	.092	-.135	.192**	.251**	.310**	1	.526**	-.526**	.215**	.395**	.376**	-.574**	-.368**	.561**
	Sig. (2-tailed)	.000	.016	.000	.000	.000	.207	.074	.008	.000	.000		.000	.000	.003	.000	.000	.000	.000	.000
	N	193	193	193	193	193	191	176	193	193	193	193	193	193	193	193	193	193	193	193
%rent	Pearson Correlation	.327**	-.098	-.340**	-.433**	.059	.082	-.323**	.149*	.240**	.451**	.526**	1	-1.000**	.119	.606**	.409**	-.584**	-.482**	.563**
	Sig. (2-tailed)	.000	.176	.000	.000	.418	.257	.000	.038	.001	.000	.000		.000	.100	.000	.000	.000	.000	.000

	N	193	193	193	193	193	191	176	193	193	193	193	193	193	193	193	193	193	193	193
%owner	Pearson Correlation	-.327**	.098	.340**	.433**	-.059	-.082	.323**	-.149*	-.240**	-.451**	-.526**	-1.00**	1	-.119	-.606**	-.409**	.584**	.482**	-.563**
	Sig. (2-tailed)	.000	.176	.000	.000	.418	.257	.000	.038	.001	.000	.000	.000		.100	.000	.000	.000	.000	.000
	N	193	193	193	193	193	191	176	193	193	193	193	193	193	193	193	193	193	193	193
%vacant	Pearson Correlation	.584**	.476**	-.159*	-.140	.470**	-.141	.041	.254**	.435**	.272**	.215**	.119	-.119	1	.476**	.478**	-.523**	-.571**	-.135
	Sig. (2-tailed)	.000	.000	.027	.052	.000	.051	.589	.000	.000	.000	.003	.100	.100		.000	.000	.000	.000	.061
	N	193	193	193	193	193	191	176	193	193	193	193	193	193	193	193	193	193	193	193
%poverty	Pearson Correlation	.530**	.167*	-.050	-.053	.163*	.038	-.201**	.232**	.290**	.675**	.395**	.606**	-.606**	.476**	1	.728**	-.474**	-.819**	.195**
	Sig. (2-tailed)	.000	.020	.494	.464	.024	.604	.007	.001	.000	.000	.000	.000	.000	.000		.000	.000	.000	.007
	N	193	193	193	193	193	191	176	193	193	193	193	193	193	193	193	193	193	193	193
%femalehouse	Pearson Correlation	.770**	.250**	.124	.225**	.160*	.029	-.186*	.244**	.366**	.558**	.376**	.409**	-.409**	.478**	.728**	1	-.392**	-.660**	.169*
	Sig. (2-tailed)	.000	.000	.086	.002	.026	.687	.013	.001	.000	.000	.000	.000	.000	.000	.000		.000	.000	.019
	N	193	193	193	193	193	191	176	193	193	193	193	193	193	193	193	193	193	193	193
%withkids	Pearson Correlation	-.559**	-.345**	.701**	.731**	-.584**	.040	.181*	-.215**	-.472**	-.256**	-.574**	-.584**	.584**	-.523**	-.474**	-.392**	1	.605**	-.185**
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.582	.016	.003	.000	.000	.000	.000	.000	.000	.000	.000		.000	.010
	N	193	193	193	193	193	191	176	193	193	193	193	193	193	193	193	193	193	193	193
mhic	Pearson Correlation	-.512**	-.399**	.136	.143*	-.396**	-.026	.076	-.226**	-.361**	-.530**	-.368**	-.482**	.482**	-.571**	-.819**	-.660**	.605**	1	-.008
	Sig. (2-tailed)	.000	.000	.059	.047	.000	.721	.317	.002	.000	.000	.000	.000	.000	.000	.000	.000	.000		.909
	N	193	193	193	193	193	191	176	193	193	193	193	193	193	193	193	193	193	193	193
density	Pearson Correlation	-.012	-.036	-.233**	-.229**	.067	.119	-.222**	.117	-.003	.201**	.561**	.563**	-.563**	-.135	.195**	.169*	-.185**	-.008	1
	Sig. (2-tailed)	.867	.624	.001	.001	.356	.100	.003	.105	.972	.005	.000	.000	.000	.061	.007	.019	.010	.909	
	N	193	193	193	193	193	191	176	193	193	193	193	193	193	193	193	193	193	193	193

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

REFERENCES

Ammons, D. N. (2001). Municipal Benchmarks: Assessing Local Performance and Establishing Community Standards. Thousand Oaks, CA, Sage Publications Inc.

Baker, G. P. (1992). "Incentive Contracts and Performance Measurement." Journal of Political Economy 100(31): 598-614.

Banker, R. D., and Morey, Richard C. (1986). "The Use of Categorical Variables in Data Envelopment Analysis." Management Science 32(12): 1613-1627.

Banks, J., and Weingast, Barry (1992). "The Political Control of Bureaucracies under Asymmetric Information." American Journal of Political Science 36(2): 509-524.

Barillo, D. J., and Goode, R. (1996). "Fire Fatality Study: Demographics of Fire Victims." Burns 22(2): 85-88.

Behn, R. D. (1995). "The Big Questions of Public Management." Public Administration Review 55(4): 313-324.

Behn, R. D. (1998). "What Right Do Public Managers Have to Lead?" Public Administration Review 58(3): 209-224.

Behn, R. D. (2003). "Why Measure Performance? Different Purposes Require Different Measures." Public Administration Review 63(5): 586-606.

Behn, R. D. (2005). "The Core Drivers of Citisat: It's Not Just About the Meetings and the Maps." International Public Management Journal 8(3): 295-319.

Behn, R. D. (2006). The Theory Behind Baltimore's Citistat. 28th Annual Research Conference of The Association of Public Policy Analysis and Management. Madison, Wisconsin.

Behn, R. D. (2006). "The Varieties of Citistat." Public Administration Review 66(3): 332-340.

Behn, R. D. (2007). What All Mayors Would Like to Know About Baltimore's Citistat Performance Strategy. Managing for Performance and Results Series, IBM Center for the Business of Government.

Behn, R. D. (2008). "Designing PerformanceStat:Or What Are the Key Stratgegic Choices That a Jursidiction or Agency Must Make When Adapting the CompStat/Citistat Class of Performance Stategies?" Public Performance & Management Review 32(2).

Behn, R. D. (2008). PerformanceStat as a Leadership Strategy: It Don't Mean a Thing if it Ain't Got that Follow-Up. Twelfth Annual Conference of The International Research Society for Public Management. Brisbane, Australia.

Bendor, J., Taylor, Serge, and Van Gaalen, Roland (1987). "Politicians, Bureacrats, and Asymmetric Information." American Journal of Political Science 31(4): 796-828.

Berman, E., and Wang, XiaoHu (2000). "Performance Measurement in U.S. Counties: Capacity for Reform." Public Administration Review 60(5): 409-420.

Bernstein, G. K. (2002). America at Risk: America Burning Recommissioned, United States Fire Administration.

Bohte, J., and Meier, Kenneth (2000). "Goal Displacement: Assessing the Motivation for Organizational Cheating." Public Administration Review 60(2): 173-182.

Bratton, W. (1998). Turnaround: How America's Top Cop Reversed the Crime Epidemic. New York, NY, Random House.

Calvert, R., McCubbins, Mathew, and Weingast, Barry (1989). "A Theory of Political Control and Agency Discretion." American Journal of Political Science 33(3): 588-611.

Chalos, P., and Cherian, Joseph (1995). "An Application of Data Envelopment Analysis to Public Sector Performance Measurement and Accountability." Journal of Accounting and Public Policy 14: 143-160.

Charnes, A., Cooper, W.W., and Rhodes, E. (1978). "Measuring the Efficiency of Decision Making Units." European Journal of Operational Research 2: 429-444.
Chen, P. Y., and Popovich, Paula M. (2002). Correlation: Parametric and Nonparametric Measures. Thousand Oaks, CA, Sage.
Choi, S. O. (2005). "Relative Efficiency of Fire and Emergency Services in Florida: An Application and Test of Data Envelopment Analysis." International Journal of Emergency Management 2(3): 218-230.
Coates, D. C., and Lamdin, Douglas, J. (2002). "School Performance Evaluation Using Data Envelopment Analysis." Public Finance and Management 2(4): 566-591.
Coe, C. K. (1983). "Rating Fire Departments: The Policy Issues." Public Administration Review 43(1): 72-76.
Cooper, W. W., Seiford, Lawrence M., and Tone, Kaoru (2007). Data Envelopment Analysis: A Comprehensive Text with Models, Applications, References and DEA-Solver Software. New York, NY, Springer.
Coulter, P. B. (1979). "Organizational Effectiveness in the Public Sector: The Example of Municipal Fire Protection." Administrative Science Quarterly 24(1): 65-81.
Dabney, D. (2010). "Observations Regarding Key Operational Realities in a Compstat Model of Policing." Justice Quarterly 27(1): 28-51.
deHaven-Smith, L. a. J. I., Kenneth C. (2006). "Management by Inquiry: A Discursive Accountability System for large Organizations." Public Administration Review 66(1): 64-76.
Dyson, R. G., Allen, R., Camanho, A.S., Podinovski, V.V., Sarrico, S.S., and Shale, E.A. (2001). "Pitfalls and Protocols in DEA." European Journal of Operational Research 132: 245-259.
Edwards, D. a. T., John Clayton (2005). "Developing a Municipal Performance-Measurement System: Reflections on the Atlanta Dashboard." Public Administration Review 65(3): 369-376.
Eisenhardt, K. (1989). "Agency Theory: An Assessment and Review." Academy of Management Review 14(1): 57-74.
Eterno, J. A. a. S., Eli B. (2010). "The NYPD's Compstat: compare statistics or compose statistics?" International Journal of Police Science and Management 12(3): 426-449.
Fahy, R. F., and Norton, Allison L. (1989). "How Being Poor Affects Fire Risk." Fire Journal January/February: 28-36.
Farrell, M. J. (1957). "The Measurement of Productive Efficiency." Journal of the Royal Statistical Society 120(3): 253-290.
Feldman, M., and Khademian, Anne (2002). "To Manage is to Govern." Public Administration Review 62(5): 541-554.
Firman, J. R. (2003). "Deconstructing Compstat to Clarify Its Intent." Criminology and Public Policy 2(3): 457-460.
Folz, D. H., and Lyons, William (1986). "The Measurement of Municipal Service Quality and Productivity: A Comparative Perspective." Public Productivity Review 10(2): 21-33.
Frazier, P. (2005) "Total Cost of Fire in the United States." 26, 22-26.
Geys, B., and Moesen, Wim (2009). "Measuring Local Government Technical (In)Efficiency." Public Performance & Management Review 32(4): 499-513.
Golany, B., and Roll, Y. (1989). "An Application Procedure for DEA." International Journal of Management Science 17(3): 237-250.
Goldstein, H. (1979). "Improving Policing: A Problem-Oriented Approach." Crime & Delinquency 25: 236-258.
Gunther, P. (1981). "Fire-Cause Patterns for Different Socioeconomic Neighborhoods in Toledo, Ohio." Fire Journal May: 52-58.
Hall, J. R. (2008). U.S. Unintentional Fire Death Rates by State, National Fire Protection Association.

Hall, J. R. (2009). The Total Cost of Fire in the United States, National Fire Protection Association.
Hall, J. R., and Harwood, Beatrice (1989). "The National Estimates Approach to U.S. Fire Statistics." Fire Technology May: 99-113.
Hannon, L., and Shai, Donna (2003). "The Truly Disadvantaged and the Structural Covariates of Fire Death Rates." The Social Science Journal 40: 129-136.
Harcourt, B., and Ludwig, Jens (2006). "Broken Windows: New Evidence from New York and a Five-City Social Experiment." The University of Chicago Law Review 73(1): 271-320.
Hasofer, A. M. a. T., I. (2006). "Analysis of Fatalities and Injuries in Building Fire Statistics." Fire Safety Journal 41: 2-14.
Hatry, H. P. (1999). Performance Measurement: Getting Results. Washington D.C., The Urban Institute Press.
Hayes, K. a. C., Semoon (1990). "The Relative Efficiency of City Manager and Mayor-Council Forms of Government." Southern Economic Journal 57(1): 167-177.
Henry, V. E. (2003). The Compstat Paradigm: Management Accountability in Policing, Business, and the Public Sector. Flushing, NY, Looseleaf Law Publications.
Ho, A. T.-K. a. N., Anna Ya (2005). "Have Cities Shifted to Outcome-Oriented Performance Reporting?- A Content Analysis of City Budgets." Public Budgeting and Finance 25(2): 61-83.
Istre, G. R., McCoy, Mary A., Osborn, Linda, Barnard, Jeffrey J., and Bolton, Allen (2001). "Deaths and Injuries from House Fires." The New England Journal of Medicine 344(25): 1911-1916.
Jennings, C. R. (1996). Urban Residential Fires: An Empirical Analysis of Building Stock and Socioeconomic Characteristics for Memphis, Tennessee.
Kania, R. (2004). "A Brief History of a Venerable Paradigm in Policing." Journal of Contemporary Criminal Justice 20(1): 80-83.
Karter, M. J., and Donner, Allan (1978). "The Effect of Demographics on Fire Rates." Fire Journal January: 53-65.
Kelling, G., and Sousa, William (2001). Do Police Matter? An Analysis of the Impact of New York City's Police Reforms. Civic Report, Center for Civic Innovation at the Manhattan Institute.
Kelling, G. L., and Coles, Catherine M. (1996). Fixing Broken Windows: Restoring Order and Reducing Crime in Our Communities. New York, NY, Touchstone.
Kelly, J. M. (2003). "Citizen Satisfaction and Administrative Performance Measures: Is There Really a Link?" Urban Affairs Review 38(6): 855-866.
Kelly, J. M., and Swindell, David (2002). "A Multiple-Indicator Approach to Municipal Service Evaluation: Correlating Performance Measurement and Citizen Satisfaction across Jurisdictions." Public Administration Review 62(5): 610-621.
Kim, S. (2002). "Participative Management and Job Satisfaction: Lessons for Management Leadership." Public Administration Review 62(2): 231-241.
Lee, S.-H., and Olshfski, Dorothy (2002). "Employee Commitment and Firefighters: It's My Job." Public Administration Review 62: 108-114.
Ludwin, W. G., and Guthrie, Thomas L. (1989). "Assessing Productivity with Data Envelopment Analysis." Public Productivity Review 12(4): 361-372.
Marshall, S. W., Runyan, Carol W., Bangdiwala, Shrikant I., Linzer, Mary A., Sacks, Jeffrey J., and Butts, John D. (1998). "Fatal Residential Fires: Who Dies and Who Survives?" Journal of the American Medical Association 279(20): 1633-1637.
Mausolff, C. (2004). "Learning From Feedback in Performance Measurement Systems." Public Performance and Management Review 28(1): 9-29.

Mazerolle, L., Rombouts, Sacha, and McBroom, James (2007). "The Impact of Compstat on reported crime in Queensland." Policing: An International Journal of Police Strategies and Management 30(2): 237-256.
Meekings, A. (2005). "Effective review meetings: the counter-intuitive key to successful performance measurement." International Journal of Productivity and Performance Management 54(3).
Melkers, J. (2006). "On the Road to Improved Performance: Changing Organizational Communication Through Performance Management." Public Performance and Management Review 30(1): 73-95.
Messner, S., Galea, Sandro, Tardiff, Kenneth, Tracy, Melissa, Bucciarelli, Angela, Piper, Tinka, Frye, Victoria, and Vlahov, David (2007). "Policing, Drugs, and the Homicide Decline in New York City in the 1990's." Criminology 45(2): 385-413.
Mierley, M. C., and Baker, Susan P. (1983). "Fatal House Fires in an Urban Population." Journal of the American Medical Association 249(11): 1466-1468.
Moore, A., Nolan, James, and Segal, Geoffrey F. (2005). "Putting Out the Trash: Measuring Municipal Service Efficiency in U.S. Cities." Urban Affairs Review 41(2): 237-259.
Moore, M. H. (2003). "Sizing Up Compstat: An Important Administrative Innovation in Policing." Criminology and Public Policy 2(3): 469-494.
Morgan, D., and Watson, Sheilah (1992). "Policy Leadership in Council-Manager Cities: Comparing Mayor and Manager." Public Administration Review 52(5): 438-446.
Moulder, E. (2007). Call 311: Connecting Citizens to Local Government Data Report, International City Management Association.
Muhlhausen, D. B. (2009). Do DHS Grants Reduce Fire Casualties?, The Heritage Foundation.
Munson, M. J., and Oates, Wallace E. (1983). The Social and Economic Consequences of Residential Fires. Washington D.C., Heath and Company.
Nicholson-Crotty, S., Theobald, Nick, A., Nicholson-Crotty, Jill (2006). "Disparate Measures: Public Managers and Performance-Measurement Strategies." Public Administration Review 66(1): 101-113.
Nyhan, R. C. a. M., Lawrence L. (1999). "Assessing the Performance of Municipal Police Services Using Data Envelopment Analysis: An Exploratory Study." State and Local Government Review 31(1): 18-30.
Nyhan, R. C. a. M., Lawrence L. (1999). "Comparative Performance Measurement: A Primer on Data Envelopment Analysis." Public Productivity and Management Review 22(3): 348-364.
Orr, M. a. W., Darrell M. (2007). "Citizen Evaluations of Local Police: Personal Experience or Symbolic Attitudes?" Administration and Society 38(6): 649-668.
Osborne, D. a. G., Ted (1992). Reinventing Government: How the Entrepreneurial Spirit is Transforming the Public Sector. New York, NY, Penguin Books.
Pallant, J. (2007). SPSS Survival Manual: A Step by Step Guide to Data Analysis Using SPSS for Windows. Berkshire, England, McGraw-Hill.
Patetta, M. J., and Cole, Thomas B. (1990). "A Population-Based Descriptive Study of Housefire Deaths in North Carolina." American Journal of Public Health 80(9): 1116-1117.
Patusky, C. B., Leigh; Shelley, Mary (2007). The Philadelphia SchoolStat Model. Managing for Performance and Results Series, IBM Center for the Business of Government.
Perez, T. a. R., Reece (2007). The Citistat Model: How Data-Driven Government Can Increase Efficiency and Effectiveness, Center for American Progress.
Perry, J. L., Mesch, Debra, and Paarlberg, Laurie (2006). "Motivating Employees in a New Governance Era: The Performance Paradigm Revisited." Public Administration Review 66(4): 505-514.
Poister, T., and Streib, Gregory (1995). "MBO in Municipal Government: Variations on a Traditional Management Tool." Public Administration Review 55(1): 48-56.

Poister, T. H. a. S., Gregory (1999). "Performance Measurement in Municipal Government: Assessing the State of Practice." Public Administration Review 59(4): 325-335.
Radin, B. A. (2006). Challenging the Performance Movement: Accountability, Complexity, and Democratic Values. Washington D.C., Georgetown University Press.
Ramanathan, R. (2003). An Introduction to Data Envelopment Analysis: A Tool for Performance Measurement. Thousand Oaks, CA, Sage Publications Inc.
Ridley, C., and Simon, Herbert (1938). "The Criterion of Efficiency." Annals of the American Academy of Political and Social Science 199: 20-25.
Roch, C. H., and Poister, Theodore H. (2006). "Citizens, Accountability, and Service Satisfaction: The Influence of Expectations." Urban Affairs Review 41(3): 292-308.
Rodgers, R. a. H., John (1992). "A Foundation of Good Management Practice in Government: Management by Objectives." Public Administration Review 52(1): 27-39.
Rosenfield, R., Fornango, Robert, and Baumer, Eric (2005). "Did Ceasefire, Compstat, and Exile Reduce Homicide?" Criminology and Public Policy 4(3): 419-450.
Rosenfield, R., Fornango, Robert, and Rengifo, Andres (2007). "The Impact of Order-Maintenance Policing on New York City Homicide and Robbery Rates 1988-2001." Criminology 45(2): 355-384.
Ruggiero, J. (1998). "Non-Discretionary Inputs in Data Envelopment Analysis." European Journal of Operational Research 111: 461-469.
Schaenman, P., Hall, John R., Schainblatt, Alfred H., Swartz, Joseph A., and karter, Michael J. (1977). Procedures for Improving the Measurement of Local Fire Protection Effectiveness. Boston, MA, National Fire Protection Association.
Sharp, C., Jones, J. and Smith A. (2006). What do we measure and why? An evaluation of the citistat model of perfromance management and its applicability to the Scottish public sector, Scottish Executive Social Research.
Silverman, E. B. (1999). NYPD Battles Crime: Innovative Strategies in Policing. Boston, MA, Northeastern University Press.
Svara, J. H. (1999). "The Shifting Boundary between Elected Officials and City Managers in Large Council-Manager Cities." Public Administration Review 59(1): 44-53.
Tipton, H. D. (1973). America Burning, National Commission on Fire Prevention and Control.
TriData (1997). Fire Death Rate Trends: An International Perspective, United States Fire Administration.
TriData (1997). Socioeconomic Factors and the Incidence of Fire, United States Fire Administration.
TriData (1998). An NFIRS Analysis: Investigating City Characteristics and Residential Fire Rates, United States Fire Administration.
TriData (1999). Profile of the Urban Fire Problem in the United States, United States Fire Administration.
TriData (2007). Fire in the United States 1995-2004, United States Fire Administration. 14.
TriData (2008). Residential Structure and Building Fires, United States Fire Administration.
USFA (2004). Firefighter Life Safety Summit Initial Report, United States Fire Administration/National Fallen Firefighters Foundation.
USFA (2010). Fire Statistics, United States Fire Administration.
Vito, G. F., Walsh, William F., Kunselman, Julie (2005). "Compstat: The Manager's Perspective." International Journal of Police Science and Management 7(3): 187-196.
Wallace, R. J. (1977). "Productivity Measurement in the Fire Service." Public Productivity Review 2(3): 12-36.
Walsh, W. F. (2001). "Compstat: An Analysis of an Emerging Police Managerial Paradigm." Policing: An International Journal of Police Strategies and Management 24(3): 347-362.
Walsh, W. F. a. V., Gennaro F. (2004). "The Meaning of Compstat: Analysis and Response." Journal of Contemporary Criminal Justice 20(1): 51-69.

Weikart, L. A. (2001). "The Giuliani Administration and the New York Public Management in New York City." Urban Affairs Review 36(3): 359-381.
Weisburd, D., Mastrofski, Stephen D., McNally, Ann Marie, Greenspan, Rosann, and Willis, James J. (2003). "Reforming to Preserve: Compstat and Strategic Problem Solving in American Policing." Criminology and Public Policy 2(3): 421-456.
Weisburd, D., Mastrofski, Stephen, Greenspan, Rosann, and Willis, James J. (2004). The Growth of Compstat in American Policing, Police Foundation Reports: 1-17.
Weitzman, B. C., Silver, Diana, and Brazill, Caitlyn (2006). "Efforts to Improve Public Policy and Programs through Data Practice: Experiences in 15 Distressed American Cities." Public Administration Review May/June: 386-399.
Willis, J. J., Mastrofski, Stephen D., and Weisburd, David (2007). "Making Sense of Compstat: A Theory-Based Analysis of Organizational Change in Three Police Departments." Law and Society Review 41(1): 147-188.
Willis, J. J., Mastrofski, Stephen D., Weisburd, David (2004). "Compstat and Bureaucracy: A Case Study of Challenges and Opportunities For Change." Justice Quarterly 21(3): 463-496.
Wilson, J. Q., and Kelling, George K. (1982) "Broken Windows." The Atlantic Online.
Wilson, W. J. (1987). The Truly Disadvantaged: The Inner City, The Underclass, and Public Policy. Chicago, University of Chicago Press.
Yang, K. a. H., Marc (2006). "The Performance-Trust link: Implications for Performance Measurement." Public Administration Review 66(1): 114-126.

BIOGRAPHICAL INFORMATION

James Horton is a Lieutenant with the Fort Worth, TX Fire Department. He earned his Bachelor of Science degree in Emergency Administration and Disaster Planning, and Master of Public Administration degrees from the University of North Texas. He completed his PhD in Urban and Public Administration at the University of Texas at Arlington. His research interests include local government management, performance measurement and public safety.