Exploring U.S. Coast Guard organizational preparedness through chaos and complexity theories

December 30, 2014 · Research Article
Dr. Gregory Sanial

Abstract

The purpose of this qualitative case study was to explore and generate a holistic approach using chaos and complexity theories that captured the Coast Guard’s strategic management and public policy processes to improve the organization’s preparedness for unpredictable events. The case study included rich interviews of strategic management and public policy staff members and reviews of existing Coast Guard policy and procedural documents related to strategy and public policy. The research findings identified several themes in the data that were consistent with chaos and complexity theories. The identified themes were linked through the lenses of chaos and complexity theories to develop a holistic approach to improve Coast Guard organizational preparedness. The implications of the developed approach highlight the relevance of chaos and complexity theories in the understanding of the external environment and improved inter and intra-organizational processes related to strategic management and public policy for the Coast Guard.

Introduction

Chaos theory and complexity theory are complementary and when used together may offer a new and comprehensive perspective to understand the dynamics of organizations and the processes of change and organizational evolution (Goldstein, 2009; Hodge & Coronado, 2007). Chaos theory can be used to show that seemingly random events can be predicted through causal relationships within a structure of relatively predictable behavior (Gleick, 2008; Guastello, 2008; Haynes, 2007). Complexity theory suggests that the local interaction of the components of a defined system will result in patterns of interaction producing unexpected behavior of the overall system (Mason & Staude, 2009). The underlying idea of complexity theory is that all interactions tend to self-organize into local systems where the behavior of the system is full of apparent surprises yet remains essentially orderly and potentially predictable (Mason, 2009).

Seemingly improbable and unpredicted events that have created national crises include the Exxon Valdez oil spill in 1989, September 11th, 2001, Hurricane Katrina in 2005, and Super Storm Sandy in 2012, among others (U.S. Department of Homeland Security, 2009; Watts, 2012). The U.S. Coast Guard was on the front lines in response to each of these unpredicted and unexpected national crises (U.S. Department of Homeland Security, 2009). With past events as an indicator, Coast Guard organizational leaders will need to continue to prepare for and react to seemingly improbable events in an operating environment that appears to have characteristics aligned with chaos and complexity theories (Guastello, 2008; U.S. Department of Homeland Security, 2009; Watts, 2012). The Coast Guard should no longer accept the status quo and the prospect of unexpected events creating organizational surprise and national crisis. Instead, new theoretical approaches should be assessed for
appplicability to Coast Guard needs and challenges. Given the extreme unpredictability of crises occurring and the variability of the type of crisis that the Coast Guard is often called upon to handle (e.g. oil spills, shipwrecks, terrorism attacks, etc.) constructs related to chaos and complexity theory appear to offer advantages in a new approach to strategy and public policy development that may benefit the Coast Guard by reducing the surprise factor of events in the external environment.

A qualitative case study approach was used combining interview data and analysis of Coast Guard strategic management and public policy documents. A case study was used to allow theory to emerge from the analysis of Coast Guard strategic management and public policy processes. The study explored and generated a new approach using a unique and rich integration of chaos and complexity theories into the Coast Guard’s strategic management and public policy processes to help Coast Guard leaders better prepare their organization for future events. The central research questions were if the themes that emerged from interview transcripts and organizational document related to strategic management and public policy were consistent with concepts and constructs from chaos and complexity theories; and, if those theories could be integrated in a new approach to public policy and strategic management to improve the Coast Guard’s preparedness for unpredictable events.

This paper is organized into three main parts. The first part includes the problem statement, the purpose of the study, and the theoretical framework from chaos and complexity theories. The middle part includes an outline of the research method and the findings. The final part includes implications, recommendations, and conclusions.

Problem statement

The Coast Guard has not been prepared for several unpredictable events that created national crises and exposed organizational shortcomings using existing strategic management and public policy processes (U.S. Department of Homeland Security, 2009; Watts, 2012). The inability to develop strategy to anticipate sudden changes in the external operating environment can have grave consequences for any organization (Allio, 2008; Bovaird, 2008; Poister, 2010). Chaos and complexity theories offer new insight for Coast Guard leaders to confront unpredictability in the external environment and enable organizations to anticipate and strategically plan for future challenges (Gleick, 2008; Meek, 2010; Mitchell, 2009). For the Coast Guard, anticipating future challenges was only part of the solution; internal organizational processes like public policy must also be similarly prepared and aligned (Meek, 2010). Leveraging and integrating chaos and complexity theory into a more holistic approach to include strategic planning and public policy specifically may become an entirely new approach to public administration and provide Coast Guard leaders with opportunities to better confront challenges in the external environment and to increase organizational preparedness (Boulton, 2010; Butler & Allen, 2008; Fairholm & Card, 2009; Haynes, 2008; Klijn, 2008; Teisman & Klijn, 2008).

Purpose

The purpose of this descriptive qualitative case study was to explore and generate a new holistic model that can inform the Coast Guard’s strategic management and public policy processes to improve the organization’s preparedness for unpredictable events. The constructs of chaos and complexity theories provided valuable insight in the development and integration of the new theory to improve organizational preparedness.

Theoretical framework
The concepts and principles of chaos theory provide a rich paradigm where researchers can examine the conditions and operating environment of an organization (Sloan, 2011). Chaos theory offers a very promising paradigm for exploration and imagination when researching how organizations evolve and operate in their external environment (Sloan, 2011). However, the interdependence of the entire system under study cannot be ignored (Gleick, 2008). Chaos theory is a separate component of the larger theoretical framework of complexity theory (Goldstein, 2009; Kayuni, 2010). Complexity theory is not a unified theory with a single, widely accepted standard definition. However, complexity theory is used to describe the actions and interactions of complex systems through an appreciation and understanding of the entire components of the system. Sensitivity to initial conditions, non-linearity, and self-organization are important components of complexity theory (Mitchell, 2009).

Public policy is the internal decision making process in a government organization (Morcol, 2010). Strategic management is the tracking of emerging situations in the external environment and synthesizing an organizational response (Bovaird, 2008). Chaos and complexity theories include an emphasis on analysis of seemingly unpredictable events, randomness, and sensitivity to initial conditions in order to generate potential predictors of future needs and capabilities (Gleick, 2008; Mitchell, 2009; Rensicow & Page, 2008).

Gleick (2008) suggested that where chaos begins, classical science often stops. Whereas classical science focuses on regularity and predictability, chaos theory focuses on irregularity and unpredictability (Gleick, 2008). However, chaos theorists focus on finding some order in the apparent disorder that is not well defined by classical science (Gleick, 2008). Chaos theory is a holistic approach to understanding phenomena that are not easily described or predicted using traditional and compartmentalized sciences that may overlook some factors contributing to the system’s behavior (Gleick, 2008).

Chaos theory is a theoretical framework that provides an alternative model to forecasting than more traditional business forecasting models based on history, linearity, predictability, and controllability (Djavanshir & Khorramshahgol, 2006). Chaos has three distinctive features: non-repeating sequences, boundedness of the observed variable, and sensitivity to initial conditions (Gleick, 2008). Chaos theory also accounts for seemingly unrelated variables that are not directly connected to an observed phenomenon yet provide strong influences on the resultant observation (Snell, 2009). Chaos theory’s most useful attribute over more traditional linear forecasting models currently used in many strategic planning processes is the way chaos theory accounts for events that traditional models ignore as noise (Snell, 2009).

The theoretical components of chaos theory can provide insight into actions or reactions in a business or policy context (Cvetek, 2008; Kayuni, 2010). Additionally, chaos theory’s practical usefulness in the business environment and other social sciences is not on specific details of a particular event or the ability to predict a specific event, but instead on the universal and shared emergent patterns in available data to provide practical insight involving future challenges in the existing environment (Sloan, 2011). Using chaos theory, relationships are no longer cause and effect, controlled, and no longer constant, instead organizational behaviors become non-linear and unanticipated (Nguyen & Kock, 2011). Chaos theory has practical usefulness in business applications because it provides a structure to deal with the common challenges of uncertainty, imperfect information, and disorder in the external environment (Fawcett & Waller, 2011; Nguyen & Kock, 2011, Samli, 2010; Theordoridis & Bennison, 2009). According to Gleick (2008) and Guastello (2008), chaos theory can be used to develop an observable time series of events where these seemingly random and unpredictable events can, in fact, be predicted in the future. These seemingly random and unpredictable events, or chaotic shocks, to the organization or operating environment can be referred to as strategic inflection points and can be of particular interest to an organization (Samli, 2010).

Complexity theory has both a theoretical and practical utility in a business environment (Mitchell, 2009;
Wheatley, 2006). Theoretical complexity theory can provide insight into reactions or interactions in a business or policy context (Kayuni, 2010; Radford, 2008a; Radford, 2008b). Additionally, complexity theory’s practical usefulness in the business environment and other social sciences is not on the specifics of a particular system interaction, but instead on the universal and shared emergent patterns in the available data to provide practical insight involving future potential interactions among system components (Mitchell, 2009; Sloan, 2011). Complexity theory is increasingly being adopted as a way to better understand the management of complex and turbulent operating environments (Mason, 2009). Traditional, bureaucratic, and mechanistic management approaches are often suitable for stable environments, but are not effective in turbulent conditions where planning cycles are much shorter (Mason, 2009).

Complexity theory can be used to explain the impact of improbable events on and the behavior of a variety of systems to include internal organizational systems and the organization’s external business or operating environment (Gleick, 2008). Complexity theory has applicability across a number of disciplines and is widely held to have applicability to both social and natural sciences (Kemp, 2009; Mitchell, 2009). The research integrated complexity theory into public policy and strategic management process of the Coast Guard. Improbable events have influenced the Coast Guard’s external environment in the past and are anticipated to continue in the future.

Chaos theory and complexity theory are distinct theories with some overlap. Whereas chaos theory is a subset of complexity theory, the use of both theories in a synthesized approach to strategic management and public policy in turbulent external environment holds promise. Chaos theory generally suggests a limited degree of predictability through an understanding of the emergent patterns in the data. Complexity theory stresses that the interaction of all components of the system under study must be fully understood and appreciated to generate insight into the actions and reactions of the entire system. The synthesis of chaos theory and complexity theory into a comprehensive approach to the business environment was undertaken in this study. Table 1 lists the general constructs of chaos and complexity theories identified from the literature and of particular interest to the study.

Table 1: Constructs of chaos and complexity theories

<table>
<thead>
<tr>
<th>Attributes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-linearity</td>
</tr>
<tr>
<td>Self-organization/local interaction</td>
</tr>
<tr>
<td>Sensitivity to initial conditions</td>
</tr>
<tr>
<td>Emergence</td>
</tr>
<tr>
<td>Noise</td>
</tr>
<tr>
<td>Unpredictability</td>
</tr>
</tbody>
</table>
Disequilibrium/chaotic shock

Constraints/boundedness

Complex systems self-organize into complex adaptive systems where the behavior of the system is full of apparently uncontrollable surprises yet is essentially orderly (Mason, 2009). Complex systems self-organize on the edge of chaos where there is a measure of stability for system sustainment and enough turbulence to overcome inertia (Mason, 2009). Complexity theory can be used to provide insights regarding the ways that the behavior of complex systems can be managed (Samoilenko, 2008). Public policy and strategy development processes can be analyzed as complex adaptive systems through complexity theory (Samoilenko, 2008). Specifically, the insights provided by complexity theory can help improve the understanding of the complexities of strategy development, public policy, and overall internal administrative processes (Boulton, 2010; Klijn, 2008; Morcol, 2010; Teisman & Klijn, 2008).

The use of complexity theory and chaos theory in management is primarily a philosophical undertaking that has limited the use of the theories in specific business process combinations like public policy and strategic management (Goldstein, 2009; Haynes, 2007). Strategic management and strategic planning processes are often reliant on perceptions and understanding of the external environment based on a historical perspective (Bovaird, 2008). Conversely, chaos and complexity contain non-linearity and unpredictability and take a broader view of the future (Morcol & Wachhaus, 2009). Non-linearity in complexity theory is meant to apply to the need to look at complex systems as a whole system instead of attempting to simplify the constituent parts of the system to the most basic component form (Kemp, 2009). Integrating chaos and complexity theory into the strategic management and public policy development processes of an organization may become an entirely new approach to public administration and public policy (Boulton, 2010; Duit & Galaz, 2008; Teisman & Klijn, 2008).

Several existing practical studies by Bovaird (2008), Butler and Allen (2008), Cvetek (2008), Fairhold and Card (2009), Haynes (2007), Jarzabkowski and Balogun (2009), Kayumi (2010), Mason (2009), Mason and Staude (2009), Theodoridis and Bennison (2009), and Wolf-Branigin (2009) among others were used as a guide in the development of the research. Although the various studies were across a wide variety of disciplines, the insight the studies provided in data sources, data analysis, variables of interest, and research methodologies when combined with similar theoretical studies of chaos and complexity theory all contributed the development of the research and served as a template to help refine and guide the research.

Complexity theory can provide insight and improve the understanding of the challenges of public policy and strategic management as individual processes (Boulton, 2010; Klijn, 2008; Morcol 2010; Morcol & Wachhaus, 2009; Teisman & Klijn, 2008). Poorly understood complexity and unrecognized chaos in the external environment are a major cause of poor decision-making and subsequently poor strategic choices during periods of change for an organization (Butler & Allen, 2008; Guastello, 2008; Williams & Lewis, 2008). A complexity theory approach to strategic management provides a more holistic perspective from traditional approaches (Radford, 2007).

Strategic management includes two components: insight about the present and foresight about the future (Sanders, 1998). Chaos and complexity theories allow leaders to look at the whole system of components of their environment to gather insight about the present and foresight about the future (Sanders, 1998). Most important, leaders who can identify the system’s initial condition as it emerges gain the opportunity to influence
the circumstances of that emergence (Sanders, 1998). Leaders will need to build organizational strategies able to adapt to dynamic change from multiple forces acting in apparently unpredictable ways generating surprise outcomes (Quade & Halladay, 2010). Within complex adaptive systems, leaders develop a strategy to influence organizational patterns in a way to insure adaptive capacity and organizational sustainability (Quade & Halladay, 2010).

A complexity theory approach to public management and public policy could help increase the understanding of both processes (Teisman & Klijn, 2008). Chaos and complexity theory have yielded some important insights in public policy but are still in an early stage of development (Bovaird, 2008, Durlauf, 2012). The use of complexity theory enhances the study of public policy because the theory incorporates nonlinearities that lie outside the range of past experiences that the public policy must address (Durlauf, 2012). Additionally, complexity theory can enhance the understanding of public policy because the theory can account for equity and efficiency tradeoffs (Durlauf, 2012). The current research extended Morcol’s, Teisman, and Klijn’s ideas to develop a model for Coast Guard leaders at the intersection of chaos theory, complexity theory, strategic management, and public policy.

**Research method**

The descriptive qualitative research used a case study approach where data generated from interviews of Coast Guard officers and analysis of Coast Guard organizational documents were used to generate a theory that addressed strategic management and public policy organizational preparedness for crises. The theory-related constructs that emerged from data analysis were assessed for integration with existing constructs of chaos and complexity theories with data collected from interviews of U.S. Coast Guard strategic planning and public policy personnel and reviews of Coast Guard policy documents relating to public policy and strategic management.

The rich interviews of Coast Guard staff members produced the first major data source. There were 13 interviews conducted. The average interviewee had the rank of Rear Admiral, Lower Half (O-7) and had 15 years of strategy and policy experience. The rich interview framework used the Mason (2009) study as a template. The interview data collected was grouped into four categories for analysis: external environment, attitudes to change, general management, and organizational structure. These categories were used in the Mason (2009) study and were used to help organize the data into manageable key areas of analysis and enabled focused interview probing. Table 2 displays a breakdown of the categories and specific issues or variables of interest.

Table 2: Issues investigated during interviews

<table>
<thead>
<tr>
<th>Categories</th>
<th>Specific Issues/Variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environment</td>
<td>Description of the external environment</td>
</tr>
<tr>
<td></td>
<td>Appearance of stability/instability</td>
</tr>
<tr>
<td>Attitude to change</td>
<td>Organizational ability to react to and cope with change</td>
</tr>
</tbody>
</table>

Emergence: Complexity and Organization
The nature of the current study required the development of a unique instrument for the interviews. During the interviews, the questions asked related to individual perceptions of strategic planning processes and public policy processes and reactions to and comments regarding shortcomings in the processes when events in the external environment were unanticipated and caused organizational crises. These questions were related to and aligned to those in previous research of chaos and complexity in a variety of settings to include retail location, classroom planning, education policy, and marketing strategy (Cvetek, 2008; Junior et al., 2012; Kayuni, 2010; Mason, 2009; Mason & Staude, 2009; Theodoridis & Bennison, 2009). Instrument validity was increased by comparison and pattern matching across multiple interviews as common themes emerged from the data collected using the instrument (Mason, 2009).

The second major data source was derived from review of Coast Guard organizational documents related to strategy and public policy. The data collection through document review was similar to that conducted in previous research in chaos and complexity in a variety of contexts (Jones, 2008; Kayuni, 2010; Mason &
The policy and procedural documents reviewed include documents related to internal standard operating procedures related to strategic management and public policy, budget submissions indicating organizational priorities and emphasis, annual reports, and other instructions and manuals delineating organizational preparedness and strategic planning criteria (Kayuni, 2010; Mason & Staude, 2009). The research only used publicly available documents to ensure future replication of the study.

The interview and policy document data was analyzed through a variety of methods to include data triangulation, methodological triangulation, and prolonged engagement (Mason, 2009). Conducting the research through a blend of interview data and reviews of existing documents appeared appropriate to provide sufficient data triangulation opportunities (Urquhart, Lehmann, & Meyers, 2010). Complexity data analysis methods needed to reflect an exploratory approach that identified and quantified trends, applied spatial analysis, identified nested occurrences, and used hierarchical linear modeling (Wolf-Branigin, 2009).

Chaos and complexity theories provided focus to the systematic analysis of the data and contributed to the development of a new more holistic theory of strategic management and public policy for the Coast Guard. The use of chaos and complexity theories was not used to constrain generation of themes from data analyses. The themes were allowed to emerge from the data initially and independently. The lenses of chaos and complexity theories were not applied to the themes until after the themes had emerged from the data. The themes were identified from the 573 codes of interest. Additionally, constructs from chaos and complexity theories were judged against emergent themes derived inductively via the content analysis of the data. The analysis of the data included a dynamic interplay of data collection, comparison, and data analysis to increase the degree of conceptualization and scope of the theory that emerged from the data after filtering the themes through the lenses of chaos and complexity theory (Urquhart, Lehmann, & Myers, 2010). Table 3 links the constructs of chaos and complexity theories in Table 1 with the categories and variables from Table 2 that were used in the data analysis. Table 3 demonstrates the relevance of complexity and chaos theories in the interview and data analysis.

Table 3: Linking matrix

<table>
<thead>
<tr>
<th>Chaos and Complexity Attribute</th>
<th>Coast Guard Strategic Planning/Public Policy Process Interview Category Issues/Variables from Table 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-linearity</td>
<td>Environment, Attitude to change</td>
</tr>
<tr>
<td>Self-organization/local interaction</td>
<td>Attitude to change, General Management</td>
</tr>
<tr>
<td>Sensitivity to initial conditions</td>
<td>General Management, Attitude to change</td>
</tr>
<tr>
<td>Emergence</td>
<td>General Management, Environment</td>
</tr>
<tr>
<td>Noise</td>
<td>Environment, Attitude to change, General Management, Structure and Staffing</td>
</tr>
</tbody>
</table>
Data analysis was conducted with the assistance of commercial software. Thematic coding was done manually by deconstructing and reconstructing the interview transcripts to categorize responses according to the elements in Table 2 through the lens of chaos and complexity theories. Thematic coding was completed using Dedoose commercial research software. Dedoose was selected primarily for its low cost and ease of use. Dedoose proved more than adequate for the study requirements.

Dedoose’s utility was primarily as an integrated platform to easily and intuitively code the data and then extract the data in a useable form. Dedoose provided the ability to extract the data in common word processing and spreadsheet software. There were 13 interviews conducted lasting an average of 40 minutes that generated 163 pages of transcripts for analysis. Within the 163 pages of transcripts and the documents of interest, a total of 261 excerpts were identified that related to the specific issues and variables of interest identified in Table 2.

Many of the coded excerpts related to more than one individual issue, variable, or probe of interest. The 261 excerpts generated 573 codes of interest relating to specific issues, variables or probes. Narrative analysis was used and focused on the meaning contained within the entire transcript instead of fragmenting the data into granular categories (Raddon et al., 2009). The emphasis on narrative analysis resulted in longer excerpts with multiple code tags vice short, fragmented excerpts with individual code tags in order to maintain full meaning of the narrative. A key essence of complexity theory is non-linearity that argues against attempting to simplify the constituent parts of a system to the most basic, fragmented, component form (Kemp, 2009). For this reason, excerpts were longer to ensure the full context was understood and maintained. The 261 excerpts across 573 codes of interest provided depth and breadth to the data and contributed conceptual density to findings. Each data source to include interview transcripts and organizational documents included an average of 38 coded excerpts of interest.

Findings
There were eight themes identified in the data. Overall, the responses to the interview questions were consistent across all interviewees. The themes in the data were:

1. **Organizational Identity Crisis**: The Coast Guard faces an identity crisis or a search for relevance in the organization’s current external environment. Issues of external messaging, fit within government, too many stakeholders, relevance and value to the public served were all found within the data.

2. **Environmental Complexity**: The Coast Guard’s external environment was viewed as complex, chaotic, constrained, non-linear, misunderstood, and threatening, among other adjectives.

3. **All Tactics/No Strategy**: The data indicated the Coast Guard is focused on tactics instead of strategy. The organization is focused on the next budget instead of the long-term organizational health. There is little enthusiasm for a strategic vision for the organization that lasts more than four years.

4. **Inward Focus**: The data indicated that the Coast Guard is inwardly focused to the detriment of the organization. There appeared to be pressure or a desire to maintain the status quo for the organization even if the events in the external environment may indicate otherwise. There also appeared to be an organizational perception of a lack of external stakeholder support that created this inwardly focused, almost bunker mentality.

5. **Organizational Disconnects**: The data indicated that the Coast Guard has organizational alignment challenges to deal with strategy and policy effectively throughout the organization.

6. **Awareness of Need to Evolve**: Almost universally, interviewees agreed the organization faces changes and needs to adapt to those changes for continued success.

7. **Looming Organizational Crisis**: The data indicated a sense of an unknown, impending organizational inflection point in the near future.

8. **Organizational Success Despite Best Efforts**: Despite some shortcomings, the organization has been and is expected to be successful responding to disasters, has exceptional people, and a bias for action.

The eight themes that were developed from the data have implications for the Coast Guard and existing methods for strategic management and public policy may not be well positioned for the current external environment. The themes of environmental complexity and looming organizational crisis imply the Coast Guard is facing unpredictable and significant challenges in the external environment and are consistent with constructs of chaos and complexity theories. The themes of organizational identity crisis, all tactics and no strategy, and awareness of the need to evolve imply the Coast Guard may not be best organized or ready to deal with events in the external environment with existing processes for strategic management and public policy. These themes as observed are consistent with the constructs of chaos and complexity theories. The remaining themes – inward focus, organizational disconnects, and organizational success despite best efforts – were not consistent with the
constructs of chaos and complexity theories. However, the opposite of two of those themes — outward focus and a fully networked organization — are considered best practices to deal with an uncertain external environment using a complexity theory based approach. This finding indicates that the Coast Guard may not be currently using a complexity based approach to the external environment. Table 4 links the themes in the data with the constructs of chaos and complexity theories in Table 1.

Finally, a model for increased organizational preparedness based in chaos and complexity theory was proposed. The developed model had two components. These two components to the model for improved organizational preparedness were a chaos and complexity based approach to environmental scanning and a complex system theory approach to intra- and inter-organizational dynamics. These two components to the model were linked together in a cycle of continuous feedback.

The first component to this model of improved Coast Guard organizational preparedness would be to leverage chaos and complexity theories to improve organizational scanning of the external environment to better anticipate events in the external environment to inform strategic management and public policy processes. The objectives of this component of the model for increased organizational preparedness are to use chaos and complexity theories as a foundation for understanding, appreciating, analyzing, and anticipating events in the external environment. The model could be used for increased understanding of events in the external environment and thereby improve organizational preparedness by reducing the element of surprise.

Mason’s (2009) research findings identified a close relationship between managerial attitudes to change and the perceptions of those managers of the external operating environment (Mason, 2009). Similarly, Mason found that the managers of firms that welcomed and enthusiastically embraced change in the external operating environment resulted in the firm being more successful in the operating environment (Mason, 2009). Mason also found that managers that did not anticipate or embrace change in the external operating environment were more likely to work at firms that were less successful and often victimized by change (Mason, 2009). Mason found the key issue for leaders in complex environments is to embrace the complexity and accept the environment cannot be controlled centrally (Mason, 2009). The Coast Guard, a hierarchal military organization predicated on control and discipline may find embracing complexity and the associated apparent lack of control difficult.

Although Mason’s study and the current research were focused on different types of organizations, the use of complexity theory, the data collected, and results had large overlap and alignment with the current study. The current study identified environmental complexity as a theme within the data. With this theme, Mason’s findings suggest that the Coast Guard needs to embrace the complexity in the environment and look for positive opportunities in the environment. However, the themes in the current study of organizational identity crisis, all tactics and no strategy, inward focus, and organizational disconnects when compared with the Mason study would indicate that the Coast Guard is potentially victimized by change and underperforming. These indications suggest an imperative for a new approach to Coast Guard organizational preparedness suggested by the developed holistic theory. Fortunately for the Coast Guard, the themes of awareness of need to evolve and organizational success despite best efforts appear to offer potential for the organization to change and embrace the complexity in the external environment and make the shift, as Mason found, to higher performance.

The second component of the model for improved organizational preparedness is a complex system theory approach to intra- and inter-organizational dynamics. This complex system would include the Coast Guard, all of the organization’s stakeholders, the Department of Homeland Security and all of the component organizations, Congress, the administration, the public, and organizational competitors for constrained federal funding. By taking a complex system approach to organizational interactions the model would leverage the existing organizational success and strengths by changing to an outward focus based on organizational interactions, change organizational disconnects into organizational connections, evolve the organization through
a new understanding of the organizational position, improving communication and understanding among stakeholders, identify and build on good practices internally, and shift to a strategic approach to organizational preparedness. The complex system approach would increase organizational preparedness by forcing the organization to take an external view and become more aware of the overall external environment within the complex system.

The findings of the current study and the themes of organizational identity crisis, all tactics and no strategy, inward focus, and organizational disconnects align to Theodoridis and Bennison’s findings that indicate the Coast Guard is a complexity adapting organization. Complexity absorbing companies outperform complexity adapting organizations (Theodoridis & Bennison, 2009). The developed model for improved Coast Guard organizational preparedness proposed embracing and harnessing chaos and complexity within the Coast Guard and if implemented and supported could enable the Coast Guard to shift from complexity adapting to complexity absorbing and could result in improved performance as suggested by Theodoridis and Bennison.

The key to linking these two components in the model is a cycle of continuous feedback. Potential changes in the external environment would need to be applied to the complex system of organizations to provide insight into potential outcomes, impacts, and changes in relationships. The result of these interactions would then provide feedback to the environmental scanning component in a continuous cycle of feedback. The model described by the theory of organizational preparedness would be updated as changes occur in the external environment or among the components identified by the complex system. The members contained within the complex system could also change based on changes in the external environment if necessary.

The developed holistic model for increased Coast Guard organizational preparedness aligned to the results of studies by Cvetek (2008), Mason (2009), Theodoridis and Bennison (2009), Nguyen and Kock (2011), and Mason and Staude (2009). The general consensus of the studies was that embracing chaos and complexity in management approaches and organizational processes oriented to a turbulent or unpredictable external environment created opportunities for increased organizational performance. The themes developed from the data of the current study indicated the Coast Guard has a complex and turbulent external environment that was not well understood by the interviewees using existing approach and that new approaches to the external environment were needed. Additionally, the themes developed from the study also indicated opportunities for improvement in areas of general management and organizational processes related to strategy and public policy. The developed model for increased organizational preparedness embraces chaos and complexity theories for the Coast Guard’s complex external environment and could evolve the Coast Guard to an organization that embraces chaos and complexity theories. In turbulent environments, Cvetek (2008), Mason (2009), Theodoridis and Bennison (2009), Nguyen and Kock (2011), and Mason and Staude (2009) found organizations that embraced chaos and complexity in the external environment and in internal organizational processes out performed their competitors.

**Implications, recommendations, and conclusions**
The study had four recommendations for practical applications of the results of the study. Specific Coast Guard applications of the study included implementation of the developed model for increased organizational preparedness, strategy and policy organizational office realignment, viewing other federal organizations as competitors in strategy, policy, and budget development processes, and the development of a strategy career path in the organization. These recommendations were all derived as practical applications to address the themes and organizational challenges derived from the interviews. The themes and organizational challenges identified in the data indicated that practical approaches based in complexity and chaos theories could increase organizational performance as indicated by the literature and similar studies.

Of particular note, one practical application of the study was for the Coast Guard to view other federal organizations as competitors in strategy, policy, and budget development processes. The research findings noted themes of a Coast Guard organizational identity crisis, with all tactics and no strategy, an inward focus, and a looming organizational crisis. The Coast Guard could apply the results of the study, even if the organization does not adopt and fully integrate the developed, holistic model for increased organizational performance, by viewing other federal organizations as competitors in strategy, policy, and budget development processes. This approach is part of the complex system approach to the developed model for improved organizational performance. Coast Guard strategists and budget development personnel should take the approach that the federal budget available is a fixed amount that will be split up among all federal agencies. The approach of growing an individual agency’s budget with a well-justified new start should be abandoned. Instead, the organization should consider any other federal agency with an existing stake or mission set on or above the water as a business competitor and consider merger or acquisition approaches to each competitor to grow the size and relevance of the Coast Guard. Taking a merger and acquisition approach to other competitors will force the Coast Guard to an outward focus, evolve the organization, and help with the identity crisis. For instance, the National Marine Fisheries Service conducts fisheries law enforcement. The Coast Guard also conducts fisheries law enforcement. As a much larger organization, the Coast Guard could probably “acquire” the National Marine Fisheries Service with process related to a hostile takeover with the right kind of value proposition to the taxpayer. Similarly, the Coast Guard could take the business approach of a strategic alliance or airline code share with the Navy and offer to be the small vessel or boat provider of choice the Navy. Again, the Coast Guard could create a value proposition that the service’s organizational strengths are better suited for coastal or inshore missions than the Navy. If the Coast Guard could show or demonstrate a better product for less or even the same price to the taxpayer, the potential growth opportunities for the Coast Guard are huge. These are just two examples of taking a more business approach towards competitors with a merger and acquisition mindset could be of benefit to the Coast Guard. Similarly, the Coast Guard could consider divesting, or spinning off missions that no longer have value propositions to the tax payer. The political and practical difficulties to such an approach are significant, however the opportunity is in alignment with the themes found in the data and could be considered.

The constructs of chaos and complexity theory were found to exist in a majority of the themes of the data within the Coast Guard’s operating environment and organizational processes related to strategic management and public policy processes. The implication of this finding for the Coast Guard was that the organization exists in an operating environment that can be described and defined using chaos and complexity theories. Therefore, the use of chaos and complexity theories for evaluation of and interaction with the external environment and internal processes should increase understanding and organizational performance through a holistic approach as proposed by the developed model (Mason, 2009; Mason & Staude, 2009; Nguyen & Kock, 2011).

In general, the implication of the developed theory for the Coast Guard for organizational preparedness highlights the relevance of chaos and complexity theories in the understanding of the external environment and the potential for improved inter and intra-organizational processes related to strategic management and public policy processes aligned with similar findings of Mason and Staude (2009). Chaos and complexity based
approaches to the external environment may identify opportunities sooner and more clearly than existing processes in the Coast Guard’s dynamic external environment (Mason & Staude, 2009).

Implementation of the developed theory for increased Coast Guard organizational performance has significant organizational implications. The themes developed from the data identified an organization in a complex external environment with an identity crisis, inward focus, organizational disconnects and yet awareness of the need to evolve. A practical application of the study would be for the Coast Guard to adopt the proposed model into the organizational strategic management and public policy processes. The implementation of the new approach would likely not be easy. One organizational document reviewed in the study highlighted the “risk of transformation fatigue and distraction” in organizational upheaval of several, previous reorganizations. The challenges of application and making changes in preparation for the Coast Guard’s approach to strategic management and public policy through chaos and complexity theories pose difficulties that would require a sound implementation plan with strong support from senior leaders.

There were several recommendations for future research. Specific recommendations for future research included a study of a fire or police department’s strategy and policy development processes, a study across a wider range and number of organizations especially with emergency response responsibilities, and a quantitative study across a range of organizations to potentially measure environmental complexity and the relationship to organizational performance based on management processes across shared chaotic shocks in the external environment.

The study did have limitations. Since the study was focused on a small part of one organization, the research findings are not necessarily a good representative of all organizations of a similar organizational structure or in a similar operating environment (Mason 2009). Similarly, since this is qualitative research, external validity will be difficult to achieve in order to generalize the potential results to other organizations (Nguyen & Kock, 2011). However, the results of the current study when combined with the results of similar studies may provide the opportunity to draw general conclusions for other organizations (Nguyen & Kock, 2011).

**Conclusions**

Chaos theory and complexity theory when understood and applied hold promise for increased organizational performance in a turbulent external environment. The constructs of chaos and complexity theories were synthesized and used to develop interview questions that generated rich data. The majority of the themes developed in the data had direction relationships to the constructs of chaos and complexity theories. The purpose of the study was met and a model for improved Coast Guard organizational preparedness was developed and should enable the organization to better organize and respond to the external environment. These findings were in alignment with previous studies and suggested by the literature on chaos and complexity theories. The developed model for increased organizational preparedness should not be extrapolated directly to other organizations or government agencies. However, the findings do demonstrate that chaos and complexity theory are useful and insightful for exploring, analyzing, and understanding the strategic management and public policy processes of organizations in a dynamic and turbulent external environment.

Table 4: Data themes linked to chaos and complexity theories

<table>
<thead>
<tr>
<th>Developed Theme</th>
<th>Attributes of Chaos/Complexity Theories</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organizational Identity Crisis</td>
<td>Self-organization/local interaction</td>
</tr>
</tbody>
</table>

Emergence: Complexity and Organization  

14
<table>
<thead>
<tr>
<th>Developed Theme</th>
<th>Attributes of Chaos/Complexity Theories</th>
</tr>
</thead>
<tbody>
<tr>
<td>Noise</td>
<td></td>
</tr>
<tr>
<td>Constraints/boundedness</td>
<td></td>
</tr>
<tr>
<td>Environmental Complexity</td>
<td>Non-linearity</td>
</tr>
<tr>
<td>Self-organization/local interaction</td>
<td></td>
</tr>
<tr>
<td>Emergence</td>
<td></td>
</tr>
<tr>
<td>Noise</td>
<td></td>
</tr>
<tr>
<td>Unpredictability</td>
<td></td>
</tr>
<tr>
<td>Disequilibrium/chaotic shock</td>
<td></td>
</tr>
<tr>
<td>Constraints/boundedness</td>
<td></td>
</tr>
<tr>
<td>All Tactics/No Strategy</td>
<td>Non-linearity</td>
</tr>
<tr>
<td>Self-organization/local interaction</td>
<td></td>
</tr>
<tr>
<td>Noise</td>
<td></td>
</tr>
<tr>
<td>Unpredictability</td>
<td></td>
</tr>
<tr>
<td>Inward Focus</td>
<td>None</td>
</tr>
<tr>
<td>Developed Theme</td>
<td>Attributes of Chaos/Complexity Theories</td>
</tr>
<tr>
<td>-----------------</td>
<td>-----------------------------------------</td>
</tr>
<tr>
<td>Organizational Disconnects</td>
<td>None</td>
</tr>
<tr>
<td>Awareness of Need to Evolve</td>
<td>Sensitivity to initial conditions</td>
</tr>
<tr>
<td></td>
<td>Non-linearity</td>
</tr>
<tr>
<td></td>
<td>Emergence</td>
</tr>
<tr>
<td>Looming Organizational Crisis</td>
<td>Non-linearity</td>
</tr>
<tr>
<td></td>
<td>Sensitivity to initial conditions</td>
</tr>
<tr>
<td></td>
<td>Emergence</td>
</tr>
<tr>
<td></td>
<td>Disequilibrium/chaotic shock</td>
</tr>
<tr>
<td>Organizational Success Despite Best Efforts</td>
<td>None</td>
</tr>
</tbody>
</table>

**References**


Emergence: Complexity and Organization