

How Complexity Science Can Help Organizations and Leaders

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Abstract

This paper explores the role Complexity Science and its associated theories play in a regional restaurant organization. Complexity Science and its associated theories have been shown to be a significant factor in aiding organizations to be more flexible and have the ability to adapt to the current dynamic business environment. General managers were interviewed to determine their understanding of Complexity Science, the utilization of Complexity Science within their organization, and what role they see Complexity Science playing in the future business of their organization. The results from this study were conclusive, it shows that managers and organizations were ill equipped to deal with the current business environment and not having the ability to adapt to the current environment puts their very success in peril.

The “Speed of Now”

As we advance deeper into the knowledge economy, the basic assumptions underlining much of what is taught and practiced in the name of management are hopelessly out of date...Most of our assumptions about business, technology, and organization are at least 50 years old. They have out lived their time [1].

There is a commonly held belief among anthropologists, evolutionary biologists, paleontologists, and others, that all species from organisms to humans, evolve and adapt to their environment [2]. Changes to an environment can come from anywhere [3]. They can come from the physical environment, external and internal influences, or out of need [4]. Humans have adapted to their physical environment, the influences that surround them, out of need for thousands of years, and this is no different today. The only real difference between then and now is that researchers and scientists study the human condition and create theory.

In the same manner that humans have adapted to their environment to survive, managers and organizations in today’s dynamic business environment have been driven to adapt to their environment, influences, and out of need to survive. Fry and Griswold [5] characterize this chaotic and dynamic environment as “commonplace to observe that we are living in an age of rapid change.” Shelton and Darling [6] characterize the factors that humans need to adapt to and state “Unstable economic conditions, rapidly changing technologies, global competition, workforce diversity, and new organizational structures are only a few of the factors contributing to the age of discontinuity.”. In the current environment that engulfs business and our very lives, chaos and complexity has become the ever-present influence that tests our adaptation skills [7].

The past fifteen years have seen an increased interest in Complexity Science by managers and organizations and an increasing number of management theorists are utilizing Complexity Science to describe and explain physical environment, external and internal influences in our environment. Many researchers have discussed how organizations, managers, and individuals adapt to complexity and chaos. For example, Peters discusses applying Chaos Theory to investment and market analysis and Warfield discusses twenty laws of Complexity Science and applies this to organizations [8] [9]. Also, Samli and Dolan, Garcia, and Auerbach suggest ways for managers to adapt to turbulent environments [10] [7]. Robbins looked at organizational culture and created seven primary characteristics of organizational culture that aid an organization to adapt to chaos and complexity [11].

Complexity Science can have a significant effect on education, managers, and organizational success. The associated theories can be applied to improve management in organizations. A few applications are to improve management practices, provide managers with a greater knowledge base, and create greater opportunities for organizations. The studies presented in this paper represent a small portion of the literature on Complexity Science; the possibilities are numerous for its application. This study responds to researchers like Axley and McHahon , Campbell-Hunt, and Tsoukas, who have all argued for the importance of Complexity Science and the study of organizations [12] [13] [14].

This study added to the current body of knowledge about Complexity Science and the awareness of Complexity Science in a regional restaurant chain. Furthermore, it provided a comparison for managers in other organizations, provide managers with a greater knowledge base, and improve management practices. Finally, understanding the role Complexity Science plays in a regional restaurant chain organization can provide managers with the tools needed to plan, organize, lead and control their business.

In terms of this study, these processes of planning, organizing, leading and controlling for managers must be defined. First, the planning process includes establishing a strategy then defining the goals and developing a plan to implement the strategy. Next, the organizing process is characterized by determining the how, what, when, where, and who of how tasks are to be completed [11]. The leading process, as defined by Robbins, is “A function that includes motivating employees, directing others, selecting the most effective communication channels, and resolving conflicts” [11]. Finally, controlling is defined as the monitoring and correcting activities that hinder the planned goals from being achieved.

This study explores if and how Complexity Science has had any influence in the business world and specifically in a regional restaurant chain. Two over-arching theme questions were posed: Are the Complexity Sciences having any influence on management and organizational decisions and will the Complexity Science have any influence on the future of the organization. A qualitative research design was used to understand the problem from the perspective of executive managers. The data collection was guided by the naturalistic and interpretivist traditions and the data analysis followed an iterative process and reported in rich detail.

Statement of the Problem

The nature of business is changing and chaos and complexity has become the ever-present influence that tests a manager's and an organization's adaptation skills. This host of ever-changing challenges is met with skills that are adapted from theories that are taught to managers based on traditional theories. This leaves managers and organizations ill-equipped to deal with the business environment that they facing. Fry and Griswold characterize this environment as "commonplace to observe that we are living in an age of rapid change" [5]. They go on further to say that "there is a general agreement that the flexible and responsive organizations are needed to cope with the chaos and complexity of the organizational environment.'. Similarly, Senge contends that adaptive organizations that favor experimentation and feedback are better equipped to deal with large quantities of information generated by the increased pace of change in a global business environment [15].

Head, Yaeger, and Sorenson contend that there is no question that organizations "must be fashioned to operate in the global arena" and management must evolve as well [16]. The problem is that Complexity Science theories are under-utilized by managers and organizations and those organizations are not evolving and adapting to the current environment. In order to survive, business and organizations must evolve and adapt to the current environment. In order to address this disparity, this study investigates whether Complexity Science is being used by organizations to help them create a more flexible resilient organization. This study investigated manager's attitude toward complexity science and if it has had any influence in the business world and specifically on organizations.

Purpose of the Study

The purpose of the study was to investigate whether Complexity Science is being used by organizations to help them create a more flexible resilient organization. For the purposes of this study, managers at one regional restaurant chain were selected. The research problem was approached from the perspective of these managers located in a major southwestern city. Two over-arching theme questions were posed: Are the Complexity Sciences having any influence on management and organizational decisions and will Complexity Science have any influence on the future of the organization?

The Impact of Complexity Science

Complexity Science has had significant impact on numerous disciplines. Its application has ranged for mathematics and physics to medicine and business. There are numerous theorists that have utilized Complexity Science to describe and explain physical environment, external and internal influences in our environment.

Benoit Mandelbrot and Mitchell Feigenbaum contributed key building blocks for Complexity Science [17]. Benoit Mandelbrot came up with the Mandelbrot set which investigated areas of geometry and nature. Mandelbrot's set ultimately led to the creation of Fractals. Fractals have been used by theorist to explain the spread of cancers and the geography of continental coastlines. Mitchell Feigenbaum utilized bifurtrication and discovered the ratio of convergence. This is a number that is essential to proving the onset of behaviors prior to the

onset of chaos. Another pioneer in Complexity Science as applied to environmental biology is Bateson. Bateson studies evolution from the perspective of “fundamental (genotype) structural change, adaptation (somatic) response to environment/circumstances, and environmental change” [17] [18].

Researchers have applied principles from Complexity Science to various disciplines based on the building blocks created by Benoit Mandelbrot, Mitchell Feigenbaum, and Bateson. Dalglish applied principles of Complexity Science and he looked for relevance in the application of Chaos Theory to cancer treatment, immune response, and the impact on vaccine creation [19].

The past fifteen years have seen an increased interest in Complexity Science by managers and organizations and an increasing number of management theorists are utilizing Complexity Science. The driver of this interest seems to be based on the increased necessity to be a global organization and to survive in the dynamic, non-linear environment. This business environment has brought executives, managers, and theorist to Complexity Science in order to maintain and increase the performance of organizations. Complexity Science has been applied to a variety of areas of business in order to address business specific needs.

Complexity Science, Complex Adaptive Systems, and Chaos theories play a large role in how information technology and technology are applied in organizations. Finnegan and O'Mahony address the competitive pressures and globalization that face organizations and have led them to find more flexible and versatile structures in order to adapt and stay competitive [20]. The use of information technology (IT) in contemporary organizations is considered a strategic advantage innovative, and a key ingredient in knowledge sharing [21]. All three of which are important to maintain a competitive advantage global marketplace filled with competitive pressures.

Complexity Leadership Theory

Management's role is essential in developing a learning organization that has the ability to adapt to its changing business environment. Developing a learning organization requires management to approach their roles differently in the face of advancing technology. The traditional tools and techniques of management must grow because the traditional goals of stability, efficiency, and predictability no longer apply [22]. They have been replaced by the introduction of significantly greater complexity into the practice of management. The development of this theory is attributed to a Lichtenstein, Uhl-Bien, Marion, Seers, & Orton and their article titled “Complexity Leadership theory: An interactive perspective on leading in complex adaptive systems” [22]. Uhl-Bien, Marion, and McKelvey suggest that Complexity Leadership Theory may provide managers with a basis for understanding organizational learning [23]. Uhl-Bien et al suggests “To achieve fitness, complexity science suggests that organizations must increase their complexity to the level of the environment rather than trying to simplify and rationalize their structures” [23].

Complexity Leadership Theory is rooted in Complexity Science theories and concepts like Complex Adaptive Systems, Far-from-Equilibrium Theory, nonlinear dynamical systems, and systems thinking [24]. This theory should help managers to understand how learning organizations are developed and sustained in a dynamic and complex environment.

Complexity Leadership Theory seeks to incorporate the capabilities of a complex adaptive system with the principles of a learning organization. This theory has four premises based on critical notions. First, complex adaptive systems provide the context where the interactions and interdependence takes place amongst agents, organizations, divisions, and the environment [23]. Second, there must be a distinction between leaders and leadership. According to Uhl-Ben et al. leadership is viewed as “an emergent, interactive dynamic that is productive of adaptive outcomes and leaders are viewed as “individuals who act in ways that influence this dynamic and the outcome” [23]. Third, this theory helps to “distinguish leadership from managerial positions. Finally, adaptive challenges are the most commonly faced problem and not technological problems faced by complexity leadership [23].

The role of leadership in Complexity Leadership Theory is that of helping to create the proper environment and conditions, but the members of the organization are the true source of change. Heckscher and Donnellon echoes this and states:

There is a growing sense that effective organization change has its own dynamic, a process that cannot simply follow strategic shifts and that is longer and subtler than can be managed by any single leader. It is generated by the insights of many people trying to improve the whole, and it accumulates, as it were, over long periods [25].

Another way to think of this is a leader can be any person and that same person can be a follower depending on the situation.

In Complexity Leadership Theory, there are three functions of leadership: adaptive, administrative, and enabling. Each of the three leadership functions has a dynamic relationship between the formal and informal forces within the social system or organization. However, each leadership function refers to different actions or activities. Adaptive leadership is “adaptive, creative and learning actions that emerge from the interactions” as it adjusts to interactions and adjusts to the environment. Administrative leadership differs from adaptive leadership in that it refers to formal managerial roles that coordinate activities in order to accomplish outcomes defined by the organization. Finally, enabling leadership works to create an environment where adaptive leadership can thrive ([23].

Complexity Leadership is a new approach to understanding organizational capabilities in a dynamic environment. This can generate new management strategies to produce changes that address the complexity in the environment [23]. Ultimately, Complexity Leadership Theory addresses the issues of an organization bogged down in its own bureaucracy by arguing that the interactions and energy of its people, like in Complex Adaptive Systems, help an organization flourish in a complex and nonlinear environment.

Study Methodology

Research into managers’ view on the influence of Complexity Science attempts to determine the degree of influence. It seeks to answer the question, what role does Complexity Science play in organizations? This study compared, contrasted, and attempted to replicate findings of similar studies in different industries in order to draw conclusions about the role Complexity Science plays in organizations..

The topic of the study was narrowed to provide a manageable scope for this study. The study does not include managers from different industries, or managers from more than one organization. Included in this study are managers from a specific organization.

The audience for this study may be limited to those with an interest in Complexity Science and those interested in organizational management. The intent of this study is to discover the degree of influence of Complexity Science on organizations. The research strategy, built upon a flexible design and an iterative process, gave this study the quality of being an unfettered inquiry.

The researchers looked to gather information from the individuals immersed in the management role and to look for patterns and distinctions in the data collected to draw conclusions that will help to place it within the context of organizational management.

Specifically, this research was intended to examine the understanding of Complexity Science from an individual's perspective where and little is known about how Complexity Science might influence business organizations. For this study, managers were selected as the participants. The reasoning behind selecting managers is that they affect a greater number of employees and that they have greater autonomy than a hourly key employees. Furthermore, there has been very little research on managers' opinion on Complexity Science and their use of Complexity Science.

Summary

The impetus for this study emanates from the desire to fill in a gap in the body of knowledge about Complexity Science and its associated theories by answering the questions, "Are the Complexity Sciences having any influence on management and organizational decisions and will Complexity Science have any influence on the future of the organization?" Extant research literature shows limited research on this topic. There is hardly any research on this phenomenon from the employers' perspectives in terms of their perception, expectations, and management; and the process by which they utilize to incorporate it into their management teams. Though the sample population was small and the results not fully generalizable; this study motivates managers to re-evaluate and perhaps rethink and refocus their perceptions, expectations, design and management practices. In other words, the findings provided a level of understanding that enables employers to more effectively translate employees' new knowledge and competencies into improved organizational performance and bottom line. It also generated additional research opportunities on the basis of which future researchers may choose, for instance, to conduct a longitudinal quantitative and potentially more generalizable version of this study. A qualitative research design was utilized to explore the problem from the perspective of executive managers. In the quest for answers, three key themes emerged from this study.

- Complexity Science and its theories do not play a role within the organization and there are no specific theories under the umbrella of Complexity Science were identified by participants in the study.
- Complexity Science and its theories are not discussed by management within the organization.

- Within the training program for managers, Complexity Science is not offered and new employees are not recruited with experience in Complexity Science

This study was successful in answering the research questions posed in the study and supporting the literature review. Furthermore, this study was able to determine that for the participants in this study, Complexity Science and its theories do not play a role within the organization, that there are no specific theories under the umbrella of Complexity Science that were identified by participants in the study as useful, Complexity Science and its theories are not discussed by management within the organization, that the training program for managers does not offer, Complexity Science as a topic of learning, and new employees are not recruited with experience in Complexity Science. On the whole, this study was successful in identifying a clear gap in understanding and training. Ultimately, this study shows that managers and organizations were ill equipped to deal with the current business environment and not having the ability to adapt to the current environment could put their businesses at risk given the current and expected conditions in the macro environment.

References

- [1] Drucker, P. F. (1998). Management's new paradigm. *Forbes*, 162(7): 152-170.
- [2] Doberneck, D. M. (2003). The complexity sciences as an emerging organizational paradigm in higher education: An exploratory study. Ph.D. dissertation, Michigan State University, United States -- Michigan.
- [3] Dent, E. B. (1999). Complexity science: A worldview shift. *Emergence*, 1(4), 5.
- [4] Tetenbaum, T.J. (1998). Shifting Paradigms: From Newton to Chaos. *Organizational Dynamics*, 26(Spring), 23-32.
- [5] Fry, B. R., & Griswold, J. S. (2003). Defining and implementing the learning organization: some strategic limitations. *Public Administration Quarterly*, 311-335.
- [6] Shelton, C. D., and Darling, J. R. (2004). From chaos to order: Exploring new frontiers in conflict management. *Organization Development Journal*, 22, 22-41.
- [7] Dolan, S. L., & Garcia, S. (2002). Managing by values: Cultural redesign for strategic organizational change at the dawn of the twenty-first century. *The Journal of Management Development*, 21(2), 101-117.
- [8] Peters, E. E. (1994). *Fractal Market Analysis: Applying Chaos Theory to Investment and Economics*. New York: Wiley.
- [9] Warfield, J. (1999). Twenty laws of complexity: science applicable in organizations. *Systems Research & Behavioral Science*, 16(1), 3-40.
- [10] Samli, A.C. (2006). Surviving in Chaotic Modern Markets: Strategic considerations in turbulent times. *Journal of Marketing Theory and Practice*, 14(4), 315-322.
- [11] Robbins, S. (2005). *Managing and Organizing People*. (11th ed.). Upper Saddle River, NJ: Pearson Education Inc. Prentice Hall.
- [12] McKelvey, B. (2004). Complexity science as order-creation science: New theory, new method. *Emergence: Complexity & Organization*, 6(4), 2-27.
- [13] Campbell-Hunt, C. (2007). Complexity in Practice. *Human Relations*, 60(5), 793-823.

- [14] Tsoukas, H. (1998). Introduction: chaos, complexity and organization theory. *Organization*, 5(3), 291-313.
- [15] Senge, P. M. (1996). The art and practice of the learning organization. *The new paradigm in business: Emerging strategies for leadership and organizational change*, 126-138.
- [16] Head, T., Yaeger, T., & Sorensen, P. (2010). Global Organization Structural Design: Speculation and a Call for Action. *Organization Development Journal*, 28(2), 41-48.
- [17] Gleick, J. (1987). *Chaos: Making a new science*. New York: Penguin Group.
- [18] Bateson, G. (1963). The role of somatic change in evolution. *Evolution*, 17: 529-539.
- [19] Dalglish, A. (1999). The relevance of non-linear mathematics (chaos theory) to the treatment of cancer, the role of the immune response and the potential for vaccines. *QJM*, 92(6): 347-59.
- [20] Muthoo, A. (1999). *Bargaining Theory with Applications*. Cambridge, United Kingdom: Cambridge University Press.
- [21] Powell, T. C., & Dent-Micallef, A. (1997). Information technology as competitive advantage: the role of human, business, and technology resources. *Strategic Management Journal*, 18(5), 375-405.
- [22] Lichtenstein, B. B., Uhl-Bien, M., Marion, R., Seers, A., Orton, J. D. (2006). Complexity Leadership theory: An interactive perspective on leading in complex adaptive systems. *Emergence: Complexity and Organization*, 8(4): 2-12.
- [23] Uhl-Bien, M., Marion, R., and McKelvey, B. (2008). Complexity Leadership Theory: Shifting Leadership from the Industrial Age to the Knowledge Era. *The Leadership Quarterly*, 18(4): 298-318.
- [24] Shelton, C. D., and Darling, J. R. (2004). From chaos to order: Exploring new frontiers in conflict management. *Organization Development Journal*, 22, 22-41.
- [25] Heckscher, C. C., & Donnellon, A. (1994). *The post-bureaucratic organization: New perspectives on organizational change*. Thousand Oaks, CA: Sage Publications.
- [26] Holland, J. H. (1995). *Hidden order: How adaptation builds complexity*. New York: Basic Books.