



Creativity, chaos and knowledge management

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Abstract

With the dynamic and turbulent nature of today's business environment, organizations have to manage under uncertain, or chaotic, circumstances. This article examines the connection between the management of an organization's knowledge and chaos theory in order to understand what implications chaos brings to knowledge management. It uses two industry cases to illustrate both the challenges and opportunities.

Keywords

adaptation, chaos, chaos theory, knowledge creation, organizational structure

Introduction

The past several decades have ushered in many technological and societal changes. While either designed or theorized to provide more structure and efficiency to the world, many of these changes have also introduced considerable uncertainty and ambiguity to an ever changing and evolving business environment. This situation can be described as *chaotic*. Society and the organizations within it can no longer completely anticipate or control the environment in which they operate.

This poses both a challenge and opportunity to knowledge management. How does one manage knowledge in a continually changing, sometimes chaotic, environment? In order to outline the influence of chaos, uncertainty and ambiguity on knowledge management, this article identifies intersecting trends in knowledge management and chaos theory. It discusses three significant aspects of knowledge management related to chaos:

- the ambiguous nature of knowledge;
- intentionally implemented chaos in the structure of an organization; and,
- how knowledge management has been used in chaotic and innovative organizations.

Two case studies are used to reflect on the impact the chaotic environment has had on those creating and managing knowledge activities in organizations.

The Knowledge Lifecycle

At a fundamental level, knowledge is created by people; it exists in their minds and is created through their encounters with new environments and information (Nonaka, 1994). The importance of this fact cannot be underestimated. The power and ability to create new knowledge resides within human beings; knowledge is unique to individuals; and indeed this ability is unique to humanity itself (Nonaka, 1988). Once created knowledge can help individuals define a current situation or context. Actions require interpretation of knowledge and its application. Application will be influenced by information gained through experience and reflection, both that of the individual and from others who have created and shared their knowledge. This is how knowledge is built and developed.

These notions reflect a lifecycle in which knowledge follows a predictable pattern (Birkenshaw and Sheehan, 2002). The lifecycle consists of four stages: creation, mobilization, diffusion, and commoditization. It is the first stage, knowledge creation, which has the most direct implications for the role of chaos in knowledge management theory.

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The creation process and creativity itself require an open ended and flexible environment in which experimentation can occur and where being unorthodox and defying the norm are encouraged. The need for flexibility and adaptiveness in knowledge creation has been well established in the literature of innovation (Leonard and Sensiper, 1998; Majchzak et al., 2004). The other stages of the knowledge lifecycle deal with communication of new knowledge throughout the organization until it becomes absorbed into the organization's knowledge base through use.

Once created, knowledge has also been defined as an entity that continually moves, develops, and changes as it is transmitted from person to person and culture to culture. Knowledge is not static. As individuals connect with one another or with documented knowledge they develop, transform, and adapt this knowledge into their own knowledge bases (Pérez-Bustamante, 1999). It is this aspect of the knowledge lifecycle that allows the application of chaos theory to understand how to manage knowledge in times of change and uncertainty.

Defining Chaos and Chaos Theory

The term *chaos* can be misleading if the underlying concept is treated as one of complete disorder, confusion, and vagueness. A chaotic system has been defined as 'a set of coherent, evolving, interactive processes which are temporarily manifested in globally stable structures that have nothing to do with the equilibrium and the solidity of technological structures' (Jantsch, 1980: 6). These systems eventually find a natural order and stability, usually outside of structures devised by society specifically to apply some level of control on the chaotic situation. The system processes and outcomes appear to be defined by well-known and defined laws that govern their motion, formation, and eventual production (Handscombe and Patterson, 2004). This has brought the term chaos to mean, in a new understanding of the term, the 'underlying interconnectedness that exists in apparently random events' (Briggs and Peat, 1998: 2). Even when it appears to human understanding and intellect that a situation is out of control, and quickly degenerating into complete randomness, there is a high probability that within the situation there lie embedded rules and guidelines which will eventually bring the system to a state of stability and harmony.

Key to this idea of chaos are the characteristics of process, growth, and motion; that structures are actually processes and not solid systems with mandates and rules imposed by others to organize the systems. Jantsch compares this new type of structure to the water flowing through a tap; this changes shape and structure as the pressure changes. However it always maintains an essential orderliness, it is 'nothing solid . . . but a dynamic régime which puts ever new water molecules through the same strands. It is a process structure' (Jantsch, 1980: 21). The system is

constantly changing as the environment demands; in the earlier example as pressure increases, the system finds a new equilibrium to maintain a consistent and productive process. A chaotic system is one of continual interactions. As new information and knowledge is created within a system it informs the processes and conditions within the system, influencing future results. This new knowledge can be very slight and amplify relatively quickly; the chaotic system must continue to be open to this change and energy and adapt with new knowledge and experience (Wheatley, 1994).

Chaos theory, an idea that returned to prominence in the 1990s, draws upon the analogy of nature to illustrate the order that lies in chaotic systems. This theory of chaos is paradoxical to the 'scientific culture' (Briggs and Peat, 1999: 5) that has influenced western society so consistently over the past several hundred years. Rooted and engrained in a society of logic, reason, order, and reductionism, western society, particularly organizations and industries, has consistently attempted to eliminate uncertainty and unpredictability through imposed structure, orders, and control, to a point where 'being in control' has become a value embodied in the society (Briggs and Peat, 1999).

Chaos theory suggests a new orientation and understanding of the world and how it functions on every level, focusing more on the process structure concepts than on solid system structures. For example, rather than understanding nature or an organization as a machine, which determines and defines what it can process and produce, it views the interactions within nature or an organization as processes leading towards the 'open evolution of structures' (Jantsch, 1980: 6).

With this continual process and movement according to the rules embedded within a system, a rich world of complex relationships emerges (Wheatley, 1994), where all activity in nature and society is judged as collective and collaborative (Briggs and Peat, 1999). In an organization these complex and collaborative relationships will exist among the individuals within the organization. It is thus important to value each individual's potential to trigger this continuous process of interactions, influencing the organization's direction and innovation and in doing so 'manage the continuous dissolution and creation of organizational order' (Nonaka, 1988: 72). If this is discouraged the organization is not recognizing the potential in the relationships and people it already has, choosing predictability and order over innovation and progress. Chaos theory posits that chaotic situations and organizations, when left to their own devices, will eventually follow a pattern and inherent structure based upon embodied values and rules, always staying within a certain proximity that seems to define and mould its direction. Thus chaos can be an ally, a desirable quality to integrate into an organizational system, when one is seeking to innovate and grow (Wheatley, 1994).

Chaos in Knowledge Management

In the knowledge management literature, chaos is generally considered from three perspectives:

- the multifaceted and ambiguous nature of knowledge;
- intentional chaos in organizations; and
- how knowledge management can help in chaotic situations.

Knowledge itself can be described as forward-looking, searching for problems and ready to consider other possibilities. In this respect, no knowledge can truly be seen as old, reliable, and capable of re-use. In each situation in which existing knowledge is used, it is being adapted by being fed new information, making associations and relationships with previously known information and knowledge, and informing the eventual conclusion. As knowledge develops and grows with new information to deal with new situations, it becomes a richer source of knowledge to be used at a future date (Bennet and Bennet, 2008). This angle suggests that knowledge grows unpredictably and that its nature more closely mirrors chaos than clearly defined order.

Knowledge creation is triggered by the introduction of something unknown, as a challenge, problem, or circumstance for which new knowledge must be created. With no such challenge or if the knowledge currently possessed by the individual or organization is considered satisfactory, the knowledge creation process can stagnate. The organization can therefore become antiquated because it does not seek new information or circumstances to challenge what it knows. Avoiding stagnation requires the provision of a dynamic and complex environment in which knowledge can grow and be challenged by new information and circumstances. In these situations knowledge can be developed while also being exercised and utilized.

Flexibility and openness to change is absolutely critical to knowledge creation. Nonaka goes as far as to insist that in order to facilitate new knowledge creation one must quite literally facilitate chaos; it is necessary to 're-create the company and everyone in it in a nonstop process of personal and organizational self-renewal' (Nonaka, 1991: 96). The organization, as a whole and each individual, must be open to continual opportunities for change and redefinition in the face of each new situation or problem. The organization can then grow and change according to the natural resources residing in the minds of its knowledge workers, increasing in complexity and depth, and eventually organizing itself around its internally held rules (Taylor, 1994). By encouraging complex and responsive environments, organizations and knowledge workers can maximize all resources available to them.

Knowledge Supported Chaos in Practice

The role of the knowledge manager should therefore be to embrace and encourage chaos to facilitate knowledge creation. This means ensuring that the routines and paradigms that inhibit knowledge growth and decision-making are destroyed by the influence of chaos and perceived crisis. This will allow for new ways of identifying and solving problems, ultimately resulting in organizational growth (Pérez-Bustamante, 1999). Among the many companies that have embraced this approach to knowledge management and organizational culture are Pixar and Google, both renowned for their knowledge management practices and their approaches to knowledge creation.

Pixar Animation Studios

Pixar's endorsement and encouragement of creative chaos can be seen in how the company has rejected hierarchical and controlled environments. Instead Pixar actively promotes the taking of risks and recognizes the importance of serendipity in the creative process.

Pixar readily confirms that strict communication hierarchies, policies, and regulations are impediments to their production of great creative works. This is inspired by Walt Disney, who held that 'continual change, or reinvention, is the norm in an organization,' and when placed together with technology 'magical things happen' (Catmull, 2008: 70). Steve Jobs, who cofounded Pixar with Ed Catmull, recognizes that innovation cannot be systematized, but rather that one must 'hire good people who will challenge each other every day' ('Steve Jobs', 2004: 96). That said, the overall vision of Pixar is in the hands of Catmull, the man in charge of creating and monitoring the unique creative mix of 'Silicon Valley techies, Hollywood production pros, and artsy animators' (Burrows, 2003), which fuels the innovation of Pixar.

In a 2009 interview, Catmull reflects upon the early days of Pixar and the development of its cutting edge technology. They would set nearly impossible goals for themselves and try to reach them. This would fuel innovation, which would in turn inspire the development of other technologies and ideas. Upon reflection, Catmull notes that while these goals, which Pixar would not only reach but surpass, were important, the value lay in 'creating an environment in which people can do cool things. If we had set out to solve all the things we actually did solve, we might have gotten frozen' (Robertson, 2009: 40). The value lay not in predicting the future and setting out goals to meet it but rather in creating an environment full of challenge and uncertainty in the form of unsolved problems, which allowed for the creation of new technologies, skills, and knowledge. With this same perspective, director Brad Bird, in an interview about the film *Ratatouille*, states 'If you try to over control the process, you limit the process' (Lewis,

2007), as he allowed for flexibility within his staff during the filming process. In this way, Pixar has developed 'new production methods and organizational innovations that bring unheard-of discipline to the crazy business of making movies' (Schlender, 2004: 212).

In embracing this flexible and ambiguous environment, the organization has had to be prepared to take risks. In their pursuit to make original films, Pixar faces uncertainty while looking for the next new idea, and must be willing to experiment. Through the process of seeking out opportunities to try new things, and even fail, Pixar gains new and valuable knowledge to inform the next experiment. This is a significant reason Pixar has found so much success.

Risk taking has become a quality inherent in the company. By setting itself challenges and intentionally looking beyond and ignoring current capabilities and structures, Pixar has ventured into the ambiguous world of the unknown in order to create new knowledge. When Catmull spoke about the development of their proprietary animation software Render-Man, he indicated that the organization had intentionally thought about 'extreme complexity' (Robertson, 2009: 38). Pixar set a goal to manage 80 million polygons, seen as ridiculous at the time. However, as Catmull states, 'we were trying to think about the problem in a different way. That forced us to redo the way we thought about the whole pipeline, which has led to an architecture that has lasted for years' (Robertson, 2009: 38). While Render-Man constitutes only a small portion of Pixar's profits today, it has played a significant role in the animation of their films. Only through intentionally tackling this extremely complex problem, risking complete failure, were they able to develop an extraordinary piece of technology that helped propel the company forward. Catmull, who often allows individuals to undertake projects that he deems 'impossible', readily acknowledges this acceptance of risk and chaos. Even though he doubts the capability exists to succeed the 'permission to try' appears to motivate the employees to prove that they are right (Catmull and Morse, 2002).

While knowledge creation is certainly stimulated through environments designed to promote ambiguity and risk, it is also inherently an incredibly serendipitous process. Moments of serendipity are crucial to knowledge creation. Innovations emerge when seemingly unrelated 'bits of information' are put together in an 'irregular, serendipitous process' (Pérez-Bustamante, 1999: 8), normally not encouraged by bureaucratic organizations (Paquette, 2005). Bird spoke directly to this in talking about the development of *Ratatouille*. 'The mistake that a lot of people make is thinking that you can force ideas to come. You can't really. All that you can do is observe what kind of environment puts you in a creative state of mind. And then try to create that environment' (Lewis, 2007).

Since this unforeseen breakthrough, ideas for each film have come about in their own unpredictable way (Lewis, 2007). In the development of the first film, *Toy Story*, the

team had been stuck for months on a scene where Buzz falls under the spell of a crane arcade game shaped as a rocket. After months of meetings, they still had little idea about what would be inside the game and what would happen once Buzz arrived in the rocket. However, in one meeting 'someone uttered the key words: *the claw*. As if floodgates had been opened, new ideas started flowing' (Prince, 2008: 137). Bearing remarkable similarity to Jantsch's analogy of the self-organizing flow of water through a tap, which changes its form based upon the pressures on the system (Jantsch, 1980: 21), the team was then able to write and create a scene that played well into the story line and aided the major success of the film. This can only happen in an open organization that allows for such spontaneous moments to happen, whether at home or in the boardroom, and then runs wherever those ideas lead them.

Pixar studios have also intentionally designed the office building to facilitate serendipitous knowledge creation. A large atrium in the middle of their facility is structured around the facilities that employees utilize every day, such as the cafeteria, meeting rooms, and mailboxes. This means they will bump into each other during daily routines and tasks, inspiring spontaneous conversations and communication that can be crucial to making connections, and creating knowledge to solve problems or create new ideas.

Google

Google began in the late 1990s, the result of founders Sergey Brin and Larry Page's research at Stanford University. The company from its onset has focused on its internal values, primarily the goal to make information readily available to everybody and to not be evil. They have retained the characteristics of a small young start up as they have grown substantially (Levy, 2005). When the company went public, the founders and investors wanted to make sure that the company would still grow without increased bureaucracy (Mangalindan, 2004). As Google grows it will keep its organization flat, transparent, and non-hierarchical (Hamel, 2006). It intends to keep the company focused on innovation and new products as opposed to quarterly results. The idea is to let the systems prove themselves in an unstructured and scattered environment, allowing products to 'develop organically' (Levy, 2005), without the concern with budgets and stakeholder expectations. Here they encourage, if not actively cultivate, chaos for the purpose of innovation.

Key to their structure is the lack of managers and management in the organization. Google is specifically designed so that approximately 25 to 50 individuals report to a single manager, rather than the 7 direct reports typically seen in their industry (Hamel, 2006; Hardy, 2005). This is done specifically so that the employees feel empowered and can work from their own desire to work and do well, rather than pressure from upper level management to perform. Structure is maintained 'peer-to-peer rather

than manager-to-minion' (Hamel, 2006). This way any engineer within the company has the opportunity to manage and develop a new product or feature, resulting in a wealth of new ideas and products (Iyer and Davenport, 2008). This type of organizational structure is the opposite of industry peers, who rely on control to keep societal structures from turning into chaos. In Google, the allowance for chaos permits the creation of new fluid, flexible and productive environments for product development.

To facilitate its desire to succeed and be innovative in software design, Google intentionally attempts to conquer technical problems that are unsolved (Levy, 2005). Incredibly gifted employees, who thrive facing dynamic challenges, would rather be faced with an insurmountable challenge. Their fascination to find the solution drives them on, rather than only being challenged by what they already know (Detschman, 2005). For instance, when Google first set out to design a new browser, the team 'began with the mental exercise of eliminating everything, then figuring out what to restore' (Levy, 2008). This confrontation with the unknown and the ambiguous allows for new knowledge creation. For Google this will ultimately result in increased revenue through newly developed products, refined algorithms, and anything else employees can develop through their continual freedom to create.

Naturally, there will be failure in this environment. Google has budgeted for developers to spend 20 per cent of their time on their own projects, which are not budgeted or in the scope of current projects (Hamel, 2006). This allows for experimentation and removes any fear of failure without sacrificing time needed for keeping the company running. Additionally, employees will never stagnate in their current knowledge base. As they continue to collaborate on projects that interest them and their colleagues, Google can assure itself that new streams of knowledge permeate the organization and that they do not limit the talent inherent in each and every employee.

This endorsement of flattened hierarchies, allowing for organic growth, and presenting its employees with challenge and choice, has led Google to the forefront of their field.

Conclusion

Our current society exists within the midst of the tides of change. These tides have particular influence on the understanding of knowledge, how it flows, and its influence on the modern workforce. The watchful eyes of knowledge managers have not missed this change.

Those with a finger on the knowledge management pulse have noted that the implementation of new technologies, their influence on our culture and ways of life and the demands of a global society, has increased opportunities for knowledge management to enable sustainable organizations. No longer can we rely on established methods of capturing and disseminating knowledge. New perspectives on knowledge creation

and use are needed. In a culture of continual change and uncertainty, sustainable communities are those who embody the ideals of 'collaborative entanglement' (Bennet and Bennet, 2008: 30), that is organizations whose individuals are always growing with and towards each other in the formation and adaptation of new knowledge.

Information overload reduces time for creative endeavour (James, 2001). Chaos theory can inform the development of knowledge creation-friendly environments, with its emphasis on bottom-up structures and uncontrolled communication across boundaries. In ambiguous and challenging environments, knowledge does not stagnate. Individuals, encouraged to communicate with others, can contribute much more to the organization. The knowledge creation process will not be stifled.

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Biography

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