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計畫主持人：林月雲

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Relationships insights in organizations: From the perspective of complexity theory

In the hyper-competitive new century, global economy and decreased cultural barriers have lowered the boundaries among countries, organizations, and departments. While technology enhances the interactions between various groups, it also makes their relationships blur. Who should take what responsibility becomes hard to define. Even cooperating with the competitors becomes a common practice nowadays.

In such a complex organizational context impacted by many unpredictable external and internal factors, running a business is no longer easy. Ideal management procedures of formulating strategies, goals deployment, implementation, evaluation, and corrective actions may not go as smoothly as expected. Since organizational environment has become dynamic, nonlinear, unbalanced discontinuous, complex, and chaotic, it is better that organizational transformations are assessed from the perspective of complexity theory to unveil the real business problems.

To achieve this purpose, this research will adopt the methodology of process research using in-depth case interview. Specifically, this research attempts to investigate whether employees have relationships insights between the organizational goals and various external factors, internal factors. In addition, this study will examine whether such relationship insights are different between organizations that have successful transformation and those that failed.

Literature review

For decades, organization theorists have invoked concepts from general systems theory such as homeostasis, cybernetic control, and dynamic equilibrium to describe organizational phenomena such as stability and adaptation (Morel & Ramanujam, 1999). However, organizations today are not as the same as the traditional view, they are dynamic systems of adaptation and evolution that contain multiple independent patches which interact with one another and the environment (Coleman, 1999; Morel & Ramanujam, 1999).

In contrast to the existing management science emphasizing control and predictability, complexity theory focus on understanding the interaction between the environment and the organization (Mathews, White, & Long, 1999a). Therefore, complex adaptive systems impacted by the unpredictable external and unknown internal factors, become dynamic, nonlinear, unbalanced, discontinuous, and chaotic (Mathews, White, & Long, 1999b). Yet, no matter how complex, nonlinear, or chaotic the system is, the order emerges in systems (Lewin, 1999). Complexity sciences are collection of concepts developed in the natural and physical sciences to explain the development and evolutionary behaviors of systems (White et al., 1997). Chaos theory, complexity theory, self-organization and bifurcation are the most selected characteristics in describing the complex systems (Mathews et al., 1999b).

Chaos theory

Chaos theory, at its most elementary level, is an attempt to understand the seemingly random behavior exhibited by a simple deterministic system consisting of only a few variables or interacting components. Chaotic phenomena are, thus, a class of deterministic phenomena that appear random or stochastic (Mathews et al., 1999b).

However, Staveren (1999) argued that although chaos shows unstable behavior between variables, it is not stochastic. The unstable pictures of nonlinear models are seemingly random but hide a pattern. Therefore, the idea of chaos should not be confused with randomness. Random behavior is unpredictable and independent of the initial position of the model. Randomness is contingent, without any underlying order, whereas chaotic behavior is also unpredictable but very much dependent on the initial condition of the model.

Furthermore, the dependence on initial conditions suggests that systems which have very close initial starting points will diverge as time proceeds. This is an essential aspect of chaotic systems. This sensitivity to initial conditions implies that without infinite precision in the measurement of initial conditions of system parameters, long-term predictability may be theoretically and practically impossible (Mathews et al., 1999b). Thus, understanding the total initial conditions, particularly the internal and external environments, is the vital beginning for explaining the chaotic dynamics of the complex organizations.

Complexity theory

Complexity theory, its principal contention is that organizations arise spontaneously and are adaptive. That means that organic life emerged spontaneously and then adapted to its environment and survived to reproduce itself (Frederick, 1998). Kauffman (1995) argued that laws of complexity spontaneously generate much of the order of the organization. Also, Anderson (1999) indicated that organizations are open because they exchange resources with the environment, and they are systems because they consist of interconnected components that work together, emphasizing the importance of the complexity. The dimensions of complexity include vertical, horizontal, and spatial complexity. Vertical complexity is the number of levels in an

organizational hierarchy, horizontal complexity is the number of job titles or departments across the organization, and spatial complexity is the number of geographical locations (Daft, 2001). With respect to environments, complexity is equated with the number of different items or elements that must be dealt with simultaneously by the organization. Complexity theory tries to match the complexity of an organization's internal factors with the complexity of its general and task environments (Anderson, 1999).

Chaos theory and complexity theory are used to explain the complex systems. Fredrick (1998) proposed that chaos theory mathematically described the behavior of nonlinear dynamic systems, which are found widely in nature (e.g. weather, heartbeat rhythms, predator-prey population links); complexity theory, also mathematically in its original form, has been used to understand the qualitative traits of nonlinear systems, such as business organizations. Moreover, long-term forecasting is almost impossible for complex systems, and dramatic change can occur unexpectedly, as a result, flexibility and adaptiveness are essential for organizations to survive (Lissack, 1999). Nevertheless, chaos theory exhibits a degree of order inside complex systems, enabling short-term forecasting to be undertaken and underlying patterns can be discerned. Complexity theory also points to the importance of developing guidelines and decision rules to cope with complexity, and of searching for non-obvious and indirect means to achieving goals (Levy, 1994).

Self-organization

Complexity theories assert that companies continuously regenerate themselves through adaptive learning and interactive structural change. These efforts periodically result in the spontaneous emergence of a whole new dynamic order, through a process called self-organization (Lichtenstein, 2000). Self-organization describes how agents

and units inside a complex organization (system) can respond to changes and cooperate with others without being told what to do (Zimmerman, 1999), and it is the natural result of nonlinear interaction, not any tendency of individual agents to prefer or seek order (Anderson, 1999). Self-organization can be formally defined as a transformational process initiated by external events, through which a new internally generated order emerges (Lichtenstein, 2000). Mathews and his colleagues (1999b) indicated that self-organization is to understand how complicated rules or spatially complex systems with many interacting components produce complex, but organized and patterned behaviors and to explain the apparent paradox of how organized large-scale structures function when their constituent elements are “swimming in a sea of chaos” (Ruthen, 1993). Further, self-organization is viewed as “the capacity of open and living systems, such as we live in and we ourselves are, to generate their new forms from inner guidelines rather than the imposition of form from outside” (White et al., 1997).

While chaos theory is an approach to the study of spatially simple systems, governed by deterministic rules, that produce complex and complicated temporal behaviors, the self-organization approach concerns the study of how systems which are spatially complex and have the potential for chaotic behavior, generate organized and patterned temporal behavior (Mathews et al., 1999b). Organizations that maintain their innate values, cultures, and principles to respond to dramatic environmental transformations would regenerate their resource configuration by the emergent natural order (Lichtenstein, 2000). This implicit motive is the learning driver that provides some order that created enough stability for agents to feel comfortable in response to complexity. Further, Coleman (1999) refers to self-organization as a process of human motivation enabled by empowerment practices that could motivate agents to take responsibility, think, and improve.

Bifurcation

Nonlinear systems may periodically behave like linear systems, but during other time periods the relationship between variables may change. Such a transition is called a bifurcation (Steveren, 1999). Bifurcations are points of equilibrium breakdown located between stability and instability, balance and disbalance (Mathews et al., 1999b).

Staveren (1999) simulated the case study from Guayaquil with two different types of chaos theoretic models, proposing a one-dimensional quadratic map and a three-dimensional model of different equations, to draw out the transition of women's roles in provisioning- productive, reproductive, and community management. These figures showed the time path of the transitions in different stages of "move to equilibrium", "oscillations", and "chaos", reflecting the external pressures importing the systems where a woman stayed with her family. This disclosure of a pattern in seemingly "chaotic" behavior in the group that could hardly cope with the crisis. Chaos involves an underlying order, guided by the institutional setting of roles. It also suggested that policy intervention should probably concentrate on the influential endogenous factors through, for example, a redistribution of and support for the three roles of provisioning, rather than a focus on an exogenous policy measure as the supply of a social fund.

Cheng and Van de Ven (1996) report the first empirical findings demonstrating the presence of chaotic processes in the innovation process. The authors use three numerical diagnostics to determine if the time series of action, outcome, and context events during the innovation journey are random, chaotic, or stable. The results show that the actions and outcomes experienced by innovation teams exhibit a chaotic pattern during the initial period of innovation development, and an orderly periodic pattern during the ending development periods; however, exogenous context events

exhibit a random pattern during both the beginning and ending periods of innovation development. The findings of chaos tell that the innovation process consists of a nonlinear dynamical system, which is neither orderly and predictable nor stochastic and random.

In addition, Tsai and Chiang (2002) and Lichtenstein (2000) examine the self-organization in industry and firms. Tsai and Chiang (2002) interviewed the firms in the rapid growing “passive components industry” in Taiwan to understand complex interaction and dynamic co-evolution between the firm and the industry. The authors conducted a longitudinal study on the development of that industry using grounded theory approach to analyze the contents of in-depth interviews. The results reveal five paradoxical interactions between the industrial development and the complex adaptive system regarding diversity and complexity, risk consciousness and self-transcendence, customer-orientation and co-evolution, punctuated equilibrium and international co-competition, and unpredictability of the future. The findings also suggest that the presence of a strong competency makes the firm less vulnerable to environmental fluctuations, and their relationship insight helped the positioning and networking to keep abreast with the trend.

Lichtenstein (2000) navigated major transitions across three firms by focusing on the self-organization amidst chaotic systems. In-depth case studies from an intensive research project reveal that the successful transition incorporated three qualities: high self-referencing, increased capacity, and interdependent organizing. A primary requirement of self-organization is that the newly emergent dynamic order be based on principles, values, and elements that are intrinsic, or self-referenced, to the system, rather than being imposed without reference to the history and learning in the organization. The more the new dynamic order is congruent with the origins and evolving expertise of the firm, the more successful the change will be. A second factor

that generates self-organization is an increase in the capacity of the firm to utilize tangible and intangible resources that already exist in the firm. A third quality that generates self-organization requires a delicate balance between structured organization and informal organizing at the edge of chaos. Self-organization would be optimized at high levels of interdependence, involving enough connectedness to allow new and fresh innovations, while at the same time maintaining clear boundaries and structures that keep the system from being overwhelmed with too many options.

In summary, complex adaptive systems change focuses on the level of activity and resources that can be generated and used by the firm. If and when the organizing activities in the company expand or drop beyond those limits, stress and tension will increase, driving the system into a nonlinear state. At that point, small actions can become amplified to a peak of tension where on particular event will initiate a system-wide reorganization. This transformation will be self-organized if the emergent activity structures are self-referenced, if they increase the system's capacity, and if they generate interdependent organizing. Finally, the higher the degree of self-organization, the higher the likelihood of survival, and of positive performance in the midterm.

Methodology

To explore the complex and chaotic organizational phenomena, this research was originally designed to interview successful as well as unsuccessful companies for a comparison. Fortunately, this author has been able to locate three entrepreneurs who had failed at least once, then rose up like sphinx stronger than before. The advantage of investigating these three companies over the original design is that other

influencing factors such as industry, personality, and life cycle can be controlled.

This author personally interviewed the three entrepreneurs for two rounds, about one month apart between the two interviews. The duration of interview ranges from 3 hours to 5 hours for each entrepreneur. On an average, they have been in the business for about 20 years. The extensive interviews provided very rich longitudinal data to study the antecedents of chaos, the bifurcation, the self-organized measures in each crisis, and their transformation. The interviews generated six bifurcation cases in total. Research results are reported in the following section.

Results

Based on the in-depth interviews and company literature in hard copies and in their web sites, the following six bifurcation cases happened in the entrepreneurs' 20 years career have been identified.

(1) Bifurcation: Wey#1

Incident: fired

Trigger: recession (overall external environment)

External: economic (“—“, main reason)

Social (“—“, minority)

Political (No)

Technology (No)

Physical (“—“, in USA)

Working environment:

Customer (No)

Competitor (No)

Supplier (No)

Labor market (No)

Internal environment (intra organization):

Strategy (“—“, minority must go first)

Structure (“—“, R&D dept. has no room in bad times)

System (“—“, Albert’s boss was not involved in firing process)

Style (No)

Skills (“+”, Albert had strong technological skills)

Staff (“—“, employee did not have much a voice)

Shared value (“—“, Albert lost trust on the company)

Self-organization:

- i. Recalled within 36 hours, when his boss found out that he was fired.
- ii. Sought more knowledge, obtained an MBA degree to learn more about the formulation of corporate strategies.

(2) Bifurcation: Wey#2

Incident: terminated a partnership

Trigger: lawsuit (intra organization issue)

External: economic (No)

Social (No)

Political (No)

Technology (“—“, computer technology advanced rapidly)

Physical (“—“, in USA imported computers from Taiwan)

Working environment:

Customer (No)

Competitor (“—“, keen competition)

Supplier (“—“, worked their way through flattering Wey’s partner)

Labor market (No)

Internal environment (intra organization):

Strategy (“—“, lacking of strategy consensus)

Structure (“—“, authority and responsibility mis-alignment)

System (“—“, management process flaw, partner imported 3 containers
computer without letting Wey knew)

Style (“—“, serious leadership flaw)

Skills (“+”, Albert had strong technological and sales management skills)

Staff (“—“, sales formed two parties because of two owners’ dispute)

Shared value (“—“, value conflict between the two partners)

Self-organization:

- i. Willpower
- ii. Cut the tail for survival
- iii. Calmly sorted the things out and found evidences to win the lawsuit
- iv. Went back to his technological expertise and invented “FIR fuel activator”

(3) Bifurcation: Wu

Incident: downsizing (from 60 to 18 employees in 1995)

Trigger: customer complaint

External: economic (No)

Social (No)

Political (No)

Technology (“—“, computer technology advanced rapidly;
“+”, internet became available)

Physical (“—“, in USA, imported computers from Taiwan)

Working environment:

Customer (No)

Competitor (“—“, keen competition)

Supplier (No)

Labor market (No)

Internal environment (intra organization):

Strategy (“—“, multi-products, hardware, software, and paper product)

Structure (“—“, 4 dept. software, support, sales, and training)

System (No)

Style (“—“, losing control of the sales)

Skills (“+”, Ming Wu has strong technological skills)

Staff (“—“, sales dept. was the main problem)

Shared value (“—“, sales couldn't serve the customers as Ming wished)

Self-organization:

- i. Re-positioned company to provide software service only (single service)
- ii. Eliminated sales and training departments
- iii. Technology sales (internet service, CD with multimedia training, no sales persons to save the traveling expenses and sales management)
- iv. Focused on niche market only – dental software
- v. Focused on providing good quality software, with fewer complaints
employees are free to offer better service to customers
- vi. Fully utilized internet technology

(4) Bifurcation: Lu#1

Incident: 3 months military discipline

Trigger: audit of Naval Food committee

External: economic (No)

Social (“—“, bad military habit)

Political (No)

Technology (No)

Physical (“—“, new soldier in the army at the officers’ disposal)

Working environment:

Customer (No)

Competitor (No)

Supplier (“—“, bribe the officer)

Labor market (No)

Internal environment (intra organization):

Strategy (No)

Structure (“—“, rigid military structure)

System (“—“, no new soldier can challenge the system)

Style (“—“, the officer asked Lu to take the bribe to his family)

Skills (“+”, obedient & intelligent, Lu took all the responsibility)

Staff (“—“, new soldier did not have a voice)

Shared value (“—“, no shared value)

Self-organization:

- i. Carefully studied the situation to minimize the trouble and knew that by taking full responsibility of the illegal gifts, he saved his officer’s reputation & family, and simplified the case so that his father, in the Defensive Dept., could offer him assistance much easier.
- ii. Endurance, during that 3 months, he was treated like a prisoner, hair

was trimmed like a monk, wearing an underpants only most of the time and had very bad food.

- iii. Psychologically strong, he was blamed by his peer after regained freedom.
- iv. Mature, did not reveal the true story to his peer.
- v. Become a hero in the army afterwards, demonstrated his expertise in a crisis.

(5) Bifurcation: Lu#2

Incident: closed computer warehouse

Trigger: uncollected account receivable (intra organization management problem)

External: economic (No)

Social (No)

Political (No)

Technology (No)

Physical (No)

Working environment:

Customer (“—“, unable to collect money from customers)

Competitor (No)

Supplier (No)

Labor market (No)

Internal environment (intra organization):

Strategy (“—“, running a warehouse was a strategic mistake)

Structure (No)

System (“—“, management system didn't detect financial flaw)

Style (“—“, too much delegation)

Skills (“—“, lacking management skills)

Staff (“—“, the MBA partner produced unrealistic financial report)

Shared value (“—“, insufficient communication)

Self-organization:

- i. Closed the business and started over again
- ii. Explored opportunities by seeking relevant information
- iii. Happened to learn that President Clinton would invest on school computer infrastructure so that students can learn more effectively using information technology
- iv. Can provide computer service to school system using factory manufacturing concept, unified service to a lot of customers.
- v. Willpower, visited 250 schools in 6 months.
- vi. Studied customer psychology and train employees to provide good service that meet customers' needs.

(6) Bifurcation: Lu#3

Incident: lawsuit (14 months, from 2002 to 2003)

Trigger: conflict between his manager and a school manager

External: economic (No)

Social (“—“, racial issue, black vs. white)

Political (No)

Technology (No)

Physical (“—“, the area has mainly black and Hispanic school board members)

Working environment:

Customer (“—“, different races)

Competitor (“—“, a little jealous because Lu was ranked #1 preferred co.)

Supplier (No)

Labor market (No)

Internal environment (intra organization):

Strategy (No)

Structure (No)

System (No)

Style (No)

Skills (“+”, Lu stucked to the process flaw and won the suit)

Staff (“—“, Lu’s manager was too emotional)

Shared value (“—“, Lu’s manager did not abide by the “politeness” rule)

Self-organization:

- i. Maintain employees (lost 110M in 14 months)
- ii. Pursued his Ph.D. degree (in his 2nd year now)
- iii. Explored opportunity constantly, assist 5 US universities to train students from China, plan to establish a non-profit organization to provide free consultation to Chinese SME and ask for donation when the SMEs begin to make money.

Table 1 Summary of six bifurcation cases

Case factor	Wey#1	Wey#2	Wu	Lu#1	Lu#2	Lu#3
Incident	Fired	Lawsuit	Downsized	Disciplined	Closed store	Lawsuit
Time			1995			2002-2003
Trigger	Recession	Value conflict	Customers' complaint	Audit	Management flaw	Conflict with customers
Main problem	External	Internal	Internal	External	Internal	Internal
Controllable	No	Yes	Yes	No	Yes	Yes
Self-organization	Semi-success	Success	Success	Semi-success	Success	Success
Problem complicated by personality	No	Yes	No	No	Yes	Yes
External Envir.						
Economic	--(T)	N	N	N	N	N
Social	-	N	N	--(T)	N	-
Political	N	N	N	N	N	N
Technological	N	-	-, +	N	N	N
Physical	-	-	-	-	N	-
Working Envir.						
Customer	N	N	N	N	-	-
Competitor	N	-	-	N	N	-
Supplier	N	-	N	-	N	N
Labor market	N	N	N	N	N	N
Internal Envir.						
Strategy	-	-	--(T)	N	-	N
Structure	-	-	-	-	N	N
System	-	-	N	-	-	N
Styles	N	-	-	-	-	N
Skills	+	+	+	+	-	+
Staff	-	-	-	-	--(T)	--(T)
Shared value	-	--(T)	-	-	-	-

Remark: "--(T)" means the source of trigger; "N" means no impact.

Base on the summary of Table 1, nine propositions can be derived.

Proposition 1:

Bifurcation caused by external environment factor is generally uncontrollable.

Proposition 2:

Bifurcation caused by external environment factor is less likely to be successfully turned around.

Proposition 3:

Organizational bifurcation is more likely to be caused by internal factors.

Proposition 4:

Organizational bifurcation caused by internal factor is generally controllable.

Proposition 5:

Organizational bifurcation is likely to be complicated by people's personality.

Proposition 6:

Self-organization can bring chaotic status to order.

Proposition 7:

Self-organization process should consider the interactions of overall external environment, working environment, and internal environment.

Proposition 8:

Organizational bifurcation caused by internal factors can be successfully turned around through self-organization.

Proposition 9:

The loop of organizational bifurcation and self-organization is a major source of innovation.

Conclusion

Organizations can naturally evolve effective strategies, structures, and processes and self-adjust to new strategies and environmental changes, which implies that managers should facilitate, guide, and set the boundary conditions within which successful self-organization can take place (Lewin, 1999). Although some previous studies try to investigate the chaotic behavior and self-organization underlying the complex system, few research integrate all the relevant environments and internal factors to construct a complete framework explaining the interaction between the environment and organization. The present study explores the key characteristics underlying the successful transformation through the lenses of complexity and chaos theories. Hopefully, research results can shed some light for interested parties.

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