



3rd International Conference on New Challenges in Management and Organization: Organization and Leadership, 2 May 2016, Dubai, UAE

Management and Organizational Complexity

Shahram Mirzaei Daryani^{a,*}, Amir Amini^b

^aDepartment of Management, Ardabil branch, Islamic Azad University, Ardabil, Iran

^bM.Sc. Graduate of Industrial Engineering, Alghadir Institute of Higher Education, Tabriz, Iran

Abstract

Complexity, whether exists or we use this term to refer to a specific position or situation? In other words, whether it is a fact or our interpretation of a particular situation? Anyway, for successful and effective management in organization theories and management knowledge, nowadays there are many discussions of the Existence of complex organizations and the necessity to revise their ideas, thoughts and understanding re-engineering. Where, chaos theory also confirms the existence of complex organizations. Accordingly, the nature of complexity, why and how it occurs and ultimately effective strategies to manage complex organizations have been explored and emphasized increasingly. In this paper, complexity and organizational complexity have been discussed in terms of incidence and existence. After that, complex organizations' management process is defined and outlined. Finally, for better management of complex organization, effective guidelines have been discussed with a particular emphasis on and approach to the use of dialogue technique.

© 2016 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Peer-review under responsibility of the Ardabil Industrial Management Institute

Keywords: complexity; organizational complexity; complex organization management; chaos theory; dialogue

1. Introduction

Nowadays, where lots of organizations operate in the globalized world and open market, the focus on competitiveness, flexibility, and dexterity has expanded and this required more adaptive structures. In this context, con-temporary complexity theories which motivate managers with objectives related to self-organization and neural network-like organizations necessary both in academic journals and in consultancy (Mitleton-kelly, 2011).

* Corresponding author. Tel.: +9845-33728020; fax: +9845-33727799.

E-mail address: shahram.daryani@yahoo.com

The specialized literature addressing complexity in management have sometimes took motivation in notions rising in other disciplines such as chemistry, physics, biology, mathematics, and computing. Metaphors have often been recommended because lots of these concepts are not easy to translate to the field of management (McMillan, 2008).

Although there is a growing interest in research in organizations taking advantage of complexity theories, complex adaptive systems, and organizational cybernetics, there is not sufficient explanation about the differences which exist between each of these theoretical approaches and the results that taking one or the other has for a certain research project or even academic consultancy.

In this paper, complexity and organizational complexity have been discussed in terms of its incidence and existence. Then complex organization's management process is outlined and defined. Finally, with a particular emphasis on and approach to the use of dialogue technique, effective guidelines have been discussed on the management of complex organization.

2. Conceptualizing complexity

'Complexity' can be defined as a feature of a system that arises as a result of the interactions of the individual components of the system (Dekker et al., 2011; Mcdaniel and Driebe, 2001). This implies that the behavior of the system cannot be lowered to the total of the behavior of its constituent elements (Dekker et al., 2011).

In simple language, in the management knowledge where experts are trying to the complexity in system and organization be depicted, this term is referred to a situation that we see the rising trend of components and thus the relationship between them.

Formation of a term called complexity and introduction of a new theory in management entitled complexity paradigm has been affected by various increasing changes and transformations of environmental factors of organizations. In the age of modern, continuous and innovative unsustainable developments, cognitive-perceptual aspects of the organization's processes and procedures do not seem easy. Accordingly, it is necessary for experts, managers and leaders of organizations to further equip with mental- cognitive capabilities of the nature and causes of complexity and achieve effective strategies in managing them. What is complexity? In other words, how the nature of it is defined and described? How complexity explanation can be done? Successfully responding to the questions, how to manage a complex organization?

According to Kauffman, "the complex whole may show belongings that are not easily described by comprehending its parts. The complex whole, in a completely non-statistical sense can often exhibit collective properties 'emergent' features that are lawful in their own right" (Kauffman, 1993; Broche, 2008; Bratian, 2014).

Complexity has been studied and analyzed from different perspectives. In some management contexts, complexity is considered synonymous with chaos theory and in some contexts; chaos theory is introduced as a manifestation of complexity.

'Complexity science' refers to the study of complex systems. Mckelvey (2004) recognizes two schools of complexity science, namely the European and the American school (Mckelvey, 2004). While the European school refers largely to the natural (physical) sciences, the American school refers to life sciences, social sciences, and chaos theory. Therefore, complexity science should not be noticed as a single unified theory, nor as two complementary theories, but it can be considered as a grouping of theories and models of adaptive, complex systems. Following this, it is worth mentioning that complexity science identifies organizations as "complex adaptive systems".

The sciences of complexity, complex adaptive systems, and organizational cybernetics are related to the study of complex systems that are distinguished by nonlinearity. The primary characteristic of complex systems tends to be self-organization (Arevalo and Espinosa, 2015).

2.1. Some definitions and interpretations of complexity

Complexity is a feature of reality that involves a non-linear approach to its study. The theories and models based on this non-linear approach to reality were formed into a new science, today known as the science of complexity, a science that can be assimilated only insofar as the properties and specificity of a complex system are perceived, and that should not be confused with the main models, theories and techniques of measurement that it uses (the bifurcation theory, the network theory, the catastrophe theory, the deterministic chaos theory, fractal geometry, synergetics, etc. Complex systems can be narrowed down to the following features:

- Complex systems cannot be comprehended by means of reductionism, i.e. By splitting the whole into component parts and adding them up, as they are made up of elements that make sense only within the integrity of the system;
- Complex systems evolve unpredictably (except for a short period of time called ‘time horizon’);
- Complex systems can undergo sudden changes in state (bifurcations);
- Complex systems have different aspects depending on the scale of analysis;
- Complex systems do not comply with the superposition principle and their evolution is therefore unpredictable;
- Complex systems are sensitive to initial conditions (slightly different initial conditions lead to very different developments);
- Complex systems have autopoietic (self-organizing) capacity and do not observe Boltzmann’s order principle;
- Complex systems can be modeled and studied in an equivalent topological space called ‘phase space’, which has its specific concepts: attractors and repulsors, attraction basin, trajectories, limit cycles, etc.;
- Complex systems are characterized by evolution and dynamics, but these are two separate issues requiring specific approaches (Broche and Marinescu, 2008).

When the components of the system are in increasing trend, the communications and transactions between them increase and it is a situation that can be interpreted as complexity (Rezaeian, 2010).

When the possibility and capability of understanding the subject, science, and system is not readily available; in other words, such a situation cannot be understood, this situation is considered complex (Murthy, 2001).

According to Reiman et al. (2014) the key features of complex adaptive organizations are:

1. Non-linearity;
2. Emergence;
3. Self-organizing;
4. Far-from-equilibrium conditions;
5. Coevolution;
6. Nested systems; and
7. History-dependence (Reiman et al, 2014).

Quoting Kahan (2004), Ajmi introduces complexity of the four types of complexity in details, dynamic complexity, social complexity, and productive complexity and describes them as follows:

A- Complexity in details: derived from analysis approach, in daily conversations can be expressed as the complexity of a phenomenon such as a system or an organization in terms of the number of parts that can be seen in that phenomenon. The more number of components a system or an organization has the more complex it will be. In this type of complexity, diagnosis and treatment ability is simple to reach. But in other types of complexity, scientific understanding and taking advantage of a variety of new ideas and thinking methods are required.

B- Dynamic complexity: from the perspective of systems thinking, recognition of this type of complexity is important. Difficulty in determining the type of relationship between system components and system, and the presence of delay in the transformation of the effects of components changes to other system components, create conditions in which functional results of the phenomenon are not clear and this will lead to the occurrence of different results in short and long term. Moreover, quite obvious measures will result in a series of expected and non-trivial events. The development of system boundaries in time and space is prerequisite for understanding dynamic complexity. In most circumstances, the main management tool is correct knowledge and deep understanding of the relationships between components and the whole system and not addressing the identification of components and their physical location. This more precise meaning of this complexity type is that cause and

effect are separated in time and space, so the distances and understanding causal relationship between them, which is nonlinear, have made their understanding more difficult.

C- Social complexity: this type of complexity means that different people see the same phenomenon different, according to the assumptions they have towards a subject. As a result, they place issues in different and various categories, so the alignment of people who are to identify and solve problems is difficult in this regard. Finding solutions to complex social issues is possible when all those who are part of the phenomenon, system and organization become involved and they accept to participate because this situation is the result of understanding of the minds of those who are in it. However, involvement of people cannot be achieved unless they are treated face to face and with no secrecy and contradiction.

D- Productive complexity: this complexity means that problems become widespread and appear through unknown and unpredictable ways in organization and community environment. So it causes events that are expected to face many difficulties. Issues with productive complexity require that those involved with them, accept that there is not only one correct and complete solution, and the context in which the phenomenon has grown and continues to exist is not recognizable at once. This kind of issues cannot be solved using prescribed packages or versions. Solutions are achieved through creative, emerging and productive processes by conducting three phases. The first phase is the diversity of ideas that people raise them. This phase is referred as divergence phase. The second phase is the phase of the emergence which is trying to discuss on the idea and their acceptance. The third phase is convergence (integration) phase. Those involved in the issue deal with summarizing and concluding remarks and make decisions on incentives and programs that are going to implement.

Regarding complexity and organizational complexity, Jackson et al. believe that:

- The relationship between the components and variables are of nonlinear relationships i.e. Each cause is the effect of another cause;
- There is unpredictability for their future;
- there is a kind of sustainable and continuous evolution and transformation;
- There is an unstable balance within the system and the system with the environment;
- There is no clear and comprehensible model;
- There is no guarantee to ensure the long-term and even medium-term planning;
- Consists of opaqueness, the ambiguities and contradictions;
- Management and leadership styles are vulnerable;
- Sometimes change in one component leads to fundamental changes in the whole system, namely butterfly effect, and
- Fault-tolerance based management is seen.

Daft discusses the complexity in organization and classifies and defines it. Horizontal resolution shows the horizontal degree or level of separation between units. Vertical resolution refers to the depth or height of the hierarchy. A breakdown by geographical regions considers the distribution of units, facilities and human resources geographically.

With a focus on system's components growing and the interactions among them, Rezaeian (2010) has identified and examined organizational complexity in three type of low, high and very high- level complexity.

In the literature of system's cognitive science in the context of the types and classification of system, Bolding has listed the 9 classes or systems which complexity is on the rise of the first class to the ninth one. Organization is in seventh category or class which is considered as complex or probably too complex system.

In his book entitled "system dynamics", Sterman (2000) has identified complexity with the availability of nonlinear relationships among system and organization's components and entities. Relationships that cause identification and study difficulties on a round- trip path and a structure with causal cycles and with the capacity of variable qualitative and quantitative amounts.

In the division of the systems, some experts have referred to simple and complex systems. For example, Rangriz and Mehrabi (2015) argued that: Simplicity and complexity of each system depends on the amount of communication or interaction of that system with its environment. The more a system is open to environment and deals with further external factors, the more it will be complex.

By developing the theory of organization metaphors, Morgan (1997) reminded that it is better to understand the different aspects of organization based on these metaphors. He has also noted that organization is a multi-faceted

system with different structures and behaviors. In other words, it brings a complex combination. These 9 metaphors are:

1. Organization as machine;
2. Organization as organism;
3. Organization as brain;
4. Organization as spirit prison;
5. Organization as successive changes flow (changing phenomenon);
6. Organization as means of domination
7. Organization as culture;
8. Organization as political system; and
9. Organization as canvas

In some system management resources, particularly in the discussions of system thinking and considering the organization as a system and affected by other issues related to system, one of the topics of system is system hierarchy i.e. sub-systems and sub sub-systems. If this division is not accompanied by goal setting and planning, the process of system conversion to its sub-systems will be associated with the incidence of complexity in the recognition of organization and its management. Also, the process of conversion of each system to its sub-systems and sub-systems to sub sub-systems and so forth will naturally bring a very complex situation when discussing system combination including inputs, process, outputs, feedback and environment.

2.2. *System, sub-systems and complexity*

Of the discussable subjects in understanding the system are system Hierarchy or the same system and system levels including sub-systems, sub-sub-systems and sub...systems within main system. Complexity is easily understood by pondering on this discussion. According to the contents of system analysis and the views of experts who believe in complexity theory Including Senge, Sterman, Ackoff, Rezaeian, Mashayekhi and Moghimi; each system consists of the interactions of its sub-systems. However, this situation can be discussed with different criteria and standards for each system especially for organization. Reflecting on this topic, when as the main system each sub-system consists of inputs, processes, outputs, environment and feedback, this combination is arguable for other levels as well. Therefore, system complexity and in this paper organizational complexity will be easily imaginable.

2.3. *The relationship between chaos theory and complexity paradigm*

Despite the development of chaos theory from mathematics, its evolution range has involved all sciences, especially the management science. In this context, some experts have discussed chaos theory in organization and management, although the discussion has generally been more comprehensive and acceptable once the terms complexity and organizational complexity are used. Features of chaos theory include:

1. Nonlinear equations of the variables;
2. Repetition of incidents and events in the context of time;
3. Self- similarity feature in system or hologram feature;
4. System's strange attractions; and
5. Delay in transformation the effect of slight change of one variable on other variables, and the whole system.

These features indicate the complexity in understanding of the structure, behavior and performance of the system.

2.4. *Summarizing the concept of complexity and organizational complexity*

Understanding complexity and complex organization is affected by human's experience, knowledge and science. In other words, complexity is a relative issue and relates to the attitudes and perceptions of people. A qualified, trained and scholar manager that takes the responsibility an organization may conduct it successfully and a manager who lacks the above characteristics considers the organization as a non-conducting and complex phenomenon. Despite this fact, due to discussed forms and origins of complexity, management of modern complex organizations

will also not be easy if does not assume very complicated. It must be admitted that the features such as unpredictability, instability, unavoidable developments, challenging decision- makings, accelerated transformations, strong paired dependencies between some system components, synergies challenges and the need for specialization and resolution exist in complex systems. Therefore, first the causes of complexity should be recognized. After that, some effective solutions should be discussed and finally a better and more effective solution should be selected and executed.

3. Complex organization management

Based on the above discussions the following process can be drawn for complex organizations management. Paying more attention to that and decision-making process, it can be more specified with FOCUS headword:

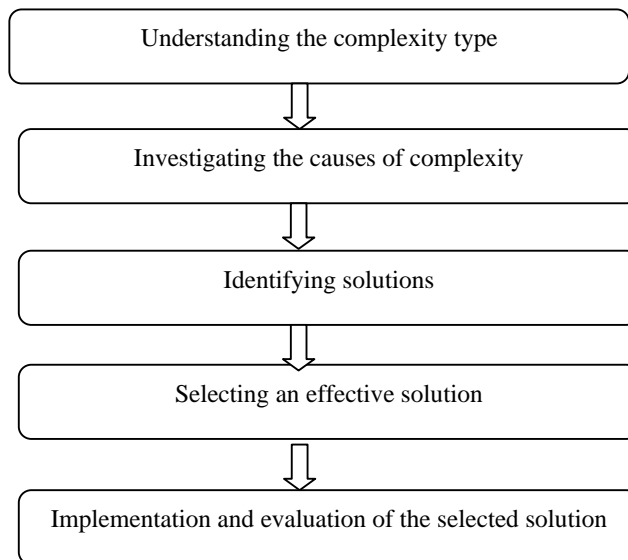


Fig. 1. The process of complex organization's management

F (find): find the problem. Whether complexity is felt or not?

O (organizing): organize a team to investigate the causes of complexity and identify solutions for problem.

C (clarity): clear the problem solution by discussing the solutions.

U (understand): improve your understanding and knowledge by selecting a solution.

S (solution): manage the complexity with the implementation and evaluation of activities.

3.1. Effective strategies for complex organizations management

Why do some organizations succeed and others fail? Studying successful organizations and especially in the context of complex organizations, the evidences are indicative of the feasibility of using different solutions. Meanwhile considering the educational and coaching restrictions, possibilities and needs, challenging nature of selection and strategy implementation, studying emerging and modern change techniques and methods and at the same time the need for creativity and innovation, the necessity of coordination and synergies are very effective and decisive. Among the solutions that can be used in complex organizations are:

- Managers and leaders to take advantage of various subjective thinking features and capabilities including: Process-oriented thinking, Holism, strategic thinking, system thinking creative thinking,

green thinking, philosophical and causal thinking, a combination of systematic thinking and intuitive thinking, inductive and deductive thinking, lean and dynamic thinking which will be affected by continuous knowledge improvement and to avoid narrow thinking, individual orienting, dogmatism and linear thinking;

- Goal setting and planning to convert the system to sub-system;
- Green human resource management;
- Implementation of workplace organizing system, 5s;
- Converting the organization to learning organization;
- Stakeholders management;
- Organizational cybernetics;
- Proper use of organic and bureaucratic structures contingent to circumstances;
- Future studies;
- Organizational Agility;
- Converting the organization to lean organization;
- Knowledge management;
- Enterprise resources planning;
- Total Quality Management;
- The establishment of quality management systems;
- Outsourcing;
- Downsizing;
- Benchmarking;
- System dynamics; and
- Reengineering in the structure and creating new structures such as virtual organizations, and organizational and team networks

4. Discussion and conclusion

Occurrence of environmental changes on one hand and limitations and restrictions on the other has imposed a situation complex on the survival of social systems including organizations. Despite various definitions and descriptions of complexity and organizational complexity, what is considered important, is to necessarily fix and deal with the management of all complexity types. The leader of this movement is system theory that maintaining the advantages of linear thinking with holistic, totality and relationship based approach has introduced system dynamics knowledge. But for better and more fundamental treatment, a combination of new ideas such as strategic thinking, nonlinear thinking, green thinking, and group thinking may play the most important role in the management of complexity of the social systems. The results of success in this role will be the adoption of effective measures and strategies, including; converting the organization to learning and lean organization, benchmarking and optimization, outsourcing and the establishment of organic structure. In the meantime, what is playing a key role and as a strong bridge between the applications and taking advantage of these ideas and the adoption of new techniques and methods for the management of complex organizations, is the use of dialogue i.e. Group thinking which more specifically means:

- Individuals' shared exploration in a way to think and reflect together;
- A way of resolving differences between people and conducting them towards something they have not already been engaging to. Therefore they will leave dogmatism and opportunism and move towards further understanding and agreement;
- A flow of meanings within individuals and between them that leads to the emergence of a new understanding;
- It is one way of being and surviving. Beyond seemingly polite behavior people came together in the spirit through dialogue, and listen to the inner voice;
- Creative and freely expressing of fundamental and complex issues and deep listening to the views of others;
- Achieving a new level of understanding and building a new basis for thinking and acting;

- Identifying underlying motives and intentions of individuals;
- Establishing contact with secret sources of thinking;
- Thinking process moves forward to the extent that it will be understandable to shared mental space of everyone;
- Underlying and context examination of beliefs and positions;
- The flow of meanings between human beings by words;
- A way that the positions and opinions are not considered strong and decisive;
- Finally, people are ready to learn from each other which means starting or continuing change in the direction of improvement and excellence and through three languages: meaning, feeling and strength.

References

- Ajmi, M. (2014). Human Consultation and interaction using the learning approach Saneei publication, Tehran (in Persian).
- Alam Tabriz, A. A., & Shadfar, H. (2013). Productivity and quality management, industrial management institute publication, Tehran (in Persian).
- Arevalo, E.; Espinosa, A. (2015). Theoretical approaches to managing complexity in organizations: A comparative analysis, *Estudios Gerenciales*, 31, 20–29.
- Bratian, V. (2014). Defining the Concepts of Organization, Economic Organization and Stabilizer from the Perspective of Complex Systems, 21st International Economic Conference 2014, IECS 2014, 16-17 May 2014, Sibiu, Romania.
- Broche, G., & Marinescu, P. (2008), *Deschideri spre lumea complexității*, Ed. Universității din București.
- Dekker, S., Cilliers, P., & Hofmeyr, J.-H. (2011). The complexity of failure: implications of complexity theory for safety investigations, *Safety Science*, 49, 939–945.
- Ghobadi, SH. (2007). System dynamics, as an application of system thinking, industrial management institute (in Persian).
- Iranzadeh, S. (2013). Complex organizations management, Forouzeh publications, Tabriz, Iran (in Persian).
- Iranzadeh, S., Sabahi, I., & Ammari, H. (2008). Strategic thinking, Forouzeh publications, Tabriz, Iran (in Persian).
- Jackson, Michael C. (2007). *Systems Thinking: Creative Holism for Managers*, 1st Edition, Wiley.
- McDaniel, R. R., & Driebe, D. J. (2001). Complexity science and healthcare management, *Advanced Health Care Management*, 2, 11–36.
- McMillan, E. (2008). Complexity, management and the dynamics of change: Challenges for practice. Abingdon: Routledge.
- McKelvey, B. (2004). Toward a complexity science of entrepreneurship, *Journal of Business Venture*, 19, 313-341.
- Mitleton- Kelly, E. (2011). A complexity theory approach to sustainability: A longitudinal study in two London NHS hospitals. *The Learning Organization*, 18(1), 45–53.
- Moghimi, S. M. (2014). Principles of organization and management, Rahe Danesh publications (in Persian).
- Morgan, G. (1997). *Images of Organization*, Sage Publication.
- Murthy, K. K. (2001). Management philosophy for the new millennium, Allied Publishers Pvt. Ltd..
- Rangriz, H., & Mehrabi, J. (2015). Advanced management theories, publications of Islamic Azad University (Qazvin branch), 2nd edition (in Persian).
- Reiman, T., Rollenhagen, C., Pietikäinen, E., Heikkilä, J. (2014). Principles of adaptive management in complex safety– critical Organizations, Safety Science.
- Rezaeian, A. (2010). System analysis and design, SAMT publications, 13rd edition (in Persian).
- Rezaeian, A. (2013). Principles of Management and Organization SAMT publications (in Persian).
- Robbins, Stephen P. (1990). *Organization Theory: Structures, Designs, and Applications* (3rd Edition), Prentice Hall, USA.
- Roth, William F. (2011). *The Roots and Future of Management Theory*. Create Space Independent Publishing Platform.
- Senge, P. M. (1990). *The fifth discipline: the art and practice of learning organization*, New York, Doubleday.
- Sterman J. D. (2000). *Business Dynamics: Systems Thinking and Modeling for a Complex World*, McGraw-Hill/Irwin, USA.
- Williams, B., & Hummelbrunner, R. (2010). *Systems Concepts in Action: A Practitioner's Toolkit*, Stanford Business Books.