

AN ORGANIZATION ON THE EDGE OF CHAOS: THE ORIGINS OF THE METAPHOR AND ITS IMPACT ON THE THEORY AND PRACTICE OF STRATEGIC MANAGEMENT

Czesław Mesjasz

Cracow University of Economics, Cracow, Poland

e-mail: mesjaszc@uek.krakow.pl

ORCID: 0000-0003-0893-5823

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Abstract: The notion “edge of chaos” coined in complex systems studies has become a part of the vocabulary of modern management theory and practice. This utterance is especially significant since it has been applied in management as a metaphor associated with innovativeness and creativity. The aim of the paper is to study what are the consequences of the fact that this term is applied in management as a dead metaphor, i.e. it is decoupled from its initial meaning. A deepened analysis of the interpretations and misinterpretations of the term “organization on the edge of chaos” applied in strategic management is presented.

Keywords: organization on the edge of chaos, dead metaphor, strategic management.

1. Introduction

The notions of complexity, edge of chaos, “butterfly effect”, systems far-from-equilibrium, complexity science, etc. coined in complex systems studies have become an indispensable part of the vocabulary of modern management theory and practice¹. Three of these terms have achieved more popularity – complexity, chaos and the edge of chaos. Together with the earlier popularized notion of turbulence in strategic management [Ansoff 1979], they constitute an example of how terms taken from science and engineering as metaphors can become important ideas shaping the theory and practice of strategic management. The expression “the edge of chaos” is especially significant since it has been applied in almost all areas of management as a metaphor associated with innovativeness and creativity.

A closer look at the notions borrowed from complexity studies to management theory, e.g. the term chaos as used in the Cynefin project [Snowden, Stabridge 2004], which allows to conclude that those terms are used as dead metaphors, i.e. they are almost decoupled from the initial meaning [Lakoff, Johnson 1995; Pawelec 2006]. This observation leads to the following main research question: what is the real theoretical and practical value of metaphors drawn from complex systems studies and applied in management?

The aim of the paper is to study what are the consequences of the fact that this term is applied in management as a dead metaphor, i.e. it is decoupled from its initial meaning. The following conjectures are put forward. First, the metaphorical expressions like the edge of chaos have a limited direct impact on a better understanding of the processes taking part in

¹ The terms “complexity science” and “complexity theory” are deliberately avoided in the study. The notions “complexity studies”, “complexity research” are applied instead. The reasons for such an approach are explained in the remainder of the text.

modern organizations and in their environment since they are built upon dead metaphors with arbitrarily coined interpretations. Second, the impact of the metaphor of the “edge of chaos” on the language of management does not derive from direct isomorphic relations between tangible systems, where this phenomenon can be observed, but from the social discourse in which interpretations of that term has been constructed. Third, a deepened analysis of the process of creating meaning of the term “edge of chaos” in management could help in increasing its usefulness in strategic management.

As an epistemological foundation a “moderate constructivism” is applied with the ontological assumption of the existence of the “being” (reality) and with the epistemological assumption that the “being” (reality) is approximately identified in an intersubjective discourse embodying narratives in which both a qualitative (verbal) approach as well as mathematics are used. The fundamental challenges from the philosophy of language [Wittgenstein 2002], hermeneutics [Matzavinos 2016], linguistics [Lakoff, Johnson 1995] and constructivism [Glaserfeld 1995; Searle 1995] are borne in mind in all considerations.

2. “Hard” and “soft” complexity of social systems

In his search for explaining the meaning of complexity, Lloyd [2001] identified 45 interpretations of this term. The intricacy of complexity studies can be found in the scheme proposed by Castellani [2018]. In other writings several definitions of complexity have been formulated and scrutinized – [Weaver 1948; Prigogine, Stengers 1984; Waldrop 1992; Gell-Mann 1995; Kauffman 1995; Bar-Yam 1997; Biggiero 2001; Andriani, McKelvey 2009; Mesjasz 2010].

The unequivocal distinction of complex systems from the “classical” systems is not possible. In the works by Wiener [1961] and Ashby [1963], defining “first order cybernetics” and “hard” systems thinking Bertalanffy [1968] – without considering the role of observer, complexity was treated as one of the important systemic features. In those works the first systemic/cybernetic characteristics of systems were enumerated: system, element, relation, subsystem, environment, input, output, feedback, black box, equilibrium, stability, synergy, turbulence. Furthermore, it can be also characterized by a multitude of such traits as adaptability, adaptation, attractor, *autopoiesis*, chaos, bifurcations, butterfly effect, closed system, coevolution, complex adaptive systems, dynamical systems, edge of chaos,

emerging properties, far-from-equilibrium states, fitness landscape, fractals, nonlinearity, open system, path dependence, Power-Law, reflexivity, scale-free networks, self-organization, self-organized criticality, self-reflexivity, synergy, synergetics, and turbulence.

The ideas originated in complexity studies are used in social sciences as models, analogies and metaphors. According to this distinction, the term model is narrowed only for mathematical structures. Mathematical models in complexity studies can be applied in three areas: computing-based experimental mathematics, high precision measurement made across various disciplines and confirming the “universality” of complexity properties and rigorous mathematical studies embodying new analytical models, theorems and results.

Under the inspiration from Lissack [1999], the ideas depicted above can be called “hard” complexity research as an analogy with the “hard” systems thinking, and to some extent with the “first order cybernetics” (objects of research independent from the observer). This research includes the mathematical modeling of systems with well-defined, operationable (computable) characteristics in physics, chemistry, natural sciences and in society. The “soft” complexity research, also coined by analogy with “soft” systems thinking [Checkland 2000] and “second order cybernetics” [von Foerster 1982], includes the ideas of complexity elaborated in other areas – cybernetics and systems thinking, social sciences and in psychology. Contrary to “hard” complexity, they are not computable. Those ideas can be divided into two groups. The first group includes those, which are based upon analogies and metaphors drawn from ‘hard’ complexity studies. They are dominating in social sciences theory and practice being very often abused and misused. The second group includes indigenous qualitative concepts of complexity like those elaborated by Luhmann [1995] – a complete indigenous definition, Cilliers [1998] – a partly indigenous idea and partly based upon analogies and metaphors.

Subjectivity is the first aspect of complexity in the “soft” approach. Following this line of reasoning, from the point of view of the second-order cybernetics, or in a broader approach, constructivism [Glaserfeld 1995; Biggiero 2001], complexity is not an intrinsic property of an object but depends on the observer. Usually it is stated that “complexity, like beauty, is in the eyes of the beholder”.

The complexity of the social system developed by Luhmann [1995] is strongly linked to reflexivity, self-reflexivity and self-reference, since a reduction of complexity is also a property of the system’s own

self-observation although no system can possess total self-insight. This phenomenon is representative for the epistemology of modern social sciences, where hermeneutics, observation and self-observation, reflexivity and self-reflexivity, self-reference and subsequently intersubjectivity play an important role. Referring to a moderate constructivism, it should be emphasized that the definitions of all categories do not have any “objective” character, independent from the observer. This is a basic epistemological assumption in modern social sciences. Therefore in systems thinking, intersubjective interpretations of concepts are the point of departure of investigations.

Due to the multitude and diversity of interpretations of the complexity and scope of management theory and practice, it is impossible to enumerate all the applications of the former in the latter. For example, *The Sage Handbook of Complexity and Management* edited by Allen, Maguire, McKelvey [2011] contains 36 chapters dealing with various, more or less separate, theoretical and management domain-related issues having two general common denominators – complexity and/or complex systems. The selection given below includes only selected examples, which are presented without a deeper assessment: complexity of organization and strategy, complex adaptive systems [Stacey 1992; 2000; Stacey, Griffin, Shaw 2000]; the Cynefin model [Snowden, Stabridge 2004] complexity, organization and strategy on the edge of chaos [Brown, Eisenhardt 1998; Eisenhardt, Brown 1998; Eisenhardt, Sull 2001; Eisenhardt, Piezunka 2011].

3. Organization and strategy on the edge of chaos

As has been stressed, a large number of studies referring to complexity and chaos in management theory and practice make any systematic research very difficult, if not impossible. Therefore, the most representative and at the same time most influential works are the texts by Eisenhardt and her co-authors [Brown, Eisenhardt 1998; Eisenhardt, Brown 1998; Eisenhardt, Sull 2001; Eisenhardt, Piezunka 2011] where attention is given to the term “organization on the edge of chaos”.

It is not the aim of this paper to explain the mathematical subtleties of the term “system on the edge of chaos”, but only to show the “journey” of this utterance during which it gained a new meaning. The term “edge of chaos” was used for the first time in the 1980s in the studies of the models describing phase transitions in cellular automata by Langton [Mitchell, Crutchfield, Hraber 1993]. Leaving aside the very sense of an abstract model, it is necessary to add that

the initial names given to that phenomenon were: “transition to chaos”, the “boundary of chaos”, and the “onset of chaos” [Waldrop 1992, pp. 230-231]. After publication in academic journals and popular books quoted above, the utterance gained its own life, from a mathematically sophisticated model to a more or less properly understood dead metaphor which has a specific psychological appeal

The works on the links between complexity and strategy published by Eisenhardt and her co-authors refer predominantly to the edge of chaos [Brown, Eisenhardt 1998; Eisenhardt, Brown 1998; Eisenhardt, Sull 2001; Eisenhardt, Piezunka 2011]. The authors expose a high level of erudition reflected in the quotations of the fundamental works, however, no sufficient attention is given to the target field of the metaphor, i.e. the mathematical and physical characteristics of the organization. The focal point of interest is strategy. Eisenhardt, Brown [1998, p. 787] underline that traditional strategy is about building long-term defensible positions or sustainable competitive advantages. In contrast, a strategy of competing on the edge is fundamentally fleeting, complicated and unpredictable. It recognizes that successful strategy today may not work well tomorrow. A summary of the approach to strategy on the edge of chaos discussed in the abovementioned works is presented in Table 1.

4. Conclusions

The criteria presented in the above table do not demand a thorough explanation as they are partly self-explanatory. Since they logically prove the conjectures of the paper, they can be summarized as follows:

1. First and foremost. The concept of the “edge of chaos” is a dead metaphor. Consequently it may not be treated as a classical neo-positivist support for applying analogies from physics, chemistry and biology in strengthening the classical scientific value of ideas applied in strategic management theory (description, identification of causal relations, prediction and normative approach).

2. The dead metaphor allows for more flexible interpretations of the phenomena in its source field. This is both a negative and a positive aspect of the application of this type of metaphor. On the one hand it can be applied in a direct way – functional and structural isomorphism between a physical system and a social system allows for learning from the behavior of the physical system. On the other hand, such a metaphor may be heuristically variable in assigning meaning to the social phenomena with no need for a direct isomorphism.

Table 1. An assessment of the application of the complexity-based approach in strategic management: an organization and strategy on the edge of chaos

Criteria/features	Issue	Sources and level of analysis	Directions of further research
Sources of complexity-related knowledge – primary sources, secondary sources, popular writings		All types of sources. Good knowledge of most important sources dealing with complexity. Fundamental mathematical publications quoted only as sources of spoken language (transitions, change). No reference to a metaphorical character of discussed concepts. No inspiration for metaphors at a deeper technical level.	Necessity to respond to the question – is the language describing mathematical models sufficient for deeper twofold analysis of organization and strategy: (a) mathematical models; (b) more relevant metaphors.
Dominating approach (qualitative/quantitative); mathematical models/metaphors		Qualitative approach. Language with typical notions of description of dynamics of organization and other types of systems.	Is it necessary to apply a more advanced quantitative approach (operationalization, simulation) in that type of qualitative narrations?
Reference to extant economic theory (Industrial Organization, theory of the firm)		Reference to transaction cost theory (in general terms).	To what extent should the knowledge in economic theory be used in strategic management theory and practice?
Characteristics of complexity		Sufficient level of knowledge. Number of elements and interactions, transition, velocity, change, learning, unpredictability, adaptation. Insufficient explanation between characteristics of “hard” and “soft” complexity.	Necessity to provide better definitions and characteristics of “hard” and “soft” complexity of organizations.
Attention given to members of organization (psychology, social psychology)		No attention given to psychological aspects of strategy building.	To what extent is psychological analysis of individuals necessary in this type of modeling? Awareness of the “edge of chaos” as a motivating factor.
Depth of cognitive/linguistic analysis		Absence of a deepened reflection of the sense of metaphor “edge of chaos”.	To what extent is cognitive/linguistic analysis necessary? In advanced models of social systems with “hard” and “soft” complexity such an approach is necessary.
System (organization) tangible/intangible attributes of CAS		Organizations as CAS. Mixed wording making difficult identification of organization under scrutiny. Mixed mechanistic approach (first order cybernetics – object independent from observer) with reference to intangible aspects of organization.	Necessity to present explicitly the characteristics of organizations treated as CAS – operationalization, formal models, simulation of extant organizations and of ideal organizations.
Structure of organization (elements and interactions within and without the system)		Structures described in general terms as fluid, networks, unstable.	Necessity to explain a paradoxical idea of “fluid structure”.
Patterns of dynamics of organization		High speed change of systems. Missing detailed aspects of description of tangible and intangible characteristics of organization.	How to explain cognitive aspects of changes in organizations treated as CAS?
Strategy – type and source of definition, precision, etc.		Sufficient communication about strategy – mix of classical understanding with modern interpretations.	Sufficient explanation of strategy.
Strategy – scope of the use of complex systems-oriented language		Complexity language treated as inspiration for the use of classical language of modern management oriented towards change. No search for more precise analogies and metaphors linking strategy with transitions, velocity, etc.	Is it necessary to develop more “isomorphic” analogies and metaphors between strategy as a social construct and operations of natural complex systems?
Interpretation of the edge of chaos		Direct reference solely to the wording. No attempts to study what is in transition in an operational sense – only broadly defined terms, strategy, systems, processes.	Is it necessary to develop more “isomorphic” analogies and metaphors and analogies between phase transitions in natural systems and in social systems treated as social constructions? Phase transitions in organizations treated as physical systems obey the laws of physics but the usefulness of this conclusion is limited.
Impact on strategic management theory		Missing reflection about how that type of language with terms with a broad meaning may contribute to management theory.	To what extent such a specific erudite narrative based upon general terms can contribute to theory of management? Is it useful as an instrument of communication?
Impact on strategic management practice		Simplifying case studies based upon speculatively identified links between organizations as complex systems and strategic management.	To what extent can such a specific narrative based on general terms stimulate practitioners for more efficient action? What was the method of identification of the “edge of chaos” in the organizations quoted as examples? What about attempts to operationalize some categories?

Source: own research based upon: [Brown, Eisenhardt 1998; Eisenhardt, Brown 1998; Eisenhardt, Sull 2001; Eisenhardt, Piezunka 2011].

3. Such terms as complexity and chaos have an additional “emotional appeal” to the readers who are not familiar with the mathematical background of the writers. The names, and especially the term “chaos” create an expectation that the ideas can put in order the perceived disorder of the social phenomena. This is obviously not true since the term “chaos” for depicting the consequences of non-linearity of phenomena is purely arbitrary.

4. A specific socio-political factor must be considered when the position of the authors has to be taken into account. Due to their intellectual and academic position, Kathleen Eisehardt and her co-author Shona Brown, who was at that time a top executive at Google, have become “exemplary leaders” of applying the metaphor “strategy on the edge” [Lashinsky 2006]. This was not the value of the direct inspiration from natural sciences, but rather the successes of organizations described by influential authors with the metaphors of the “edge of chaos”. In such a case, the metaphors have a heuristically valuable inspiration rather than a direct application aimed at increasing the effectiveness of strategic management. This phenomenon also exposes the constructivist aspects of applications of complexity-rooted ideas in the theory and practice of strategic management.

The directions for further research can be formulated as follows:

1. It is not necessary to study complexity in general and to make attempts to develop a universal theory of complexity of social phenomena, including management. The applications of the terms “complexity” and “chaos” in various contexts should be studied instead.

2. A deepened semantic analysis of applications of the terms “chaos” and “complexity” is necessary in management theory.

3. Qualitative conclusions drawn with the use of dead metaphors should be used as a foundation for quantitative models, e.g. Complex Adaptive Systems.

Bibliography

Allen P., Maguire S., McKelvey B. (eds.), 2011, *The Sage Handbook of Complexity and Management*, SAGE, Los Angeles.
 Andriani P., McKelvey B., 2009, *From Gaussian to Paretian thinking: Causes and implications of power laws in organizations*, *Organization Science*, vol. 20, no. 6, pp. 1053-1071.
 Ansoff H.I., 1979, *Strategic Management*, Macmillan, London.
 Ashby W.R., 1963, *An Introduction to Cybernetics*, Wiley, New York.
 Barabási A.-L., 2003, *Linked. How Everything is Connected to Everything Else and What It Means for Business, Science, and Everyday Life*, Penguin, New York.

Bar-Yam Y., 1997, *Dynamics of Complex Systems*, Addison-Wesley, Reading, MA.
 Bertalanffy L. von., 1968, *General Systems Theory*, Braziller, New York.
 Biggiro L., 2001, *Sources of complexity*, *Human Systems, Non-linear Dynamics, Psychology and Life Sciences*, vol. 5, no. 1, pp. 3-19.
 Brown S., Eisenhardt K., 1998, *Competing on the Edge. Strategy as Structured Chaos*, Harvard Business School Press, Cambridge, MA.
 Castellani B., 2018, *Brian Castellani on the Complexity Sciences*, Art & Science Factory, 9 February, http://www.art-science-factory.com/complexity-map_feb09.html (16.09.2018).
 Checkland P., 2000, *Soft systems methodology: A thirty year retrospective*, *Systems Research and Behavioral Science*, vol. 17, pp. 11-58.
 Ciliers P., 1998, *Complexity and Postmodernism*, Routledge, London.
 Eisenhardt K.M., Brown S.L., 1998, *Competing on the edge: Strategy as structured chaos*, *Long Range Planning*, vol. 31, no. 5, pp. 786-789.
 Eisenhardt K.M., Sull D.N., 2001, *Strategy as simple rules*, *Harvard Business Review*, vol. 79, no. 1, pp. 106-119.
 Eisenhardt K.M., Piezunka H., 2011, *Complexity Theory and Corporate Strategy*, [in:] Allen P., Maguire S., McKelvey B., (eds.), *Handbook of Complexity and Management*, SAGE, London, pp. 506-523.
 Foerster H. von, 1982, *Observing Systems. A Collection of Papers by Heinz von Foerster*, Intersystems Publications, Seaside, CA.
 Gell-Mann M., 1995, *What is Complexity?*, *Complexity*, vol. 1, no. 1, pp. 16-19.
 Glasersfeld E., von, 1995., *Radical Constructivism: A New Way of Knowing and Learning*, The Farmer Press, London.
 Gleick J., 1987, *Chaos: The Making of a New Science*, Viking Press, New York.
 Holland J.D., 1995., *Hidden Order: How Adaptation Builds Complexity*, Basic Books, New York.
 Kauffman S. A., 1995, *At Home in the Universe. The Search for Laws of Self-Organization and Complexity*, Oxford University Press, New York, Oxford.
 Lakoff G., Johnson M., 1995, *Metaphors We Live by*, University of Chicago Press, Chicago.
 Lashinsky A., 2006, *Chaos by Design. The Inside Story of Disorder, Disarray, and Uncertainty at Google. And Why It's All Part of the Plan. (They hope.)*, *FORTUNE Magazine*, vol. 154, no. 7, 2 October, http://archive.fortune.com/magazines/fortune/fortune_archive/2006/10/02/8387489/index.htm (15.04.2018).
 Lissack M.R., 1999, *Complexity: The science, its vocabulary, and its relation to organizations*, *Emergence*, vol. 1, no. 1, pp. 110-126.
 Lloyd S., 2001, *Measures of complexity: A non-exhaustive list*, *IEEE Control Systems Magazine*, vol. 21, no. 4, pp. 7-8.
 Luhmann N., 1995, *Social Systems*, Stanford University Press, Palo Alto, CA.
 Mantzavinos C., 2016, *Hermeneutics*, [in:] Zalta E.N. (ed.), *The Stanford Encyclopedia of Philosophy (Winter Edition)*, <https://plato.stanford.edu/archives/win2016/entries/hermeneutics/> (27.12. 2016).
 Mesjasz C., 2010, *Complexity of social systems*, *Acta Physica Polonica A*, vol. 117, no. 4, pp. 706-715, <http://przyrbwn.icm.edu.pl/APP/PDF/117/a117z468.pdf> (10.04.2012).

- Mitchell M., Crutchfield J.P., Hrabar P., 1993, *Dynamics, computation, and the "edge of chaos", A re-examination*, SFI Working Paper: 1993-06-040 <http://samoasantafe.edu/media/workingpapers/93-06-040.pdf> (17.04.2015).
- Pawelec A., 2006, *The death of metaphor*, *Studia Linguistica Universitatis Iagellonicae Cracoviensis*, vol. 123, pp. 117-121.
- Prigogine I., Stengers I., 1984, *Order out of Chaos*, Bantam, New York.
- Searle J. R., 1995, *The Construction of Social Reality*, The Free Press, New York.
- Snowden D., Stabridge P., 2004, *The landscape of management: Creating the context for understanding social complexity*, *E:CO*, vol. 6, no. 1-2, pp. 140-148.
- Stacey R.D., 1992, *Managing the Unknowable: Strategic Boundaries Between Order and Chaos in Organizations*, Jossey Bass, San Francisco.
- Stacey R.D., 2000, *Strategic Management & Organizational Dynamics. The Challenge of Complexity*, Pearson Education Limited, Harlow.
- Stacey R.D., Griffin D., Shaw P., 2000, *Complexity and Management. Fad or Radical Challenge to Systems Thinking*, Routledge, London.
- Waldrop M.M., 1992, *Complexity: The Emerging Science at the Edge of Order and Chaos*, Simon & Schuster, New York.
- Weaver W., 1948, *Science and complexity*, *American Scientist*, vol. 36, no. 4, pp. 536-544.
- Wiener N., 1961, *Cybernetics: Or Control and Communication in the Animal and the Machine*, Hermann & Cie, Paris, MIT Press, Cambridge, MA.
- Wittgenstein L., 2002, *Philosophical Investigations [German Text with a Revised English Translation]*, Blackwell Publishers, Blackwell.

WPLYW METAFORY „ORGANIZACJA NA KRAWĘDZI CHAOSU” NA TEORIĘ I PRAKTYKĘ ZARZĄDZANIA STRATEGICZNEGO

Streszczenie: Pojęcie „krawędź chaosu”, występujące w badaniach systemów złożonych, stało się częścią słownictwa teorii i praktyki zarządzania. Termin ten jest szczególnie istotny, ponieważ jest wykorzystywany w zarządzaniu jako metafora związana z innowacyjnością i kreatywnością. Celem tekstu jest zbadanie konsekwencji tego, że określenie „krawędź chaosu” jest stosowane w zarządzaniu jako martwa metafora, czyli że jest oderwane od swego początkowego znaczenia. W artykule przedstawiono pogłębioną analizę poprawnych i błędnych interpretacji pojęcia „organizacja na krawędzi chaosu”, stosowanych w zarządzaniu strategicznym.

Słowa kluczowe: organizacja na krawędzi chaosu, martwa metafora, zarządzanie strategiczne.