

BUSINESSES AS FRACTAL ORGANISMS IN CHAOTIC AURA

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“Clouds are not spheres, mountains are not cones, and lightning does not travel in a straight line. The complexity of nature's shapes differs in kind, not merely degree, from that of the shapes of ordinary geometry, the geometry of fractal shapes”
Benoit B. Mandelbrot, *The Fractal Geometry of Nature*

—Abstract —

All conventional organization systems move towards its end and fall down on doing business. The new economy requires some default issues for organizations anymore to meet the need of dynamic, fast-changing and fluctuated environment. Organizations should accept changing business world dynamics and shape their strategic framework to survive in destructive competition aura. The known theory explains this circumstance is the chaos theory. Chaos theory studies the behavior of dynamical systems that are highly sensitive to initial conditions, an effect which is popularly referred as the butterfly effect. It assumes random but followed a pattern behaviors, an extreme complexity and nonlinear and non-periodical system. In terms of organizational paradigm, chaos theory refers to a subset of chaos incorporates principles of quantum mechanics and presents them in a complex systems environment. Today organizations should recognize the “layout in chaos” as an inevitable part of the environment. Fractal organization is proposed as a new organization structure capable of proactively perceiving the environment and of autonomously adapting to the changing environments. The organizational structure relies on the concepts of chaos theory, fractal geometry,

fractal dimension of existence and fractal structures in the universe. Fractal organization is open, self-organized, reconfigurable, self-contained and acquired its being phenomenon. This structure try to solve the similarity-differences paradox in business, discuss the recent meaning of authority and hierarchy, mention about copying all parts both similar and different, focus on “spontaneity” and explain nonlinear behavior. The fractal organization requires some drivers such as learning, inquiring, considering the business as a whole soul, self-regularity, cultural DNA, etc. This conceptual study defines the meaning of the fractal organization as a new organizational form; assumptions and features of this structure and its requirements and drivers. This paper handles businesses as fractal organisms in the chaotic environment and presents strategic formulas to struggle for survival.

Key Words: *Fractal Organization, Chaos Theory, Autonomy, Nonlinear Behaviour, Spontaneity.*

JEL Classification: M

1. INTRODUCTION

Up-to-date market dynamics and decentralisation have brought about the need of flexible and robust organisational structures for all resources. To meet the need of such an environment, the organization system should be equipped with an open, reconfigurable and scalable organisational structure (Shin et al., 2009:1791). Organizations should accept changing business world dynamics and shape their strategic framework to survive in destructive competition aura. Today organizations should recognize the “layout in chaos” as an inevitable part of the environment. Fractal organization is proposed as a new organization structure capable of proactively perceiving the environment and of autonomously adapting to the changing environments. The organizational structure relies on the concepts of chaos theory, fractal geometry, fractal dimension of existence and fractal structures in the universe. In this paper, survival of organizations can be accomplished with a complete fractal architecture that provides a single shared complete business framework for the adaptive business. An fractal architecture overcomes some typical organizational and environmental limitations (Ramanathan, 2005:51).

2. AN OVERVIEW THE BASIC CONCEPTS AS ANTECEDENTS OF FRACTAL ORGANIZATIONS

2.1. CHAOS THEORY

Today organizations try to struggle with chaos to survive in intense competitive environment. Chaos is defined as extreme muddle, complication situation or non-periodic and non-static system. Also it is regarded as the amorphous and disordered situation of matter before cosmos. According to Greek myths, the chaos is first appearance of The God. Also it is identified as name of the God as the unknown at Chinese mythology. Edward Lorenz (1963) established a meteorological model regarding the chaos theory. Hereby he defined the chaos as a layout acts random and has straight geometrical structure. Also Stacey (1993) describes chaos as the irregular and well-defined behaviour seen in nature and human societies and caused by the nonlinear feedbacks.

Chaos theory is based on “precise adherence to the initial state” principle and accepts a regular irregularity. Chaos theory studies the behaviour of dynamical systems that are highly sensitive to initial conditions, an effect which is popularly referred as the butterfly effect. It assumes random but followed a pattern behaviours, an extreme complexity and nonlinear and non-periodical system. In terms of organizational paradigm, chaos theory refers to a subset of chaos incorporates principles of quantum mechanics and presents them in a complex systems environment. Today organizations should recognize the “layout in chaos” as an inevitable part of the environment.

2.2. FRACTAL GEOMETRY

Euklidian geometry interests in geometrical figures with range of 0-3 dimensions. However, they have no projections in the real life and are only idealized abstractions. Mandelbrot (1982) brought a new perspective to the geometry by discovering mathematical side of figures in the nature. He called these figures as fractal derived from Latin word “fractus” which means “fragmented” or “broken”. Fractal geometry based on figures with fractional dimension, self-similar structures seems at every scale, forever branchings and compatibility these branchings and main structure.

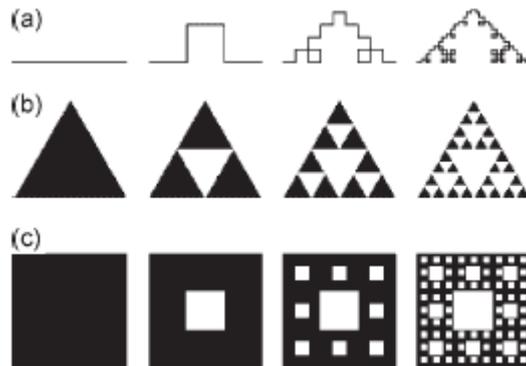
Fractals broke some of the basic rules of classical Euklidian geometry. Fractals contain repeating themes and details, sometimes with variations, and sometimes without, and fractal shapes typically contains an apparently infinite number of versions of themselves. Fractals come in different types and styles: They can recognisable features that repeat ad recur across space and across scale (Baird, 2011:1).

Fractal theory is a new interdiscipline intercrossing natural science and social science, aiming to study the sophisticated phenomenon underneath. Fractal is one important part of modern nonlinear theory. Although only a few decades have passed, it has produced profound influence on the concept of nature, science, method, and thinking (Jingwen, 2011:1).

2.3. FRACTAL STRUCTURES AND DIMENSIONS

“A fractal set is one for which the fractal dimension strictly exceeds the topological dimension.” (Mandelbrot, 2004:38). He defines a fractal structure as geometric figures which demonstrate similar structural properties with whole. In fact, it is difficult to define a fractal. Definitions involve different variables such as scale-dependent length, fractional dimensionability, self-similarity or recursion, reducibility etc. (Baird, 2011:1). A fractal is generally defined as an independently acting corporate entity whose goal and performance can be precisely described (Warnecke ve Hüser, 1993). The term “fractal” was coined to describe organisms and structures in nature, which arrive at multiple and complex solutions by using a small number of self-imitating elements. Fractals communicate directly with their counterpart fractals following an efficient communication scheme. Fractals can be distributed without the restriction of space. They select relevant methods to achieve their goal by performing tasks with many beneficial characteristics (Ryu and Jung, 2004:316-317).

Figure 1. Iterative Construction Examples of self-similar fractals: (a) Koch square room, (b) Sierpinski's triangle and (c) Sierpinski's carpet



Source: Oswaldo Morales-Matamoros, Ricardo Tejeida-Padilla and Isaias Badillo-Pina (2010), "Fractal Behaviour of Complex Systems", *Systems Research and Behavioral Science*, Vol.27, pp.73.

Fractals fulfil a certain number of theoretic and methodological criteria including an high level of organization, shape irregularity, functional and morphological auto-similarity, scale invariance, iterative pathways and a peculiar non-integer fractal dimension (Losa, 2005:1).

Fractal denotes a self-similar shape recursively constructed. That is, fractal implies self-similar recursion, 'a similar pattern inside of another similar pattern'. This concept has been adopted as a design principle in such diverse fields as statistical mechanics, computer graphics, and system designs, which are based on the idea that a rather simple iterative process may produce highly complex patterns: The concept of fractal is somewhat ambiguous because fractal can be interpreted either as a self-similar entity or a system of the self-similar entities, or both (Shin et al., 2009a:1793-1794).

Fractal-specific characteristics include self-similarity, self-organization, self-optimization, goal-orientation, dynamics and vitality (Warnecke and Hüser, 1993). Embodiment and implementation of these characteristics into the intelligent enterprise give such advantages as flexibility, co-operability and adaptability (Ryu and Jung, 2004:319).

Properties of Fractals: Different points originated from same fractal are not dependent from previous points. Essential features of fractals are summarized as follows (Warnecke ve Hüser, 1993; Jingwen, 2011:1; Pavlovich, 2009:51; Shin et al., 2009b:1032):

- self-similar and provide services
- proceed self-organization in two ways:
 - Operative way: procedures are optimally organized with suitable methods
 - Tactical and strategic way: fractals determine, formulate, and try to achieve their goals dynamically and autonomously. Fractals also regenerate, restructure and evaporate themselves
- goal-oriented; the goal system composed of the coherent combination of individual goals is free from contradictions while attaining the objective of achieving corporate goals
- dynamics, fractals should be networked through efficient information and communication systems through they are spatially distributed
- its parts have the same form or structure as the whole, except that they are on a different scale and may be slightly deformed
- its form is extremely irregular or fragmented, and remains so, whatever the scale of examination is
- contain "distinct elements" whose scales are very varied and cover a large range
- have the same degree of irregularity on all scales, and look the same whether examined close up or far away
- fractals are shapes that are systematic even when their components are uncertain in outcome and form
- have a fine structure, i.e., details on arbitrarily small scales
- too irregular to be described in the traditional geometrical language, both locally and globally
- self-similar (at least approximately or stochastically)
- defined in a simple way, perhaps recursively
- have formation by iteration and fractional dimension and
- create unlimited number of figures at the finite space.

3. FRACTAL ORGANIZATIONS

Fractals are a category of complexity theory models that might effectively be used by organization scientists as they conceptualize emerging patterns occurring across levels of analysis. Some authors proposed that fractals in an organizational context would imply the occurrence of similar patterns across organizational levels (Black et al., 2007:425). A fractal approach differs conceptually from existing methods in highlighting nonlinearity and recognizing endogenous and stable sources of apparent unpredictability (Farjoun and Levin, 2011:825).

Fractal organizations are composed of self-similar entities, referred to as fractals. Decisions are made through cooperation and negotiations with associates that each have an equal responsibility. The role of each fractal changes, depending on the circumscribing status of the dynamic and turbulent environment. The structure of fractal organizations can be regarded as a hybrid type of structure. However, fractal organizations can change their structure, operational policy, and even strategy dynamically and flexibly in order to perform specific missions (Ryu and Jung, 2004:317).

In fractal organizations, system flexibility and responsiveness are achieved by allocating all resources into multifunctional cells that are capable of processing a wide variety of products (Saad, Lassila, 2004:3529). Fractal organization is open, self-organized, reconfigurable, self-contained and acquired its being phenomenon. An organization's vision, beliefs, symbols, values and purposes provide not only employees' perception about the organization's reason for being but also exchange this to people's existence.

Table-1: The Differences Between Hierarchical Organizations and Fractal-based Organization

	<i>Hierarchical Organization</i>	<i>Fractal-based Organization</i>
Structure	Hierarchically structured once only, at a specific point in time	Subject to a constant process of change (dynamically restructured)
Entity relationships	Administrative higher unit and passive lower units	Coordinative higher fractal and active lower fractals
Task processing	Perform tasks according to specified objectives	Perform tasks through goal-formation process
Unit function	Each unit has its own functions according to its position and role	Every fractal has same functions but its roles can be dynamically changed
Adaptability	Suitable for a stable environment	Suitable for a turbulent environment
Flexibility	Inflexible	Flexible

Source: Kwangyeol Ryu, Mooyoung Jung (2004), “Fractal Approach to Managing Intelligent Enterprises” in **Creating Knowledge Based Organizations** (Eds. Jatinder N.D. Gupta, Sushil Kumar Sharma), Idea Group, p.315, <http://books.google.com.tr/books?id=7aHM3hjWsjUC&lpq=PA319&dq=fractal%20organization&hl=tr&pg=PA348#v=onepage&q=fractal%20organization&f=false> (Accessed 20.6.13).

Fractal organization provides enormous flexibility because each cell can produce nearly every product (Montreuil, et al., 1999:501). The fractal organization requires some drivers such as learning, inquiring, considering the business as a whole soul, self-regularity, cultural DNA, etc. Also fractal organizations try to solve the similarity-differences paradox in business, discuss the recent meaning of authority and hierarchy, mention about copying all parts both similar and different and focus on “spontaneity” and explain nonlinear behaviour. Getting fractal of organizations forces managers to change their paradigm. This paradigm is “the total is the bigger than all alone parts”. This refers to importance of synergy. Fractal organization managers have higher uncertainty tolerance.

4. DISCUSSION

The need of the time is to alter our thinking from a linear and sequential base to a whole-body or systems base. Adopting a fractal view of organizations brings into focus a new and powerful body of organizational knowledge. A level of organizational dynamics is revealed that is unavailable with the use of

conventional organizational seeing and thinking. In the rapidly changing world, such insight could spell the difference between business failure and business success. Routine management tasks such as strategy formulation, cost cutting, process redesign, product formulation, management of change and leadership development can be conducted anew with powerful and innovative insights, unavailable when management is approached traditionally through a linear and sequential thinking approach (Malik, 2004:99).

In fractal organization, every fractal must be able to perform its task independently and, at the same time, each fractal must engage in constant integration by transferring the relevant information. Although each fractal in a complex system is independent in its ability to function, this functioning is meaningless without constant integration with the system as a whole. An effective knowledge management processes apparently constitute the basis for the ability of the complex adaptive system to respond rapidly and effectively to the environment and that the fractal structure of the complex adaptive system is a condition for the organization's ability to manage knowledge effectively (Shoham and Hasgall, 2005:225-236).

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