Chapter 10

The Dynamic Usage of Models (DYSAM) as a Theoretically-Based Phenomenological Tool for Managing Complexity and as a Research Framework

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ABSTRACT

In this paper, after recalling some fundamental concepts used in the science of complexity, we focus on theoretical and applicative cases of interest for the science of management of complex systems, where processes of emergence occur with the acquisition of new properties. The tool proposed is the DYnamical uSAge of Models (DYSAM). Within this framework we then focus upon a) the theoretical difference between growth and development; b) the sustainability of development rather than of growth as originally introduced in the literature; c) the concept of long tail (when, after initial large volume sales, low-revenue and infrequent buying may become a very important percentage of the entire business) as in telecommunications and management of long-tailed systems; d) non-reductionist management of complexity not reduced to solutions, and e) a future line of research to model processes of emergence.

INTRODUCTION

The Science of complexity or *Nonlinear Science* introduced a variety of approaches providing a conceptual framework for modeling and studying complexity in Management.

In the first section we introduce the concepts of the constructivist role of the observer, the theory of *logical openness,* the concept of *coherence,* Multiple Systems and Collective Beings, and DYnamical uSAge of Models (DYSAM). Those concepts allow one to introduce the reader, in the second section, to discussions of new, possible and concrete approaches such as the Dynamic Usage of Models (DYSAM) dealing with the difference between growth and development, and the concept of *Long Tail* in business. Third and fourth sections refer specifically to sustainability and the peculiari-

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ties in the management of complexity. Fifth and sixth sections present distinctions between the management of complex and non-complex phenomena. Seventh section presents a possible line of future research as introduced in the literature. The Appendix introduces precise definitions of Linear, Linearization and Approximation for the reader. This paper focuses upon new theoretical approaches for dealing with and modeling complex systems as well as processes of the acquisition of new properties.

BACKGROUND

Various approaches have been introduced in the literature for dealing with *complex systems* intended as systems where processes of self-organization or, better, emergence occur leading to the acquisition of new properties.

Indeed, systems do not only *possess* properties, but are also able to *acquire*, i.e., make emergent, new ones. Examples of the emergence of systemic properties in complex systems are a) the acquisition of properties such as collective learning abilities in social systems such as flocks, swarms, markets, firms, industrial districts and, in physics, superconductivity and lasers; b) behavior in natural and artificial systems; and c) functionalities in networks of computers (e.g., the Internet). We focus upon some crucial aspects to be necessarily considered in modeling such phenomena and the importance of *managing social complex systems*. The aspects considered are:

The Constructivistic Role of the Observer

In the scientific literature systems are traditionally described as entities established by interacting elements able to *acquire* in an *objectivist way*, i.e. observer independent, properties which their component elements do not possess. The *necessary and sufficient conditions* for establishing this phenomenon is assumed to be that elements as *designed* (for artificial systems) or *represented* (for natural systems) by the observer, interact in a suitable way, for instance when an electronic device acquires properties, i.e., functionalities, when *powered on* allowing individual electronic components to interact.

Moreover, two conceptually different cases may be considered (Guberman & Minati, 2007):

a) Systems are considered *as given* in an *objectivist* way when they are artificially designed, i.e., the component parts and how they interact are known in advance because they are designed in a certain way.
b) Systems considered in a *constructivist* way include natural systems, i.e., which have not been artificially designed. In this case the observer decides upon a suitable level of description to be applied (i.e., by considering what should be considered as components and interactions) to the systems, *as if they had been designed as such*. Observers constructively model phenomena *as systems* (Butts & Brown, 1989; von Glasersfeld, 1995).

In this view, the observer becomes generator of *cognitive existence*, i.e., the observer does not distinguish between model and *real* system. In this case, the system *is* the model and is a cognitive strategy. The question is *how is it more effective to think that something is* (the model), rather than to try to find out *what it really is* (the latter case is a particular case of the former).

The observer is theoretically part of the phenomenon itself as for a) *uncertainty principles* based on the model and the level of description adopted; b) cognitive science when science studies itself; and c) *second order cybernetics* when the system is not only able to *regulate* itself by using rules, but also by *producing* new rules, for instance, through learning.

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