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Chapter III

Toward an Autopoietic Approach for Information Systems Development

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INTRODUCTION

Several weaknesses of information systems development methodologies have been identified and studied in the recent years. These weaknesses can be viewed from different perspectives such as:

- **The characteristics of the outcomes, i.e., information systems**: The current methodologies are producing systems with rigid and inflexible that are difficult to maintain and to evolve (e.g., Loucopoulos, 1991).
- **The degree of the domain-independence**: There is a gap between the way system development methodologies in the mainstream of scientific and technical literature and the way they are carried out in real life situations. This is mainly due to the domain-independence of most of these methodologies (Bansler & Bolker, 1993, Vessy & Glass, 1998).
- **The conceptual and philosophical bases**: The dominance of the functionalistic view in the most of current methodologies (Hirschheim, Klein & Lyytinen, 1995, Iivari, 1991, Iivari, Hirschheim & Klein, 1998).

In addition, most of information systems development methodologies underutilize the richness of concepts and insights provided by new and emerging theories such as autopoiesis, self-organization, and fuzzy logic. Moreover, they do not accommodate the new emerging information systems and technologies such as component and framework technologies, web-enabled information systems and ERP.

To this end the objective of this chapter is to introduce a new approach[1] to information systems development based on the theory of autopoiesis as a theory of living system in particular (Maturana & Valera, 1980), and as a theory of system building through self-referential closure in general (Luhmann, 1990, Luhmann, 1995, Luhmann, 1986). Among the salient features of this approach are the following:

- Information Systems Development (ISD), in the first place, is more than a problem-solving activity, the assumption adopted by most of methodologies developers; rather it is the process of enhancing the "*structural plasticity*" [2] of host system (e.g., an enterprise) through the utilization of the information technologies. In other words, it is the process of building the necessary mechanisms that support the "*structural coupling*" [3] between the host system and its environment. Therefore, it provides a *perspective* view to the EIS rather than the conventional *descriptive* one.
- It introduces the concept of structural plasticity of information system by subordinating its structure to the function required and allowing the information system structure to be seen as an emergent order that is dynamic and constantly changing.
- It accommodates the salient feature of autopoietic systems, namely, the simultaneous *organizational closure and structural openness*.

The chapter is organized as follows. Section II outlines the emergent characteristics of contemporary enterprises and their information systems. Then the system-theoretic concepts of autopoiesis and its extension to social system are introduced in section III. In section IV these concepts, together with the Patte's principle of semantic closure, are used to redefine the information system and its goal as "*the system that support the creation, storage, and maintenance of the "negotiated meanings" about the things in the enterprise's cognitive domain through a network of recurrent communication*". Section V outlines the implications of the proposed approach for information systems development (ISD) methodologies. Section VI, summarizes the chapter.

THE EMERGENT PROPERTIES OF ENTERPRISES AND THEIR INFORMATION SYSTEMS

Fast pace of technological changes, global competitions, and the knowledge-based economy are among the most influential characteristics of the contemporary business environment. Moreover, unpredictability, changes and uncertainty seem to be the only facts of life.

In order to survive and prosper in such harsh environment, enterprises strive to adapt new and radical organizational forms and management practice that encourage novelty, innovation, flexibility and responsiveness, and facilitate change. Traditional, hierarchical and Tayloristic management principles seem incapable of inducing such combination of survival factors.

The evidences of this paradigm shift can be observed in many domains. In the domain of management, new organizational forms have appeared under variety of names: 'adaptive', 'dissipative', 'imaginary', 'hybrid', 'flex-firm', 'virtual', 'semi-