Chapter 2.8
System Approach to MIS and DSS and its Modeling within SD

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ABSTRACT

In this chapter, the authors discuss system dynamics (SD) as a research methodology in Information Systems (IS). The goal is to demonstrate the usefulness of SD methodology in research and its implementation in IS and management Information Systems (MIS). The authors briefly discuss the fundamentals of SD methodology models and causal loop diagrams (CLD) as well as model validation. The usefulness of this transdisciplinary methodology has been demonstrated with the case of the quality of IS success and satisfaction. Some examples of modeling for public decision assessment of sustainable development as well as inventory control using SD have been demonstrated. The advantage of SD is in its natural language problem definition, which can be easily transformed into a directed graph that is convenient for qualitative and quantitative analysis in computer programs. SD enables studying the behavior of complex dynamic systems as the feedback processes of reinforcing and balancing loops.

INTRODUCTION

In this chapter, we discuss research methodology in information systems (IS) or, more precisely, in management information systems (MIS) within system dynamics (SD). IS is highly relevant and its problems are very complex; therefore, a variety of research methodologies addressing this field has been developed. This variety of approaches is conditioned by the context of the IS and the perspectives of the authors. IS plays the most important role in all living and technical systems. It provides communication among elements and

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environments in the course of achieving goals, or maintains the reference values of the state variables. Without feedback and anticipative information, the functioning and developing of the systems would be impossible. However, depending of the nature of the systems, there are enormous differences among the types and complexities of IS.

In living systems (biological) or organizational systems (human-made), the main purpose of IS is to provide for the functioning of the system and, as such, it is an inseparable part of it. IS is a set of interrelated elements that can gather, store, process and retrieve information. IS consists of information inputs, state and outputs. Without this control, learning and adaptation are impossible. For research purposes, it should be considered as the part of the whole with the goal of providing functionality of the whole.

Without intending to have a deeper elaboration of the historical evolution of different IS at different phenomena, we would merely like to point out that all information systems are relations of special elements defining information subsystems with the purpose of providing communication within the system. When we refer to IS, we consider the information subsystems and research methodology that we used, and we have in mind the methodology that considers all relevant aspects of the whole system. For example, one of the established methodologies is the System Approach (SA). SA methodology was discussed in greater detail in (Ackoff, 1998, Kljajić & Farr, 2008).

The following text will be limited to the IS that is part of human-made organizational systems: enterprise, government organization, global organization, etc. The goal of IS in all these organizations is to provide control (management) of the system. Due to task and information processing ability, the IS in organizational systems have hierarchical structures, starting with Transaction Processing Systems, followed by MIS, Decision Support Systems (DSS) and ending with Executive Information Systems at the top of hierarchy (Laudon & Laudon, 1988). A similar classification can be found in (Ackoff, 1969): Data Processing, MIS, Decision-Making and Support System and Management System on the top. By analogy, a similar classification could be found in living systems: the central nervous systems with the brain at the top, followed by the spinal cord and with the peripheral nerve systems. Each of the levels has local tasks and autonomy in order to facilitate data processing but is harmonized with the whole IS and within its own system. With organizational systems, IS consists of ICT, Software and Specialists who take care of the good functioning of IS and users.

Our main attention will be devoted to the IS of organizational systems. Even within organizational systems, there is great diversity from small and medium-sized enterprises (SME), large enterprises, government as well as global internet-oriented IS. As the backbone of the systems, IS has impact on individuals, groups, organizations and markets (Georgantzasa & Katsamakas, 2008). The success of an organization is proportional to the quality of IS. Therefore, much research effort has been devoted to the research methodology of the development, maintenance, user acceptance of IS and user satisfaction with IS. However, thus far there are no commonly accepted methodologies to predict that success of IS development project. From the Web of Science (WoS Expanded, 2011) we found 21,280 articles with "information systems" in the title and 1,516 articles with Quality and Success of IS. When we looked for IS&MIS we found 2,150 articles, IS(s)&MIS=901, and IS&DSS=479.

Some of the most influential papers devoted to research methodology of IS are (Davis, 1989; Davis et al., 1989) and (DeLone & McLean, 1992, 2003). Davis described the method of the measurement "technology acceptance model" (TAM) for modeling user acceptance of information technology IT. TAM defines several variables (blocks) interconnected in causal order: external variables influence on Perceived Usefulness and