Chapter 4

The Importance of Systems Methodologies for Industrial and Scientific National Wealthy and Development

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ABSTRACT

The relationship between industrial and scientific knowledge and systems methodologies is discussed in this paper. As the measure of the former on the macro level, Gross Domestic Product (GDP) is assumed to be the consequence of systems' Research and Development (R&D), which is estimated indirectly by the number of articles published in academic journals in the last 40 years. It is assumed that Production, Management and Information Systems (IS) can be considered suitable main representatives of the quality of organizational processes and that GDP is their consequence. In turn, the Systems Approach (SA), Systems Engineering (SE), Operational Research (OR), Information Systems Development (ISD) and Simulation represent the methodology set for coping with organizational complex processes. We looked for the articles containing the aforementioned variables as topic keywords in core scientific databases. Results show a sufficient correlation between the number of publications and the GDP.

INTRODUCTION

The fact that “complex systems” is one of more frequently-used terms in scientific literature indicates its importance. Our goal is to analyze the proportion of methodology and process aspect devoted to this subject in scientific journals. This is library research based on WoS publications over the last 40 years. The aim is to clarify both the relevance of R&D as well as the methodologies that contributed to the development of complex systems. From the research point of view, human activity in order to gather new knowledge can be considered from two aspects: the subject of the research itself (process) and the methodology using different methods, tools and techniques for process analyses (Mingers, 2008).
With a conception of complex systems, we understood a system within which a complexity of interaction among system elements plays a main role. One of the most complex systems is human-made organizations. Organizational systems are complex because production, information, management as well as psychological, social, material, financial, and energetic relations interplay between subsystems and their surroundings. The goal and interests enforce characteristics and activities that condition systems behavior and its development. Decision making is the main force for the organization of harmonious development. It comprises different activities of R&D and management processes in order to control the desired behavior as well as anticipate future behavior. A decision-making problem is a complex one since we have to deal with complex information and “… the capacity of the human mind for formulating and solving complex problems is very small compared with the size of the problem” (Simone, 1957). For this reason, systems methodology and IS for decision assessment of complex problems should play a central role (Kljajić, 2000).

It is supposed that the quality of new goods is the consequence of market-driven R&D that, as a consequence, results in income as well as in published articles in relevant journals and conferences. We looked for articles that included topics such as: Production, Management, Information systems (IS), Simulation, Systems Approach (SA), Systems Engineering SE, Operational Research (OR), which sufficiently depict correlations with GDP and carrying information on sustainable development. It was supposed that Production, Management and Information Systems are the main representatives of quality of organizational process and that GDP is their consequence, while SA, SE, OR, ISD and Simulation represent well-established methodologies for coping with complex organizational process. The argument for this can, in part, be found in the paper (Hosman et al., 2008), in which the relations between investment in IS and its impact on GDP were analyzed. More detail about the meaning and definition of the abovementioned variables can be found in the papers (Mora et al., 2008; Petkov et al., 2008; etc.). In (Kljajić & Farr, 2008) it was found that Simulation and SA are far more dominant than other methods. In the same paper, the deep relationship among different methodological disciplines for complex systems development and maintenance is also discussed in depth. For example, SE is understood as a composition of SA and engineering of solutions for systems problems independent of the type of process. However, a SA can be also considered as an enhanced SE for complex problem solving, taking into account not only stakeholders’ requirements but also the environment’s requirements. That means considering a complex system from all relevant points of view in its environment during developing, maintaining and functioning. The reason for similarities and differences of methodology titles were discussed in Lazanski and Kljajić (2006). The role of the simulation methodology in the understanding of systems is constantly evolving and increasing. Currently, in modern organizations two words are dominant: change and learning, from which are derived “change management” and “learning management.” Human knowledge, the simulation model and decision methodology, combined in an integral information system, offer a new standard of quality in management problem solving (Simon, 1967). The simulation model is used as an explanatory tool for a better understanding of the decision process and/or for defining and understanding learning processes. An extensive study on using the simulation method in enterprises can be found in Gopinath and Sawyer (1999). Information systems and decision support is an important area in Management Information Systems (MIS), as a part of complex SE (Mora et al., 2008).

The main goal of this paper is studying the relationship between industrial and scientific national progress/development and systems methodologies. Others studies have researched the value of of them on particular projects (Baker &