IGI PUBLISHING **ITJ4016**

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This paper appears in the publication, International Journal of Information Technologies and The Systems Approach, Volume 1, Issue 1
edited by **David Paradice, Manuel Mora © 2008, IGI Global**

On the Study of Complexity in Information Systems

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ABSTRACT

This article addresses complexity in information systems. It defines how complexity can be used to inform information systems research, and how some individuals and organizations are using notions of complexity. Some organizations are dealing with technical and physical infrastructure complexity, as well as the application of complexity in specific areas such as supply chain management and network management. Their approaches can be used to address more general organizational issues. The concepts and ideas in this article are relevant to the integration of complexity into information systems research. However, the ideas and concepts in this article are not a litmus test for complexity. We hope only to provide a starting point for information systems researchers to push the boundaries of our understanding of complexity. The article also contains a number of suggested research questions that could be pursued in this area.

Keywords: *agent-based modeling; chaos; chaos theory; complexity, complexity theory, complex adaptive systems; decision support theory; distributed collaboration; emergence; general systems theory, inquiring systems; IS theory; organizational systems*

INTRODUCTION

This article reflects some thoughts of the editorial review board for the complexity area of this new journal. We are pleased to see a journal introduced whose mission is to truly emphasize a systems approach in the study of information systems and information technology. Within this area of the journal, we will focus on the issue of complexity. We think it is befitting of the area that this article was a group effort. Complexity has many aspects, and we are eager to receive submissions that are truly informed by a systems approach in general and a complexity perspective in particular.

In the sections that follow, we will outline some thoughts on what complexity is, what it can mean when used to inform information systems research, and how some individuals and organizations are using notions of complexity. We provide some comments on how organizations are dealing with technical and physical infrastructure complexity, as well as the application of complexity in specific areas such as supply chain management and network management

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to more general organizational issues. We offer these pages as a beginning of a dialog on the topic, not as an exhaustive or restrictive set of criteria. We believe the concepts and ideas in this article are relevant to the integration of complexity into information systems research and that, in most cases, some aspect of these topics will be apparent in future submissions. However, the ideas and concepts in this article are not a litmus test for complexity. We expect, and hope, that information systems researchers will push the boundaries of our understanding of complexity through their efforts, which they report in this journal.

COMPLEXITY CONSIDERED

Human life is frequently described as becoming more and more complex, and rightly so. It seems that the terms "complex" or "complexity" appear everywhere. In some part, this is because life really is complex! But this conclusion is also driven by the fact that over the last few decades, we have learned more about the nature of complexity and the role that complexity plays in our lives. Complexity is a feature of all living and natural systems. The approach we speak of has permeated the natural sciences as a way of understanding natural order. However, its application to human systems is to date fragmented.

A recent issue of the journal *Complexity* (Complexity at large, 2007) provides a glimpse of this phenomenon. The first seven pages provide an index into complexity studies from a wide range of disciplines. Here we find news about studies in biodiversity, weather prediction, stem cells, learning, gene therapy, battlefield operations, algorithm development, morality, neural activity in primates, topographical issues in anthropology, organ development, consciousness, robotic reasoning, human moods, and, appropriately, complexity measures. Presumably, the common thread in all of the articles referenced is some notion of complexity.

The focus of this area in the *International Journal of Information Technology and the Systems Approach* (IJITSA) cannot, unfortunately, be so broad. We must limit our scope to topics in information technology. That, however, will not be a serious constraint. The application of complexity theory to information system design, implementation, testing, installation, and maintenance is well within the scope of this IJITSA area. Fundamental issues related to definition, measurement, and application of complexity concepts are valid areas of inquiry. In looking at complexity in information technology, however, we cannot overlook the organizational structures that technology supports, in the image of which information technology is designed.

Information technology underlies and supports a huge part of the operations of modern organizations. By extrapolation, therefore, the role of information systems as they support complex organizational processes is well within our scope. Simon (1996) argued that complexity is a necessary feature of organizations and Huber (2004), in a review of management research, underscores the importance of recognizing that organizational decision making in the future will occur in an environment of growing and increasing complexity.

Indeed, information technology underlies a large part of life itself for young people today. Their lives are entwined in online social networks. They may have a "relationship" with hundreds of other people who they have never met. Their identity may be connected to online activities in ways that no other prior generation has ever experienced. Concepts such as "network" and "relationship" are fundamental to complexity. Investigations of information technology supported communities through a complexity theory lens are certainly within the scope of this area of IJITSA. But complexity and interdependency underlie "normal" social science as well. Granovetter's seminal work (1973, 1983) on "weak ties" in social networks remains a model today in social network theory (Watts, 2003). As well, Lansing's study of Balinese farming reflects a complex systems approach to traditional society (Lansing, 2006).

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