Association for Information Systems
AIS Electronic Library (AISeL)

December 2004

Who Should Be Blamed For Information System Failure? Integrating Systems Thinking Into IS Education

Vo van Huy
Ho Chi Minh City University of Technology

Bongsug Chae
Kansas State University

Who Should Be Blamed For
Information System Failure?
Integrating Systems Thinking Into IS Education

Vo Van Huy

Department of Information Systems

Ho Chi Minh City University of Technology

vhuy@sim.hcmut.edu.vn

Bongsug Chae

Department of Management

Kansas State University

bchae@ksu.edu

ABSTRACT

IS failure has been observed and documented in various literature. Many researchers have tried to understand the phenomenon by studying success or failure factors with a hope that IS professionals can learn from these lessons. It seems that these contingency factors are not sufficient to understand the whole picture of IS failure and its causes. We may need a further investigation of the problem from the root: IS education. In this paper, we argue that the problem with many IS failures is due to the design of the IS curriculum that lacks the idea of systems thinking. We suggest to incorporate systems thinking component into IS education as a long term strategy to deal with IS failure problem.

Keywords

MIS education, systems thinking, Interdisciplinarity, IS curriculum, IS failure

INTRODUCTION

IS failure[1] has been observed and documented in various literature (Barker, 2003; Bussen and Michael 1997). Many researchers have tried to understand the phenomenon by studying success or failure factors (Birks, 2003) with a hope that IS professionals can learn from these lessons (Lyytinen and Robey, 1999).

For example, Clemons (1995) found that reasons for BPR failures are unrelated to the technical ability of organizations to implement information system but to the organization's ability to understand its uncertain future strategic needs and its inability to make painful and difficult changes in response to these future strategic needs. Lorenzi and Riley (2003) have shown that reasons for IS failure include communication, complexity, organization, technology, and leadership and classified failure into four major categories: technical shortcomings, project management shortcomings, organizational issues, and the continuing information explosion. Lyytinen and Robey (1999) argue that organizations fail to learn from their experience in systems development because of limits of organizational intelligence, disincentives for learning, organizational designs and educational barriers. Their interesting finding is that organizations have not only failed to learn, but they have also learned to fail as organizational culture perpetuates short-term optimization. In a different stream, Mahaney and Lederer (2003) use the agency theory to explain the failure of information systems development projects that result in four main factors: contracts (outcomes), monitoring, goal conflicts, and task programmability techniques. Cule (2000) proposed a categorized framework of risks so that IS professionals may choose the appropriate managerial behavior to mitigate each of them.

In our view these contingency factors are not sufficient to understand the whole picture of IS failure and its causes as no conclusive evidence could be found from the literature. The success factors of IS implementation found in many researches do not ensure system success. Many of IS problems and failures can be attributed to organizational behavioral problems, rather than purely technical (Bostrom and Heinen, 1977). Bussen (1997) compared a failed case with the success factors documented from the literature and found that IS failure was due to broader issues than the narrowly focused factors suggested by the factor research approach. They include the social, cultural, political and economic context of the system as a whole (Bussen, 1997). To overcome this limitation of the factor approach, some researchers have proposed a comprehensive diagnostic framework and interpretive process for performing a diagnosis (Davis et al., 1992).

It is our view that we need a further investigation of the problem of IS failure from the root: IS education. As Lyytinen and Robey (1999) note that IS professionals commonly assume that their biggest challenge is to acquire new technical knowledge

---

[1] In this paper, IS failure is referred to both system failure and project failure, although later in this paper it implies curriculum failure.

and this is one of the sources that prevent IS professionals learning from IS failure. They call for reforming IS education to make the learning process effective to IS professional. In this paper, we argue that the problem with many IS failures is due to the design of the IS curriculum that lacks the idea of systems thinking. We suggest to incorporate systems thinking component into IS education as a long term strategy to improve IS professionals' capacity and to deal with IS failure problem.

The paper is organized into the following manner. We first view IS in organization as a complex system and IS as an interdisciplinary field. We then discuss the nature of many current IS curricula focusing on linear thinking and single perspective. We next review current trends of systems thinking and how they can be valuable to IS education in understanding the failure problem. Finally, we suggest some guidelines for how to incorporate systems thinking into IS education.

IS IN ORGANIZATION AS A COMPLEX SYSTEM AND IS AS AN INTERDISCIPLINARY FIELD

An IS in organization can be considered as complex as it consists of many different subsystems, involves human interactions, and interacts with the environments. Kay et al. (1999) outlined main features of general complex systems: non-linear behavior, hierarchical, self-organizing (internal causality), chaotic behavior and others. Relationships between IS and organization as well as its environment are often nonlinear, reflecting social interactions. An IS typically is hierarchical, as it consists of functional subsystems such as accounting, sales and marketing, personnel, and operations. The introduction of large scale information system into organizations emerges a non-linear complex system (Butterfield, 1998). IS within organizations rarely represents an equilibrium state (Dhillon and Ward, 2002). Therefore, IS in organization emerges to become complex social systems (Walsham et al., 1988) and often chaotic (Dhillon and Ward, 2002); IS becomes interdisciplinary in nature (Gorgone et al., 2002). IS deals with not only engineering and technology but also with organizational and social issues (Lyytinen and Robey, 1999).

However, the traditional approach to Management Information Systems (MIS) curricula development is technology-oriented (Williams and Heinrichs, 1993, Lyytinen and Robey, 1999, Romm and Pliskin, 2000). Many IS courses or curricula focus on technical skills (database, telecommunication, programming, etc.) at the expense of analyzing the impact of the technology on organizational structure, work, and people (Gupta and Wachter, 1998) and the connection of IS courses with "business/management" is tenuous (Mutch, 1996). Thus, many current proposed IS curricula lack the integrative and pragmatic IS education most demanded by business professionals (Gupta and Wachter, 1998, Lee et al., 2002, Lee et al., 1996, Zack, 1998, Burn and Ma, 1997). Consequently, IS students are often unable to view the problem of IS development in organizations from a multidisciplinary perspective.

SINGLE/LINEAR THINKING IN IS EDUCATION

Universities are traditionally organized into disciplines such as natural sciences, social sciences, business studies, etc. (Brewer, 1999). These are further divided into subdisciplines. Also currently accepted principles for university management and curricula development were created decades ago, and universities have tended to be closed systems where disciplines are isolated and independent (Takala et al., 2001). Consequently, higher education has failed on many new issues such as social complexity, cultural and economic globalization and increasing interdependences (Jenlink, 2001). Ackoff (1999b, p533) said: "neither nature nor society is organized as the universities are into disciplines." The way that universities are organized may create the false impression that real world is divided into the same parts. This fragmentation has not provided students with a unified view and application of subjects as expected by society (Houseman, 1979).

MIS programs are facing the same problem: students are required to learn a number of different subjects that are taught in a way that one subject is *independent* of other subjects. In most MIS programs, students are required to complete a series of technical core courses that exclusively focus on the concepts of a single technology discipline. For example, a computing curriculum (Turner, 1991) proposed 84% lecture hours for technical courses and only 8% for non-engineering subjects (e.g., social, ethical and professional issues).

It is not a surprise if IS professionals tend to take single perspective thinking in viewing and solving real world business problems. Taking a single perspective, an IS professional usually sees problems of organizations in the "hard systems" or in the lack of appropriate technologies and often propose some technology-based solutions. Single perspective thinking is often resulted from too much emphasis on specialization training that prevents the problem solvers from thinking "out of the box." Single perspective thinking can work well for technical or engineering fields but it can defeat problem solving in MIS as a social science.

SYSTEMS THINKING

A system is a complete entity that consists of two or more parts with relations to each other and to an environment. Systems thinking is based on systems approach in which the whole is more than the sum of the parts and every part has an effect on the system behavior. In messy environments, many authors (Senge, 1990; Checkland, 1981; Mitroff and Linstone, 1993) would propose systems thinking as a foundation for problem solving. Systems thinking means seeing things as a whole or holism. Although using the same terminology, different authors approach systems thinking based on different concepts and paradigms. In the remaining section, we focus on three schools of systems thinking among a large number of research and practice streams in systems thinking (Jackson, 2003).

Senge's Systems Thinking & System Dynamics

Senge's (1990) systems thinking is based on system dynamics paradigm (Forrester, 1961), in which feedback loops, delays, and non-linear behavior or relationships are emphasized. System dynamics (SD) is a methodology for modeling the structure and behavior of complex systems (Forrester, 1961). It has successfully been applied to solve complex problems in a variety of environments: world (world dynamics), city (urban dynamics), organizations, groups, and individuals (Sterman, 2000). Vennix (1996) applied system dynamics to group model building, which serves as a basis for a group decision support system (GDSS). In system dynamics, modeling generally goes through two stages: qualitative and quantitative (Forrester, 1961; Wolstenholme, 1990). The quantification process is emphasized because without quantifying the relationships between the variables, qualitative modeling fails to identify the system elements that produce the dynamic behavior of complex systems (Forrester, 1971).

Problem solving in system dynamics (SD) involves six steps: describe the system, convert description to level and rate equations, simulate the model, design alternative policies and structures, educate and debate, and implement changes in policies and structure (Forrester, 1961, 1994). Senge's (1990) systems thinking concept based on system dynamics methodology is a conceptual framework, a body of knowledge and tools that has been developed to make the full patterns clearer and to help us see how to change them effectively. The important tool of Senge's systems thinking is archetypes, which are the patterns of behaviors of some common social systems. These patterns are based on experiences learned from a great number of system dynamics models (Forrester, 1971, 1994). Some interesting archetypes are "limits to growth," "shift the burden," "tragedy of the common," and "fixes that backfire." In addition to these archetypes, Forrester (1971) observed that some behaviors of complex systems are counter-intuitive and created some rules of thumb that are helpful for systems thinkers. Some examples are:

- Today's problems come from yesterday's solutions[2]
- The harder you push, the harder the system pushes back
- Behavior grows better before it grows worse
- The easy way out usually leads back

Checkland's Soft Systems Methodology

Systems thinking that uses the soft systems methodology or SSM (Checkland, 1981) was devised to deal with ill-structured problems. A problematic situation should be viewed from its history and background. The SSM analyzes the systems with two streams: logic-driven and culture-driven, which consider the social and political contexts of the problem situation. The interaction of the two streams helps to understand the problem. The logic stream consists of identifying relevant systems, modeling these systems, comparing models and real world, and determining desirable and feasible changes based on cultural analysis. To assist identifying systems, SSM proposes to use CATWOE elements, which stand for customers, actors, transformation process, worldview, owner, and environmental constraints.

Checkland's systems thinking tries to avoid reductionism that is inherent in natural sciences where analytical methods are dominant. SSM promotes systems thinking as it allows to view a problem from multiple views and accept that there are multiple realities of a problem. Checkland's approach is also similar to Forrester's system dynamics approach in the sense

---

[2] For example, the structure of disciplines in a university was a solution in the past but maybe a problem now.

that systems thinking is involved with building conceptual models of the problem that can be compared with real world situation. SSM is distinct due to its underlying assumptions (Checkland, 1981).

Mitroff & Linstone's Systems Thinking

The Unbounded Systems Thinking (UST) or the multiple perspectives approach (Mitroff and Linstone, 1993) modeled after Churchman's Singerian inquiring system (Churchman, 1971) has been used effectively to understand complex issues in messy environments. Mitroff and Linstone identified three most typical perspectives to view a messy problem: T is the Technical Perspective; O is the Organizational or Societal Perspective; and P is the Personal or Individual Perspective. Mitroff and Linstone (1993, p98) believed that "each perspective reveals insights about a problem that are not obtainable in principle from others."

According to Mitroff and Linstone (1993), there is no neat T perspective methodology for problem solving in messy environments. From the technical perspective (T), traditionally a problem should be formulated objectively and quantitatively, which disregards human and organizational factors. This perspective tends to produce a solution to a problem that people will eventually resist implementing. Scientists tend to emphasize the Technical Perspective while leaders favor the Personal Perspective and other stakeholders call for adopting the Organizational Perspective. In a messy environment, problems can hardly be solved if a single perspective is taken; thus, we need to sweep-in other perspectives than T into problem structuring until the problem can be understood and agreed upon. There is no limit in the sweeping-in process. "Every discipline, profession, way of knowing so as to give the broadest possible view of any problem" (Mitroff and Linstone, 1993, p.109) can be swept in. In this sense, we consider UST offering the broadest term of systems thinking that is to see the whole thing from any possible angle.

INCORPORATING SYSTEMS THINKING INTO IS EDUCATION

IS courses can be classified into three types: technological, supporting (social sciences or business administration), and MIS. Technical courses may include some purely technical courses (such as computer architecture, data structure, operating systems, etc.) that have their origin in computer science and foundation courses (such as database, visual programming, software engineering, system analysis and design etc.) that are supposed to be used in later MIS courses. MIS courses (such as e-commerce, software project management, decision support systems, etc.) are supposed to integrate with knowledge in other related fields. Supporting courses consist of tools and organizational functional courses. Accounting, statistical methods, quantitative methods are tool courses that can be taught in a conventional manner: lecture, exercise or problems and tests. Social science courses that study the psychology and behavior of individuals and groups can also be taught in conventional manner, but students generally have difficulties in integrating these topics with IS courses without real life experiences. Also, we maintain that in many IS curriculum, students are generally lacking systems thinking courses that teach the general picture of management and organizations. In this kind of courses, students or participants learn how to generate ideas, how to build a theory of their own, and how to test an idea to understand the complex nature of organizations (Lyytinen and Robey, 1999).

The incorporation of systems thinking perspective into IS education should be done via two stages. In the first stage, we need to integrate contents of cross-disciplinary subjects of management and organizations into one interdisciplinary course. This kind of courses may potentially be involved with multiple subjects, but emphasis is dependant on course designers. In the second stage, we need to integrate systems thinking tools or framework that is available in the literature into the course. As presented earlier, Senge's systems archetypes/Forester's system dynamics, Checkland's SSM, and Mitroff and Linkstone's UST are exemplars of such tools or framework. These stages are combined into a methodology for designing IS education.
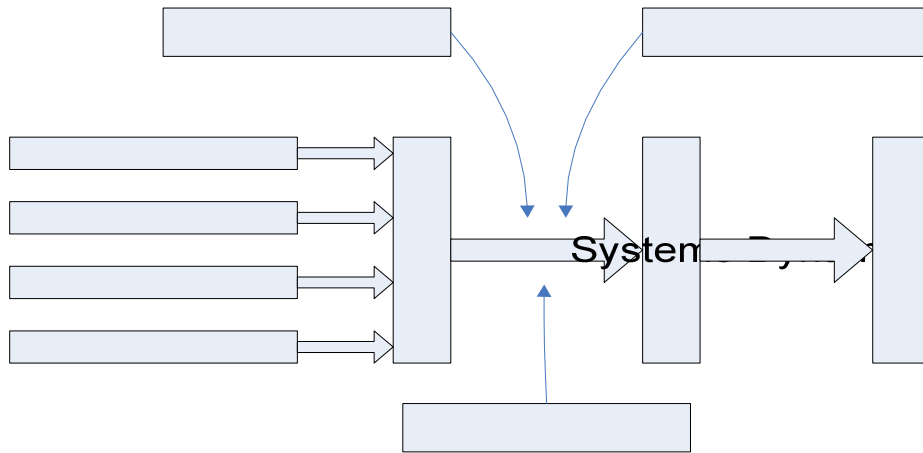
Figure 1. Incorporating Systems Thinking Into IS Education

Integrating Contents of Cross-Disciplinary Subjects into One Interdisciplinary Course

To provide students with cross-disciplinary contents for the first stage, four general strategies can be adopted: content analysis, combined courses, integrative cases (Michaelsen, 1999), and action research.

In the first strategy (or content analysis), faculty tries to understand other disciplines to a level at which they can explain conceptual linkages with other issues or subjects. The advantage of this strategy is its simplicity, little efforts of coordination, and easy to implement. Its major disadvantage is lacking students and faculty's enthusiasm. The second strategy is using a faculty team to teach multiple cross-disciplinary courses. Its advantage is better effect on student learning as it tries to develop a conceptual framework of cross-functional issues via interactions among faculty. The second strategy may create more problems than the benefit it can offer, because it requires high level of faculty effort for building things from scratch, coordination, and conflict resolution. Students often see more problems in this approach than the benefit that they can receive: the big picture. Integrative case approach is the most common due to its easy to implement without much trouble. The main requirement is to design the cases so that they can be used across multiple courses. This strategy also requires coordination but significantly less than in the combined courses.

Integrative case study seems to be the best candidate for teaching cross-disciplinary contents such as IS (Lyytinen and Robey, 1999, Romm and Pliskin, 2000). Case study has been a popular teaching method used extensively at business schools. Learners are often provided a case with a guideline or a framework for discussion. The normal approach to case method begins with a system description, followed by some guidelines and questions, the participants will be required to design alternative policies and structures. Case studies are often written in a descriptive mode that depends on observation, discussion and debate. Participants learn through analyzing, discussing about the case. Case study methods can enhance learners' mental models by exposing them to realistic or complex environment. Its advantage lies in ability to expose students to real world and critical issues (Burn and Ma, 1997).

One of the main weaknesses of the case method is that a recommendation for the case can never be tested. As a result, participants' mental models remain biased with untested assumptions or beliefs. Forrester (1971) identified several weaknesses of case study method: (i) no quantitative foundation; (ii) some implicit knowledge cannot make explicit; (iii) dependence on intuitive judgment for policy analysis; and (iv) difficulty to draw the dynamic interactions to come to conclusions or recommendations. Graham et al. (1994) has proposed model-supported case studies to overcome disadvantages of case study method.

The fourth strategy would be applying action research into IS education. Action research is "an iterative process involving researchers and practitioners action together on a particular cycle of activities, including problem diagnosis, action intervention and reflective thinking" (Avison et al., 1999, p. 94). A key characteristic of action research is that investigators try to fulfill the needs of their study subjects and, at the same time, generate new knowledge. This method has been successfully used in IS doctoral education (Kock et al., 2002), and was successfully adopted in the master level (Burn and Ma, 1997). In the undergraduate level, a capstone IT course (Gupta and Wachter, 1998) can adopt this method to integrate concepts which were previously treated elsewhere in isolation. A growing number of undergraduate IS programs have been adopting such an action-based capstone IS course through which both students and clients get benefits.

Integrating Systems Thinking Tools/Frameworks into IS Courses

Aram and Noble (1999) believe that the dominant models of learning and thinking in business schools are appropriate to the stable and predictable aspects of organizational life which is ambiguous and uncertain in nature. For the second stage, IS curriculum need to provide IS students with a dynamic picture of IS and organization and their interaction. System thinking in general and the three schools of system thinking in particular can make significant contributions to IS courses.

Foremost, integrating the general idea of systems thinking into IS courses can begin at the most entry level IS course, which is "Fundamentals of Information Systems"[3]. This is where business majors (including MIS majors) are exposed to the field of IS and learn the meaning of IS. In this sense, this entry level course would be very critical for reforming MIS education. Drawn from a long period of various IS studies, Hirschheim and Klein show that clearly there is a problem with non-IS practitioners' (and senior management) view of IS: they have a narrow, unrealistic image of IS and unrealistic expectations about what IS can and cannot accomplish.[4] Almost three decades ago, IS systems designers' narrow, static and functionalistic view of IS and organizations was attributed to IS failure (Bostrom and Heinen, 1977). Today this view is still dominant in many IT projects (Markus and Benjamin, 1997). The way the entry level IS course has been taught at most undergraduate programs can be attributed for such a functionalistic view of IS. The view of IS as complex systems, as we argue from systems thinking, clearly needs to be adopted. And other specific topics in this course (Laudon and Laudon, 2004) as well as advanced IS courses should be taught based on such an organic, holistic view of IS. This alternative view helps students consider information systems to be more than the sum of their socio-technical parts and to focus on the networks of relationships between the socio-technical parts.

In this regard Senge's system thinking/system dynamics can be used to help student look beyond the apparent mess presented by surface appearances to see if there are any underlying patterns of feedback loops that determine IS behavior. Occasionally, computer simulation techniques can help to tease out the effects that the relationships between parts and loops are producing (Jackson, 2003). Other methods such as causal loop diagram can be successfully used for IS courses (e.g., accessing students' understanding of IS, explaining various components of IS and their interactions) (Croasdell et al., 2003). In an advanced IS course such as Information Systems Planning and Project Management, Senge's systems thinking can be advanced to a higher level with quantitative foundation and simulation capabilities using Forrester's (1961) system dynamics methodology, where IS students and professionals can conduct experiments and make judgments. In other business-oriented IS courses such as Strategic Information Systems and Management of Information Technology, this system thinking can be a powerful tool for students to anticipate the organizational impacts of various IT-related decisions and actions such as outsourcing (McCray and Clark, 1999) and deployment of new IT projects (Lyneis et al., 2001).

Checkland' SSM has shown that the effective design of support systems, such as information systems, depends on a clear understanding of the purposeful activity that is to be supported in the higher order human activity system (Jackson, 2003). This is a significant advancement from such narrow, functionalistic views/understandings of IS development and management having been taught in intermediate and advanced IS courses such as Systems Analysis & Design, Database Design and Management and Advanced Systems Analysis & Design. For these courses, SSM can offer an excellent way of exploring purposes, using human activity system models to find out what is possible given the history, culture and politics of the problem situation. We can consider some specific tools in SSM: rich pictures, root definitions and conceptual models (Jackson, 2003). Rich pictures are actual drawings that allow the various features of a problem situation, as it is perceived, to be set down pictorially for all to see. They can be the bridge to the rigour of the logic-based stream of system analysis. By following, a root definition that includes CATWOE is formulated to explore the possibilities available for IT-based change in the problem situation given its history, culture and politics or what IS researchers call the installed bases (Star and Ruhlender, 1996), institutional contexts (Orlikowski and Robey, 1991) and formative contexts (Ciborra and Lanzara, 1994). Then, conceptual models are constructed to facilitate structured debate about the problem situation and any changes to it that might be desirable. This then can be further combined with existing modeling techniques for systems analysis and design. Also existing IS development methods such as MULTIVIEW (Avison et al., 1998) which adapted SSM are more practical and IS-

---

[3] For this discussion, we refer to Gordon et al's (2002) Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems 2002.

[4] They also pointed out that there is a significant disconnect between IS practitioners and researchers. The view by practitioners is quite distant from that suggested by IS studies using such theories as Structuration Theory, Actor Network Theory, Institutional Theory and Systems Thinking.

oriented than the original SSM could be taught in advanced system development courses and a capstone course combining with action research.

Mitroff & Listone's UST relying heavily on Churchman's work can serve as a useful tool for other IS courses in different ways. UST can be integrated into decisions support systems and its related IS courses such as knowledge management, data mining, etc. As an extensive survey of DSS literature (Eom, 2000) indicates, systems thinking has already made important contributions to the research and education of decision support systems. Recently, Courtney (2001) suggests the need of a new decision-making paradigm for DSS. His analysis indicates that conventional DSS have mainly supported technical perspectives only, not organizational or personal concerns. His proposed model based on UST can be a useful tool/framework in such IS courses to understand decision making and DSS (and Knowledge Management Systems) design and implementation issues through multiple perspectives including ethics and aesthetics. Ethics education has been recognized important for IS professionals (Mason, 1995, Boland, 1987, Walsham, 1993) and also Gorgone et al (2002) find strong ethical principles as one of four guiding assumptions about the IS profession.[5] However, ethics is rarely found in current IS curriculum and apparently no specific theoretical and practical methods/tools are available for ethics education for IS professional. The vacuum of ethics is a major danger for IS field (Linderman and Schiano, 2001). Recently, some authors have offered the potential of UST as a tool/framework for ethics education, particularly ethical DSS design (Chae et al., In Press). The introduction of ethical analysis tools or methods, such as the one espoused by Wood-Harper et al (1996) to IS courses is expected to lead to the increasing ethical awareness and principles among IS students.

Recently, IS Research has been dominated with behavioral science, while IS courses and practices are dominated with design sciences. UST is a potential base for solving the problem of the disconnection between IS practitioners and researchers. More integration between industry and academia can be achieved by unifying design science and behavioral science in IS research agenda. Design science should play a more important role in the IS profession (March and Smith, 1995, Hevner et al., 2004), particularly in academia to balance with current behavioral IS research stream. The results of this effort should be incorporated into IS courses. Action research can be a good strategy for this purpose. By this way, it is anticipated that IS practitioners' narrow, static and functionalistic view of IS will be overcome with more holistic and systems thinking one. The UST can provide IS researchers and IS curriculum developers with a framework of how to make a complete research circle between IS behavioral science and design science (Hevner et al., 2004). Both behavioral science and design science research should be incorporated into IS curriculum.

In summary, systems thinking offers an organic, holistic view of IT and allows to see complexity, interactions and change in IS. The three schools of system thinking in particular can offer useful tools/framework for and make distinct as well as synergic contributions to IS courses. In general, Senge's thinking/system dynamics serve a tool for explaining and predicting complex systems interactions in various IS contexts (e.g. IS project management, planning, use, and implementation). Checkland's SSM helps students understand the problematic situation correctly and explore the desired goals through the support of information systems. In this sense it can be an important tool for courses related to IS development and the application of emerging, complex technologies which require a significant organizational change. Finally, UST can offer some useful tools or methods for addressing multiple perspectives including ethics and aesthetics.

CONCLUSION

Systems thinking emerges as an important tool to tackle "messy problems" (Ackoff, 1999a) in today's dynamic environment. There are different schools of systems thinking based on different concepts and paradigms; but they all refer to seeing things as a whole – holism – within a framework that helps IS professionals deal with complexity in a holistic way. Systems thinking calls for an integrative, multiple perspectives approach to the problematic situation. This article proposed a two-stage methodology of integrating systems thinking into IS education and described what IS courses with systems thinking look like and how one can begin including it in IS curriculum. Importantly, the article calls for promoting systems thinking in IS education. Traditional thinking modes emphasize the rational, linear, efficient and functionalistic features while new ways of thinking should promote flexible modes such as interpretive, nonlinear, systemic, and creative thinking.

It is very important to reform IS education in the direction that emphasizes not only information technology content but also organizational problem solving (Lyytinen and Robey, 1999), individuals' concerns, political aspects, ethics, etc. The goal of reforming IS education is to help IS professionals effectively learn from failure. With the help of systems thinking, problems with many complex systems can be studied, modeled and simulated. It is able to make experience-based knowledge management the art of capitalizing on failures and missed opportunities (Jarke, 2002).

---

[5] While ethics is recognized as an important guiding assumption about the IS profession in IS curriculum 2002 the document does not include any IS course related to ethics education.

REFERENCES

1. Ackoff, R.L. *Ackoff's Best: His Classic Writings on Management* John Wiley & Sons, Inc., New York, 1999a.
2. Ackoff, R.L. "Disciplines, the Two Cultures, and Scianities," *Systems Research and Behavioral Science* (16) 1999b, pp 533-537.
3. Avison, D.E., Lau, F., Myers, M.D., and Nielsen, P. "Action Research," *Communications of the ACM* (42:1) 1999, pp 94-97.
4. Avison, D.E., Wood-Harper, A.T., Vidgen, R., and Wood.J.R.G. "A Further Investigation into Information Systems Development: The Evolution of Multiview2," *Information Technology & People* (11:2) 1998, pp 124-139.
5. Barker, T.F., Mark N. "ERP Implementation Failure: A CASE STUDY," *Information Systems Management*, Auerbach Publications Inc., 2003, pp. 43-49.
6. Birks, D.F.N., Syed Zailani, S.H.M. "Factors influencing GIS project implementation failure in the UK retailing industry.," *International Journal of Information Management*, 2003, p. 73.
7. Boland, R. "The In-Formation of Information Systems," *Wiley Series in Information Systems,* R. Boland and R. Hirschheim (eds.), John Wiley & Sons, Chester, 1987, pp. 132-142.
8. Bostrom, R.P., and Heinen, J.S. "MIS Problems and Failures: A Socio-Technical Perspective. PART 1: The Causes," *MIS Quarterly* (1:3) 1977, pp 17-32.
9. Burn, J., and Ma, L.C.K. "Innovation in IT Education - Practising What We Preach," *Information Resource Management Journal* (10:1) 1997, pp 16-25.
10. Chae, B., Paradice, D., Courtney, J., and Carol, J. "Incorporating an Ethical Perspective into Decision Support Systems Design," *Decision Support Systems,* In Press.
11. Chan, S.L., and Choi, C.F. "A conceptual and analytical framework for business process reengineering," *International Journal of Production Economics* (50:2-3), 1997/6/16 1997, pp 211-223.
12. Churchman, C.W. *The Design of Inquiring Systems: Basic Concepts of Systems and Organization* Basic Books, New York, 1971, p. 277.
13. Ciborra, C., and Lanzara, G.F. "Formative Contexts and Information Technology: Understanding the Dynamics of Innovation in Organizations," *Accounting, Management & Information Technology* (4:2) 1994, pp 61-86.
14. Clemons, E.K.R., Michael C. "Identifying sources of reengineering failures: A study of the behavioral factors contributing..." *Journal of Management Information Systems*, M.E. Sharpe Inc., 1995, p. 9.
15. Courtney, J.F. "Decision Making and Knowledge Management in Inquiring Organizations: A New Decision-Making Paradigm for DSS," *Decision Support Systems* (31:1) 2001, pp 17-38.
16. Croasdell, D., Freeman, L., and Urbaczewski, A. "Concept Maps for Teaching and Assessment," *Communications of AIS* (12) 2003.
17. Cule, P. "Strategies for Heading Off is Project Failure.," *Information Systems Management*, Auerbach Publications Inc., 2000, p. 65.
18. Dahlbom, B., and Mathiassen, L. "The Future of Our Profession," *Communications of the ACM* (40:6) 1997, pp 80-89.
19. Davis, G.B., Lee, A.S., Nickles, K.R., Chatterjee, S., Hartung, R., and Wu, Y. "Diagnosis of an information system failure: A framework and interpretive process," *Information & Management* (23:5), 1992/11 1992, pp 293-318.
20. Dhillon, G. "The Clinical Information System: A Case of Misleading Design Decisions," *Cases in Information Technology Management in Modern Organizations,* J. Liebowitz and M. HKhosrowpour (eds.), Idea Group Publishing, Hershey, 1997, pp. 275-287.
21. Dhillon, G., and Ward, J. "Chaos Theory as a Framework for Studying Information Systems," *Information REsource Management Journal* (15:2) 2002, pp 5-13.
22. Eom, S.B. "The Contributions of Systems Science to the Development of the Decision Support System Subspecialities: An Empirical Investigation," *Systems Research and Behavioral Science* (17) 2000, pp 117-134.
23. Gharajedaghi, J. *Systems Thinking* Butterworth-Heinemann, 1999.
24. Ginzberg, M.J. "EARLY DIAGNOSIS OF MIS IMPLEMENTATION FAILURE: PROMISING RESULTS AND UNANSWERED QUESTIONS*." *Management Science*, INFORMS: Institute for Operations Research, 1981, p. 459.
25. Gorgone, J.T., Davis, G.B., Vlacich, J.S., Topi, H., Feistein, D.L., and Longenecker, J., H.E. "IS 2002 Model curriculum and guidelines for undergraduate degree programs in information systems," *Communications of the Association for Information Systems,* 2002.
26. Gupta, J.N.D., and Wachter, R.M. "A Capstone Course in the Information Systems Curriculum," *International Journal of Information Management* (18:6) 1998, pp 427-441.

27. Heeks, R. "Information Systems and Developing Countries: Failure, Success, and Local Improvisations.," *Information Society*, Taylor & Francis Ltd, 2002, pp. 101-112.

28. Hevner, A.R., March, S.T., Park, J., and Ram, S. "Design Science in Information Systems Research," *MIS Quarterly* (28:1) 2004, pp 75-105.

29. Hirschheim, R.A., and Klein, H. "Crisis in the IS Field? A Critical Reflection on the State of the Discipline," *Journal of Association for Information Systems* (4:5) 2003, pp 237-293.

30. Houseman, C.A. "Disciplinarity or Interdisciplinarity?,"*Interdisciplinarity and Higher Education,* J.J. Kockelmans (ed.), The Pennsylvania State University Press, 1979, pp. 2-10.

31. Jackson, M.C. *Systems Thinking: Creative Holism for Managers* John Wiley & Sons, Ltd, Chichester, 2003.

32. Jarke, M. "Experience-based knowledge management: a cooperative information systems perspective," *Control Engineering Practice* (10:5), 2002/5 2002, pp 561-569.

33. Jenlink, P.M. "Designing Educational Systems for the Twenty-First Century," *Systems Research and Behavioral Science* (18:4) 2001, pp 283-285.

34. Kay, J.J., Regier, H.A., Boyle, M., and Francis, G. "An ecosystem approach for sustainability: addressing the challenge of complexity," *Futures* (31:7), 1999/9 1999, pp 721-742.

35. Kaye, G.R. "Information systems successes and failures: research findings from the compounding industry.," *Journal of Information Technology*, Routledge, Ltd., 1990, p. 73.

36. Kock, N., Davison, R.M., Figueiredo, A.D., and Cunha, P. "Can Action Research be Successfully Used in Information Systems Doctoral Research? A Panel Discussion," *Informing Science* (June) 2002.

37. Larsen, M.A., and Myers, M.D. "When success turns into failure: a package-driven business process re-engineering project in the financial services industry," *The Journal of Strategic Information Systems* (8:4), 1999/12 1999, pp 395-417.

38. Laudon, K.C., and Laudon, J.P. *Management Information Systems*, (Eighth Edition ed.) Prentice Hall, Upper Saddle River, NJ, 2004.

39. Lee, C.C., Kettinger, W.J., and Kuilboer, J.-P. "Market Segmentation of Information Systems Academic Programs," *Journal of Information Systems Education* (8:2) 1996, pp 57-65.

40. Lee, D.M., Trauth, E.M., and Farewell, D. "Critical Skills and Knowledge Requirements of IS Professional: A Joint Academic/Industry Investigation," *MIS Quarterly* (September) 1995, pp 313-340.

41. Lee, S., Koh, S., Yen, D., and Tang, H. "Perception Gaps between IS Academics and IS Practitioners: An Exploratory Study," *Information & Management* (40) 2002, pp 51-61.

42. Linderman, J.L., and Schiano, W.T. "Information Ethics in a Responsibility Vacuum," *The Data Base for Advances in Information System* (32:1) 2001, pp 70-74.

43. Lorenzi, N.M., and Riley, R.T. "Organizational ISSUES=change," *International Journal of Medical Informatics* (69:2-3), 2003/3 2003, pp 197-203.

44. Lyneis, J.M., Cooper, K.G., and Els, S.A. "Strategic Management of Complex Projects: A Case Study Using System Dynamics," *System Dynamics Review* (17:3) 2001, pp 237-260.

45. Lyytinen, K., and Robey, D. "Learning failure in information systems development.," *Information Systems Journal*, Blackwell Publishing Limited, 1999, p. 85.

46. Mahaney, R.C., and Lederer, A.L. "Information systems project management: an agency theory interpretation," *Journal of Systems and Software* (68:1), 2003/10/15 2003, pp 1-9.

47. March, S.T., and Smith, G.F. "Design and Natural Science Research on Information Technology," *Decision Support Systems* (15) 1995, pp 251-266.

48. Markus, M.L., and Benjamin, R.I. "The magic bullet theory in IT-enabled Transformation," *Sloan Management Review* (Winter) 1997, pp 55-68.

49. Mason, R.O. "Applying Ethics to Information Technology Issues," *Communications of the ACM* (38:12) 1995, pp 55-57.

50. McCray, G.E., and Clark, T.D. "Using system dynamics to anticipate the organizational impacts of outsourcing," *System Dynamics Review* (15:4) 1999, pp 345-373.

51. Michaelsen, L.K. "Integrating the Core Business Curriculum: An Experience-based Solution," *Selections* (15:2) 1999, pp 9-17.

52. Mitev, N.N. "The business failure of knowledge-based systems: linking knowledge-based systems and information systems methodologies for strategic planning.," *Journal of Information Technology*, Routledge, Ltd., 1994, p. 173.

53. Mitroff, I.I., and Linstone, H.A. *The Unbounded Mind: Breaking the Chains of Traditional Business Thinking* Oxford University Press, Inc., New York, 1993, p. 177.

54. Mutch, A. "Information Management: A Challenge for Business Education," *International Journal of Information Management* (16:6) 1996, pp 445-455.

55. Orlikowski, W.J., and Robey, D. "Information Technology and the Structuring of Organizations," *Information Systems Research* (2) 1991, pp 143-169.

56. Richardson, G.P. *Feedback Thought in Social Science and Systems Theory* University of Pennsylvania Press, Philadelphia, 1991.
57. Romm, C.T., and Pliskin, N. "How Can We Use Case Studies to Promote Soft Skills in IS Education," *Journal of Informatics Education and Research* (2:3) 2000, pp 1-10.
58. Senge, P.M., and Sterman, J.D. "Systems Thinking and Organizational Learning: Acting Locally and Thinking Globally in the Organization of the Future," *Modeling Learning Organization,* Microsoft (ed.), 1994.
59. Star, S., and Ruhlender, K. "Steps Towards an Ecology of Infrastructure: Design abd Access for Large Scale Information Spaces," *Infomation Systems Research* (7:1) 1996, pp 111-134.
60. Takala, M., Hawk, D., and Rammos, Y. "On the Opening of Society: Towards a More Open and Flexible Educational System," *Systems Research and Behavioral Science* (18:4) 2001, pp 291-305.
61. Turner, A.J.e.a. "Computing Curricula 1991," *Communications of the ACM* (34:6) 1991, pp 69-84.
62. Vargo, J.V. "Interdisciplinary Coursework - A Systems View," *Journal of Information Systems Education* (5:4) 1993.
63. Walsham, G. "Ethical Issues in Information Systems Development," The IFIP 8.2 Working Group Information Systems Development: Human, Social and Organizational Aspects, North-Holland, Noordwijkerhout, The Netherlands, 1993.
64. Walsham, G., Symons, V., and Waema, T. "Information Systems as Social Systems: Implications for Developing Countries," *Information Technology for Development* (3:3) 1988, pp 189-205.
65. Williams, G.A., and Heinrichs, L.R. "A Proposed MIS Curriculum Modeled on Anthony's Pyramid," *Journal of Information Systems Education* (5:3) 1993.
66. Wood-Harper, A.T., Corder, S., and Wood, J.R.G. "How We Profess: The Ethical Systems Analyst," *Communiations of the ACM* (39:3) 1996, pp 69-77.
67. Zack, M. "An MIS Course Integrating Information Technology and Organizational Issues," *The Data Base for Advances in Information System* (29:2) 1998, pp 73-87.