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Management Information Systems Education from A Systemic Viewpoint

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As a proponent of systems thinking and as an MIS educator, I am interested in assuring that systems thinking is (and remains) incorporated into MIS education, not nominally but truly in spirit. This paper reviews some of the highlights of the history of MIS education, with a view toward the identification and preservation of its systemic spirit.

KEY WORDS: management information systems; information; design; Ackoff.

1. INTRODUCTION

The field of management information systems (MIS) has had a variegated development in its relatively short life span. It started as a child of operations research and decision sciences in the late 1950s. In a couple of decades, it declared its independence and became a separate field. In its phenomenal growth since the 1970s, it has gone through a number of twists and turns that have taken it farther and farther away from systems thinking in some ways, while preserving the notion of systems at its core in other ways. As an MIS educator, I have found it quite a challenge to integrate systems thinking into MIS. While the notion of systems seems to be, at least nominally, one-third of MIS (the *S* in MIS), it occupies far less than one-third of the MIS literature in the academic world. I am not sure what place it occupies in the practitioner's world of MIS.

This paper reviews some of the highlights of the development of MIS from an academic viewpoint, especially as they relate to systems thinking. In the first section, I explore the concepts of information and information requirements as they relate to levels of systems. In the second section, I consider the various ways of interpreting "MIS" and the discrepancy between these viewpoints and management systems as expounded by one of the fathers of systems thinking.

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Information systems—as subsystems of management system—are discussed in the third section. The last section discusses the *process* of systems design as covered in the MIS literature vs. the way it is handled in the systems literature.

2. COMMUNICATION AND INFORMATION

We start with the very concept of information. In Chapter 9 of their *On Purposeful Systems*, Ackoff and Emery discuss communication concepts. The teleological framework defines communication in terms of the choice model, where the actor is confronted with choices (alternative courses of action), consequences (outcomes), and the probabilistic producer/product relationships between the two. These three are collectively referred to as the parameters of choice.

Communication is defined as the production of a message that changes one or more of these parameters. If the parameter changed is the

- probabilities of choice, then the communication is called *information*;
- efficiencies of choice, then the communication is called *instruction*;
- relative values of the outcomes, then the communication is called *motivation*.

During its first few decades, MIS concentrated on the first item above: information. This was done in the context of

- electronic data processing systems, which perform transaction processing functions and record detailed, factual data; and
- management reporting systems, which monitor the operational activities of the organization, providing summarized, factual information (feedback) to management.

Only during the last two decades has the field considered the second type of communication, namely, instruction-based. This has become known as the domain of expert systems.

The field of MIS never quite graduated to the third type of communication, namely, motivation-based. In a sense, this is the most important of the three parameters, for that is where everything begins. A system can produce the most comprehensive type of information, along with the most sophisticated set of instructions. But all of this presumes that the manager in charge cares about that information and that instruction. It assumes an incentive system in which rewards are tied to performance. Most of the time, this turns out to be an unwarranted assumption. Most of the voluminous reports provided by formal information systems are ignored by their intended users because they are perceived as irrelevant.

In its own defense, MIS may present either of the following arguments in favor of ignoring the motivational dimension.

(1) That motivation is a psychological issue and, therefore, outside of the proper realm of information systems. This justification is as valid as stating that modeling is a mathematical issue (or that design is an engineering issue) and therefore outside the proper realm of MIS—which is to say it is *not* valid.
(2) That the name of the field is (management) *information* systems and not (management) *communications* systems, to which the rebuttal would be, in that case, why does the field incorporate instruction-based systems, namely, expert systems?

An important reason for ignoring motivational types of communication goes far beyond motivation as a psychological phenomenon. It has to do with organizational structure and the notion of the hierarchy of objectives (Rahmatian, 1985). The choice model discussed above corresponds to reality only if we consider it hierarchically. An objective (i.e., a desired consequence or outcome) makes sense only in the context of the higher objective(s) toward which it is only a means. Consider an example. The objective of an advertising campaign may be to generate an increase in corporate revenues of $10 million. An information system is then set up to track the actual increase in revenues. This system may inform the manager that the advertising campaign actually produced $12 million in increased revenues. This would look like an unqualified success until we look at the higher objective, which is an increase in *net* revenues. If the above campaign cost $15 million, then it was really a failure with respect to this higher objective. MIS people are notorious for blindly and silently accepting whatever assignment that happens to have "plopped on their plates" (Weinberg, 1982) and avoiding the larger picture. Most MIS people never learned the creative use of the why-chain of questioning as illustrated in the following, more complex example. The following is a typical conversation between the user/manager ("User") and the technical MIS staff ("MIS").

User: Produce a report for me on the aging of backorders, showing all backorders sorted by date.
MIS: OK. When do you need it?

The following is the way the above conversation would take place if driven by the hierarchy of objectives.

User: Produce a report for me on the aging of backorders, showing all backorders sorted by date.
MIS: How do you intend to use it? (Which is a polite version of "why do you need this report?")
User: To assure that backorders get filled on a first-in/first-out basis (i.e., when stock gets replenished, the oldest backorder get filled first).
MIS: Are you afraid that the longer an item is left on backorder, the greater the probability that it will be canceled by the customer?
User: Yes.

MIS: Is our cancellation rate too high?
User: I don't know what our backorder cancellation rate is.
MIS: Do you want me to get some information on that first?
User: OK.

At this point, the MIS person would run a report showing the percentage of backorders that were canceled over a certain period of time. If this figure is considered too high, then the conversation may continue as follows.

MIS: It is not clear that our high backorder cancellation rate is due to lengthy duration (perception of excessive waiting). It may be due to other factors, such as the customer finding the same item at a lower price at one of our competitors while waiting to hear from us. Do you want me to see if there is any correlation between cancellation rate and backorder duration?
User: Yes.

Let's say that at this point the MIS person runs the correlation report and finds a high correlation between the two factors. The conversation continues.

MIS: So what we really need is a backorder shipping system that has priority built into it: when a shipment is received, the system brings up the records of all the backorders for the received item, sorted by order date. Moreover, the system forces the shipping clerk to fill orders on a first-come/first-served basis. Only you (the boss) will be authorized to override the system in assigning shipping priorities in special circumstances.
User: Yes, I think I like this system!

Note the multiple turns in motivation as we ascended the hierarchy of objectives. We started with a request for a report, based on hidden assumptions; we ended up with the request for a system, based on verified assumptions.

What changes in MIS curricula need to take place to prepare an MIS person for the type of thinking exemplified above? Given the variety of MIS programs in place, there is no pat answer to this question. However, regardless of the manner in which MIS curricula are implemented, it is obvious that more emphasis on systems thinking is desirable in an MIS curriculum. What I am recommending is a shift of emphasis from purely technical MIS considerations to combined managerial–technical considerations. In the purely technical MIS mindset, the only question that arises when an assignment is formulated is, "What is the best way of doing this?" while never questioning the "this." In the managerial–technical mindset, you take the given assignment and ask "Why is this necessary to be done in the first place, and aren't there better ways of reaching the same goal?"

3. MANAGEMENT SYSTEMS

A management system [as laid out in Chapter 6 of Ackoff's (1970) *A Concept of Corporate Planning* as well as in Chapter 6 of his (1981) *Creating the*

Corporate Future] is the backbone of any MIS. One expects MIS textbooks to base their entire structure on this type of framework and make all the other concepts and examples revolve around it. Not so. This is generally perceived as the outdated, boring part of MIS. A leading MIS textbook (Laudon and Laudon, 1998), which consists of over 700 pages, devotes exactly 2 pages (pp. 44 and 45) to MIS while extensively covering "cutting-edge" topics (such as neural networks and parallel sensor systems). Another popular text (Turban, 1999) talks around the MIS framework. It covers various topics such as types of management reports, the importance of measurement, and the stages of problem solving (Simon), but these are never integrated into a coherent framework.

On the positive side, how should an MIS text be written? The principal guidelines behind the design of the ideal MIS textbook would be as follows.

1. Define the organization as an open system (along with major systems concepts)
2. Discuss operational (resource conversion) vs. managerial (decision making) types of systems
3. Discuss the external stakeholders and their needs for
   A. Information (Who needs what information, and why?)
   B. Systems (What applications, driven by what technologies, with what attributes, would the users interact with?)
4. Discuss the internal stakeholders and their needs for
   A. Information (Who needs what information, and why?)
   B. Systems (What applications, driven by what technologies, with what attributes, would the users interact with?)

The above topics can be expanded to incorporate the various types of systems applications under the proper category. For instance, most expert systems are operational-level systems, while most decision-support systems are management-level systems. The one application that cuts across all the above categories is telecommunications.

5. Apply systems thinking to systems development itself: Discuss the processes and principles of systems development
   A. The stages of systems development
   B. The various possible approaches to systems development
   C. The management of the systems development process
6. Discuss managing systems once they are installed and operationalized
   A. Managing the staff
   B. Managing the hardware
   C. Managing the software
   Etc.

MIS has had a somewhat confusing identity, partially reflected in (if not

contributed by) its name. The term "management information system" has become a sort of Rorschach inkblot test in which different people project different contents into the same term. The following are among the possible interpretations of "MIS":

(A) a system that provides management with information,
(B) a system for managing information, and
(C) the management of an information system.

While related, these perspectives are not identical. The ideal MIS textbook needs to cover all three. In fact, most do. And yet, despite their apparent comprehensiveness, they miss some of the cornerstone concepts that systems thinkers associate with management systems, including the concept of *decision record:* the explication of all the assumptions behind the decision, along with the documentation of the analysis process leading to the decision (Ackoff, 1981). This is not to be confused with the familiar concept of database, which is an integral MIS concept. A database is collective, corporate memory of business transactions taking place in an organization. Ackoff's concept of a decision record can perhaps be renamed a decision-base. As a consultant, I know that most organizations I have dealt with never track the history of their past decisions. Hence, with a turnover in top management and/or board of directors, they tend to make the same mistake over and over. As an academician, I am not familiar with *any* MIS textbook discussing this concept.

In their effort to become a "jack of all trades," most MIS books end up being "master of none." It is perhaps due to these difficulties that the field of MIS has experienced a shift to a new name: "information technology (I/T)." This is indeed a clever name change. With the emphasis now being on technology (tools), the field is no longer obligated to deal with the complicated issues of management and decision making. The new emphasis is on tools and their capabilities. After all, bits and bytes are so conveniently measurable. Two repected MIS researchers (Laudon and Marr, 1994) use MIPS (million instructions per second) as their operationalization of "installed I/T capital" in testing the hypothesis that there is a relationship between productivity in organizations and installed I/T capital. The complex manifold of issues associated with the planning, analysis, design, implementation, and evaluation of information systems is thus reduced to a single, convenient measure: MIPS.

4. MANAGEMENT INFORMATION SYSTEMS

The official party line of MIS is this: to make decisions, managers need information. From this was born the naive and simplistic view that what stands between problems and solutions is facts, and only if managers have the right information will problems be solved. The factor completely ignored in all this

is *how* managers use (or fail to use) the information received: how their mental models and hidden assumptions influence the way they use information. The complexities of interpreting information somehow got lost in the shuffle. If factual information were indeed the sole determinant of decision outcomes, then one would be at a loss explaining contradictory prescriptions proposed for the same situation, such as by democrats/republicans, conservatives/liberals, etc.

The fundamental paradox of decision making is this: Decisions are always about the future consequences of present actions, whereas (factual) information is always about the past. Databases store data about what has happened, whereas the decision maker needs to know what *will* happen if ... and how to evaluate this possibility meaningfully. The only bridge linking the past to the future is through statistical/mathematical/logical modeling, which may be called *relational information.* Decision support systems and expert systems do deal with relational information. That much credit should be given to the filed. The failure lies in ignoring the decision maker's mental model of the situation and his/her hidden assumptions. Mason and Mitroff's profound *Challenging Strategic Planning Assumptions* never quite made it to the MIS mainstream. If decision making were simply a matter of receiving the right information and using it in the right way, that would mean the elimination of management, for all decisions could then be predefined (rule-based) and hence automated. We know this has not happened and, most likely, never will.

John Rockart's (1979) critical success factor (CSF) method has been a much-discussed and -publicized approach to understanding management information needs. Basically what it says is, Give managers information about the few factors that they believe are critical to the success of their business, the operative word here being "believe." This is far too subjective. Decades of advances in management science and operations research tell us that objective research and analysis are required to reveal the factors *truly* (not supposedly) relevant to a situation. An effective MIS demands—if not generates—the validation of the link. And yet, it is ironic that Rockart bases his CSF method on managerial belief rather than on factual data. It is also noteworthy that Ackoff's powerful repudiation of the myth, "The manager needs the information that he wants," was never seriously explored in the MIS literature.

One may critique the CSF method on a different basis. From a systems viewpoint, one can question the very notion of a "critical factor." If, by definition, all the components of a system (such as an organization) have to work together to produce an intended result, then no component is any more or any less critical than any other component.

Another recent strand in MIS is the emerging popularity of *Executive Support Systems* (Rockart and DeLong, 1988). The core concept of ESS is the drill-down capability that allows managers to navigate through various levels of a problem, from the highest, most aggregate to the lowest, most concrete. In other

words, an ESS aims at giving managers all the information that they could possibly get. This approach is of course based on the myth that the more information a manager receives, the better. Ackoff (1967) debunked this myth by pointing out that, in reality, the less we really know what information we need, the more information we will ask for. In the limiting case, when we have no idea what we are looking for, we will ask for all the information in the world, thus effectively postponing the decisions as to which subset of this information is truly relevant and what to do with it after it has been obtained.

5. THE PROCESS OF SYSTEMS DESIGN

We now come to the process of systems design. One of the cornerstones of systems thinking is what Ackoff has named *idealized design*. This methodology, or variants of it, has been adopted by the MIS literature with other labels attached to it, such as *business process reengineering* and *future perfect*.

As an intellectual movement, business process reengineering (BPR) was founded by Michael Hammer (1990). After a lucrative consulting business and a series of essentially repetitive books on the subject, Mr. Hammer was recently charged with the criticism that BPR was nothing new. His answer was, "So what?" (Nolan, 1997). Perhaps the consulting world can accept this as creative redesign itself. That would be understandable. After all, managers and business executives are interested in ideas that work and are stated in a language comprehensible to them. What I find less acceptable is that the academic community should fail to do its homework and interpret what essentially amounts to a play on words (redesign vs. reengineering) as a drastically new approach.

But did the reengineering movement (regardless of what you call it) really work? Thomas Davenport, one of its founders, voices serious reservations about it (1995). According to Davenport, reengineering was born when three components were brought together, none of which was new but none of which had previously been connected either. It began with technology: the real value of computing was not simply in doing work more efficiently, but in changing how work was done as well. To that was added the notion of "business processes," borrowed from the then-hot quality movement. The last piece of the puzzle was the idea of a clean-sheet-of-paper change program, an appealing prospect to large industrial companies seeking to escape the straitjacket of the past. Big companies with big problems were eager for Big Change. The missing element, according to Davenport, was a consideration of the social impact of this movement. "The rock that reengineering has foundered on is simple: people. Reengineering treated the people inside companies as if they were just so many bits and bytes, interchangeable parts to be reengineered. But no one wants to 'be reengineered.' No one wants to hear dictums like, 'Carry the wounded but shoot the stragglers'—language that makes workers feel like prisoners of war, not their

company's most important assets." This is a far cry from the participative principle of interactive planning as advocated by Ackoff (1981, pp. 65–70).

The future perfect concept was proposed by Stanley Davis (1987) in a book by the same title. Its basic argument runs as follows.

1. Technology is getting better and better (smaller, faster, more user-friendly, cheaper, etc.).
2. Any business process is based on a certain technology. Therefore,
3. Business processes are getting better and better. Add to this,
4. Taken to its logical conclusion, technology will get perfect. Therefore,
5. Business processes should be developed with a vision of perfection. Part of this vision involves enabling customers to get *whatever* they want, *any time* they want it, *anywhere* they want it, and *any way* they want it.

Starting with an idealized vision, unhampered by imperfections in current technology, is the hallmark of idealized design. The difference between idealized design and future perfect methodologies is in terms more of time (about 20 years) than of substance.

What is interesting about both business process reengineering and future perfect is that neither of them is intrinsically information technology-based. Neither is Ackoff's idealized design. And yet, because most of the examples given by Hammer and Davis happen to have a technological flavor to them, they were embraced by the field of MIS as though they were part and parcel of the field. Ackoff's *A Guide to Controlling Your Corporate Future* and *The SCATT Report* are bone fide forerunners of any later reengineering manual, except that they were written years before anyone heard of BPR.

6. CONCLUSION

In this paper, I have taken the standpoint of an MIS academician interested in teaching and research. I have discussed four interfaces between MIS and systems thinking. However, two questions should be raised at this point.

First, What are the boundaries of MIS? Where is the core and where are the fringes? With a liberal interpretation of "management" (to include concerns related to the administration of all types of organizations at various levels), "information" (to include multimedia), and "system" (to include structured and semistructured procedures and technologies for performing tasks), it is difficult to imagine what would *not* be covered under the umbrella of MIS: hence the need for MIS scholars to be open-minded and not be lured by familiar catch phrases while ignoring unfamiliar ones.

Second, To what extent is the academic evolution of MIS relevant to the real world of organizational behavior and corporate performance? In other words, if companies are doing it right in practice, why care about the evolutionary path of

the idea? The small minority of companies that are doing MIS innovatively, such as Cypress Semiconductor Corporation (Rodgers, 1990) are continuing to thrive and prosper, but they are following the systems approach anyway, without necessarily being self-conscious and articulate about it. On the other hand, the large majority of companies that are not doing MIS right keep running into trouble again and again. To the extent that the systems approach is a child of successful management practice and imaginative management vision, it will preserve its timeless character and continue to be practiced by enlightened managers, regardless of its basis in the academic community. That, after all, is not an undesirable state of affairs.

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