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INFORMING SCIENCE AS CONCEPTUAL FRAMEWORK FOR DEVELOPING INFORMATION SYSTEMS

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Utilizarea pe scară tot mai largă a Sistemelor Informatice (IS), a căror semnificație a crescut în diversitate şi complexitate, a impus luarea în considerație a unui cadru conceptual care să favorizeze dezvoltarea acestora, definit ca Ştiința Informării (InfoS). Lucrarea examinează limitele actualelor cadre de definire a IS şi propune o nouă abordare, evoluționară, pentru statuarea InfoS. Pentru a clarifica rolul InfoS se analizează relația dintre noțiunile de „cunoştințe" şi „informație" aşa cum apar aceste noțiuni in cadrul Tehnologiei Informației. In final se discută oportunitatea introducerii Ştiinței Informării în curricula universitară, ca factor cheie în potențarea şi diseminarea creației ştiințifice.

The extensive use of the Information Systems (IS), whose meaning has been growing in diversity and complexity, lead to considerate a new conceptual framework for their development, defined as Informing Science (InfoS). The paper examines the limitations of existing frameworks for defining IS and introduces a new evolutionary approach to state the InfoS definition. To understand InfoS role, the paper analyses the relation between „knowledge" and „information" as these notions appear in the field of Information Technology. Finally some suggestions for the placement of the Informing Science in universitary study curricula are discussed, as well as its method of segmenting knowledge creation and dissemination.

Key words: information, knowledge, Information Systems, Informing Science

1. Introduction

The maturing field of Information Systems (IS) is still experiencing growing pains. It is not well recognized. Its research is fragmented, and its educational organization is not only fragmented, but competes with topics taught by other fields. First, IS is not well differentiated from Applied Computer Science. Secondly, it seems that the both the research and the teaching of IS is anything but unified. To understand how IS has reached this current state, we need to examine how, in the past, IS determined what areas of knowledge it includes. Primarily, two methods have been used: one based on the other fields IS references and one based on definition. This paper introduces a third method, evolution.

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2. Definitions for Information Systems and Informing Science

Reference disciplines based approach.

The first method determines which knowledge is and is not IS by the fields it references. Many authors have used this approach to define the field and use frameworks that are quite similar to one another. For example, Laudon [1] argues that IS is derived from computer science, management sciences, organizational behavior, behavioral science, management accounting, economics, and library science. They all agree that the field of IS exists at the intersection of three sets of fields: business (management, inexact science), computing (technology), and systems (organization, exact science).

King [2] argues that the appearance of the term "reference disciplines" in IS discourse reflects that the area of IS still lacks a "solid intellectual center". But reference disciplines are critical for an evolving field for three reasons. First, reference disciplines are a well-established source of intellectual capital; second, they provide the IS community with an "appeal to authority"; and finally, reference disciplines are an excellent way for identifying pockets of research that are uncharted.

Definition based approach

Two definition-based methods have been used to define IS. One defines current IS by classifying the methods and topics have been studied in the past. The second approach is teleological, defining IS by the functions it provides its clientele.

<u>Classification definition.</u> Barki, Rivard and Talbot [3] took the approach that IS is what IS does and set out to define the field by classifying its research. But defining a discipline through a keyword classification scheme of research has a number of limitations: it is descriptive, not proscriptive; it is static, unresponsive to changes in the field and environment; the classification itself has cultural bias built-in and the classification scheme is at best arbitrary.

<u>Functional definition.</u> In contrast to the classification definition, the functional definition is more dynamic and open to change. One of the earliest and most influential attempts to do this was by Mason and Mitroff [4]. They used an expanded sentence definition to provide boundaries of what is and what is not IS research. Cohen [5] expanded the work of Mason and Mitroff by conceptualizing IS through a meta-model derived from information theory. He applied a metasystem framework that defined IS on three levels: an Information-Using Environment, a Development Environment, and a Management Environment.

A new approach - Evolution

This paper suggest evolution as a third approach to defining what areas of knowledge are IS. The evolutionary approach to IS examines the origins of the field. This approach is quite useful in understanding the current lack of consensus. It also points out connections to reference fields, both past and current.

Fifty years ago there were no individuals who professed IS, either as academics or as professionals. The profession of IS came into being through the evolution of other, precursor, occupations. One such occupation is the efficiency expert. The profession of efficiency expert came into existence to meet the needs of managers wishing to optimize the assembly line. Another precursor occupation is the accounting machine operator. The oldest organizations that include IS professionals, such as ACM, drew membership from these workers. They operated the machines and provided much of the earliest programming. Both computer operation and programming are rooted in this profession.

Clearly, the profession of IS did not evolve from any one occupation. The separate and disparate parent occupations of IS led to the misunderstanding of what IS is, both inside and outside the field. To avoid such a mistake, this paper proposes a new conceptualization of IS having at its heart is a functional definition, as follows:.

Definition 1. *Information Systems is the field of inquiry that attempts to provide the business client with information in a form, format, and schedule that maximizes its effectiveness.*

Let us now expand the definition above by removing the restriction that the client must be business related. This provides a definition for a number of disparate fields that share some common goals. We will call these fields collectively the discipline of Informing Science.

Definition 2. *The fields that comprise the discipline of Informing Science provide their clientele with information in a form, format, and schedule that maximizes its effectiveness.*

The definition points to three interrelated components: the client (who has a task to perform that requires information for its completion), the delivery system (for providing information), and the informing environment that creates information to aid the clients complete their tasks. Merely changing one term shows linkages between IS and a host of other fields. This paper refers to these fields collectively as the discipline of Informing Science. The definition also provides explanatory power over why non-IS disciplines teach courses on topics that IS claims for its own. While IS focuses on providing managers and other business clients with information, other fields define their clientele differently. For example, the clientele for education includes students. The information needs of students and of managers are not the same, but the task of providing information so as to make it useful for these two constituencies has a great deal of overlap.

3. The Informing Science framework

The first of the works from which the Informing Science framework is derived is Shannon's model of the communication process [6]. At its core, the model proposes understanding communications through its impact on five fundamental elements: the sender, the receiver, the medium, encoder, and decoder. Shannon defines information as a reduction in uncertainty. In this model, information can be said to be transmitted (and received) only if the receiver has reduced entropy. That is, information is defined in terms of the receiver's level of uncertainty. In the field of Information Systems, we would say information is defined as that which reduces risk for the decision-maker.

A second conceptual development from which the Informing Science framework is derived is that of the "meta-approach" to modeling. The meta-systems approach applies set-theory-like thinking to the analysis of systems. The obscurity of this useful approach has limited its use by researchers.

A third and final framework from which the Informing Science framework is derived is Leavitt's Change-Equilibrium Model [7]. Leavitt writes that to understand organizational change, we must consider four distinct elements as inter-related: the task, technology, structure, and people. The key points here are that the components are interrelated, so a change in one affects all the others, and that the task, the technology, and other key components comprise the model.

Putting it together, we can consider that the Informing Science framework has three components: the informing environment, the delivery system, and the task-completion system.

Informing Environment. The informing environment is analogous to the sender and encoder in the communication model. Unlike the communication model, the Informing Science Framework considers the informing environment at three levels of abstraction. These three levels are (1) the instance (using a system that is in place), (2) the creation of new instances of informing (to the organization or any of its components), and, at the highest level, (3) the creation of new designs for informing. An academic example of these three levels is as follows: (1) teaching a course someone else has designed, (2) designing a course that will be taught by others, and (3) creating a new curriculum. The purpose of the informing environment is to provide information to the client in a form, level of detail, and sequence to optimize the client's ability to benefit from that information. This component draws heavily upon applied behavioral sciences.

Delivery System. The delivery system refers to the use of information technologies (computing, communications, and so on) that support the implementation of informing environments. This corresponds to the transmission or media component of the communications model. Information technologies are not limited to computing. Data communication includes video and voice, and even personal contact when it is augmented through planned communication.

Task-Completion System. The driving force behind the creation of informing environments and delivery systems is that a task needs to be accomplished. The task defines what information is needed. This task completion component typically involves a person who has a job at hand. It corresponds to the decoder - receiver components in the communications model.

The task completion system is the sole component that defines the difference among various academic disciplines that comprise Informing Science. In business, the decision-maker commonly is a person (worker or manager) needing help completing a business process. In library science, the task commonly is helping a patron or creating a system to help future patrons. While the task may be different for students, readers or viewers of journalism, or business decision-makers, all share the need to be informed so as to be able to complete their task at hand.

Let now consider Informing Sciences (InfoS) as a new discipline, one that subsumes IS and other fields that endeavor to inform their clientele. In this acronym the term "informing" must be understand as a basic mean to transmit information: "…information is the inward-forming of a person that results from an engagement with data."[8]. The hierarchical structure is not well suited to benefiting from or adapting to the multidimensional nature of knowledge. As a consequence, InfoS must explain the true relation between information and knowledge.

4. Implications in organization of universitary activities

Therefore, a systemic meaning of information and/or research efforts oriented to a Systemic Information Theory, could surely serve as a catalyst for the integration process of new curricula in technical universities, in particular in the fields of Computer Science, Information Technology and Systems Engineering. The main consequences could be the following:

1) With the systemic approach we outlined above, we can conclude that in the fields of Information Systems and Informing Sciences, information should be considered four-folded: *subjective i*nformation should be considered as well as *objective* information, the informative empirical processes of *perceptions* and the *actions* taken on the information received, filtering/modifying it as a consequence of subjective filters, knowledge, emotions, feelings, attitudes, values, etc. The IS development field takes into account mostly the software development side, i.e. the objective information processing, and does not care too much for the subjective information processing, let alone the perceptual phenomena and the subjective information filtering. University curricula should be extended and/or

modified and development methodologies should be re-designed according these four folds of information. These four aspects should be integrated but never confused as it is usual to happen in academic courses and textbooks, as well as in methodological design and methodologies use in consulting, in the industry and in the corporative world. Even in the objective perspective data and information are completely different. *Datum* is the independent variable and *Information* is the dependent one. Information is not formatted or organized data; information is not data in context as usually it is claimed in some IT circles and textbooks. Formatted data are formatted data, not information. Data in context is data in context, not information, by any means.

2) Knowledge (expressed in Data) and Information are two sides of the same coin**:** the datum is the objective side of the information, and the information is the subjective side of the datum. Objective data are transformed to information by means of a subject's perception and interpretation. A computer supported IS should have an electronic data processing sub-system and a biological/human data processing system, adequately related to each other, in order to compose as a whole an IS. Consequently, analysis/synthesis activities should be done for both sub-systems, and not just, or mainly for the electronic processing, or the software development, side. Software users should also be "developed" and "maintained" accordingly. If not, we will be developing an electronic data processing system, or a "system for information," a system with the potential of producing information, but not an Information System, in the sense that the system is producing and processing information.

3) A datum might be informative or not informative. Consequently, we should distinguish among the concepts of data, informative data (knowledge) and information. A very important practical consequence we can draw here is: *Informative systems are not the same as Information Systems. Informative Systems are part of Information Systems.*What is usually referred in the literature as electronic information processing is, rigorously speaking, *informative data processing*. To develop Information System, requires necessarily the development of an informative system, but this will not assure the development and use of the respective information system.

4) The confusion between objective and subjective information processing is very dangerous, both intellectually and pragmatically. Information Technologies consultants, systems analysts, software development projects managers and university professors in software development should be aware, and make aware, about this homonymy in the term "information". Unfortunately this is that the case, in the present. The confusion exists, even in prestigious vendors, consultants and authors. In MIS (Management of Information Systems) there are two systems to be developed: an objective information system and a subjective-information system. The result of this is that the system developed is an

informative system, not an information system, let alone an informing system. An informative system needs an informed user to be an information system. The process by which an informative system informs a user is an informing system. This is a very important conclusion, especially for information systems developers' education and training. They should be proficient in software development, which is a *necessary* condition, but it is not a *sufficient* one. They also should be proficient in what is required to assure the transformation of the data into information, or the transformation of objective-information into subjective-information. Otherwise they might fail in developing information systems, even if they develop high quality software.

5) A last problem to discuss is the existing gap in the high-level educational programs between the new IS oriented didactical objectives and the knowledge creation and dissemination. The problem is most endemic to new fields, which do not fit cleanly in the outdated paradigm on which universities are administered. Universities use a hierarchical approach to knowledge creation and dissemination. Universities divide knowledge hierarchically into colleges (or faculties) and then departments. The theory behind this categorization of knowledge made sense when the university began. This structuring of knowledge no longer meets the needs of a more complex environment. There are alternate structures, including the matrix structure and the virtual organization.

Under the matrix structure, researchers and teachers who are assigned to a specific administrative unit are assembled into teams based on the needs of the team. A teaching or research project may require, for example, a computing expert and a linguistics expert to collaborate. For research, this approach is used informally at times when colleagues from different fields collaborate on research. However, cross-field collaboration is less than common, and cross-college collaboration is rare. For teaching, any collaboration is rare. The reward structure is particularly ill-equipped to deal with cross-disciplinary work.

The third approach, the virtual organization, has the fluidity of the matrix approach without requiring separate administrative structures. The current university as a virtual organizational would easily accommodate the cross-disciplinary realities of today's world. One method to accomplish this is for faculty to join ad hoc independent teaching or research centers that take on complimentary missions. The centers can establish their own reward structures.

5. Conclusions

The primary purpose of this paper is to make some suggestions of how we may distinguish between knowledge and information. When it comes to the word "information", we can use this for signs that exist independent of a subjective holder. In this way we can talk about information as an *object*. However, going back to the origin of the word, information derives from the verb describing, informing. In this case it is the *process* that is in focus. Then there is the *result* of the process, i.e. an informed person who knows something new, or something more for sure. In the latter case we can refer to it by saying either: the receiver is informed of something specific, or the receiver has certain knowledge about this something.

The second objective of the paper was the definition of the framework of Information Systems and Informing Science and of its role as background of the educational process. The paper suggests that the many problems of fragmentation first made apparent by IS are due to the very structure of the university and its method of segmenting knowledge creation and dissemination.

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