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A BROAD KNOWLEDGE OF INFORMATION TECHNOLOGIES: A PREREQUISITE FOR THE EFFECTIVE MANAGEMENT OF THE INTEGRATED INFORMATION SYSTEM

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A Broad Knowledge of Information Technologies: A Prerequisite for the Effective Management of the Integrated Information System*

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Abstract

There is a trend towards the bringing together of various information technologies into integrated information systems. The managers of these total systems therefore must be familiar with each of the component technologies and how they may be combined into a total information system. To accomplish this, the effective manager should first define the overall system as an integrated flow of information with each step identified; then, the alternate technologies applicable to each step may be selected. Methods of becoming technologically aware are suggested and examples of integrated systems are discussed.

1. Introduction

The information sciences are now being faced with a managerial paradox that other technology-oriented and broad-based disciplines have also encountered. As individual technologies and sub-disciplines become more sophisticated, more complex, and more specialized, the need to understand how all these parts fit together to make complete operational systems becomes all the greater. Therefore, as the information sciences become more technology oriented, more specialized and more complex, the need for information systems managers (or perhaps information systems integrators) will become more evident.

We have seen this happen in other applied sciences that involve integrating a number of diverse sub-disciplines. For example, the aerospace, communications, and electronics fields all developed the "total systems" or "integrated systems" approaches in the early 1960s. The energy and environmental areas are also well along the path towards a total systems approach. Now, I think the time has come for the information sciences to move towards a more integrated view of information systems management.

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In order to accomplish this, we need to encourage the development of information managers who view information processing as a continuum and who are knowledgeable of the broad spectrum of information concepts and technologies.

A multi-disciplinary "umbrella" information society, such as ASIS, is in an ideal position to do this. In fact, we are doing it as demonstrated by WESCAN ASIS' selection of "Knowledge of Technologies" as its 1980 conference theme.

In the remarks that follow, I will present some suggestions as to how we, as information scientists and managers, and as members and leaders of ASIS, can broaden our perspectives.

2. An Integrated Approach of Applying Technology to Information Systems Design and Management

The theme of the WESCAN ASIS 1980 Conference presents as a provocative question: "Should technology dictate who will manage information?" I think that all of us here agree that we should manage and apply technology in solving our constituents' information problems. Technology is our tool, not our master. An integrated approach to overall information systems design and management combined with sufficient knowledge of the relevant technologies is the solution.

In order to make logical decisions regarding which technologies to employ and how, where, and when to employ them, the information manager should approach the problem at two levels:

(a) First, the flow of information should be viewed as a continuum, an integrated process from point of origination to end use with steps along the way; and

(b) Second, each step can then be evaluated as to technology options in terms of benefits and costs to both the particular function and the system as a whole.

2.1 Defining the "Total" Information System

The effective application of technology to information activities (or for that matter, any activity) is greatly enhanced if one first defines the "total" system, its users and purpose, its components, and how the components fit together. Information managers should not get hung up on information jargon (e.g., document vs. data) or storage media (e.g., hardcopy vs. digital) or institutional titles (e.g., library vs. information center). We have been delegated by our constituents (both end users and funding sponsors) with the responsibility of delivering information in the most cost-effective manner.

Therefore, a prerequisite to not only effectively using technology but managing effective information is defining and charting our entire system's information flow as a continuum. This holds true for all levels of information systems whether they are basic manual document collections or advanced on-line automated data systems. Systems analysis (i.e., breaking a system into its component parts) and systems synthesis (i.e., integrating the parts back into a whole) should look into such information matters as:

(a) Information input and output requirements,
(b) Information content requirements, and
(c) Storage, transfer, and processing media requirements.

These elements should first be viewed in a general sense for the system as a whole and then for each component from beginning to end. All the while, one should keep in mind what the overall purpose of the system is to serve information users (i.e., determine who they are and what their information needs are).

Once we understand our full system flow, function, and purposes, we are ready to make decisions regarding the application of technology to the components.

While this may seem academic, I feel I must emphasize it. In the almost eleven years I spent as an information systems consultant, I observed too many cases of technology misuse or "technological slavery" that could have been avoided if the information manager had only defined what the system was supposed to do. For many years, I had the privilege of working for one of the true pioneers of the computer field, Isaac Auerbach. Isaac once remarked that he thought a major advantage of automating a manual operation was not so much the benefit of automation per se, but that flow charting an activity forced the manager to define exactly what it was he was supposed to be doing, often for the first time.

2.2 Becoming Knowledgeable of Technological Alternatives

An information manager who understands his system's information flow and components (whether the system is a one-person library or a national information network) then can effectively evaluate the technology alternatives that apply.

The modern and effective integrated systems-oriented information manager not only views his own system as an integrated information flow, but also acquires a broad-based and working knowledge of as many relevant information technologies as possible. In this respect, the effective manager can consider himself analagous to an architect. To properly advise and represent his clients (the building owners and users), the architect must first understand the clients' needs. Then he must be sufficiently knowledgeable in all the component technologies that comprise a building "system" to select those that best suit the client's needs and to ensure that components fit together. The same is true of the information systems manager.

The well-rounded information manager should be aware of the basic concepts and general technical state of the art in at least these sub-disciplines of the information sciences:

- Computer text processing, information retrieval, and data base management including both mini-computer and large mainframe applications;
- Library automation;
- Information storage media (including microforms, digital, audio-visual, graphic, and hardcopy);
- Data communication techniques (including digital and facsimile);
- Publishing, printing, and reproduction technology; and
- Word processing systems.

The information manager does not have to become an expert in each of these areas but he should be sufficiently knowledgeable in order to determine which are applicable to his needs and where he can go for assistance. (Just as the architect need not know how to solder a pipe fitting, he has to understand the principles and limitations of plumbing and plumbers.)

The broad-based information manager can become knowledgeable in the available technologies in various ways that can be mixed and/or matched depending on one's interests and circumstances. These include formal training ranging from university level courses to continuing education seminars such as those run by ASIS and other societies; selective reading of the periodical and monograph literature; attending professional meetings; information exchange with colleagues in the various disciplines, and actual on-the-job training.

However an individual acquires the broad-based awareness of the specific technologies, the most important prerequisite for the information manager is an open mind. If we lock ourselves into believing that we are only just a librarian, or a computer specialist, or indexer, or archivist, etc., we may not be able to be fully objective in selecting the best technology alternatives for our ultimate users. Just as the architect must design the building in response to client needs, so we must design the information system. Users and particularly funding sources, want our objective recommendations; they do not want a subjective sermon on why "our way" is better than that of the "other" information professional.

3. Examples of the Integrated Information Systems Approach to Using Technology

Several examples of this trend towards a broad view of information science and information management can be cited.

Perhaps the most obvious example is ASIS. We are truly an international information society that includes all information technologies under one umbrella. I doubt if there are other information professional groups that would select "knowledge of technologies" as an annual meeting theme. In my view, ASIS is an ideal place for information managers to meet and communicate in the interests of developing an integrated approach to technology.

I discovered an example of an industrial firm's approach to integrated information systems in a recent (July 14, 1980) Business Week advertisement. In this ad Bell & Howell stated:

> This is what it means to be an information systems company. Information is knowledge. To work for business, government, education or industry, it has to be controlled. To control information is to store it, retrieve it, distribute it or display it. And that requires functional innovations. When these innovations interact, a system is created that makes information work. An information system. Our business is information. Our job is to make information work by providing the means to control it.

We see no bickering over which technology is better in Bell & Howell's approach; in fact, the last two sentences could even serve as a motto for ASIS.

Another example of an information system that bridges virtually all information processing technologies (and is near and dear to me) is the one I am affiliated with - the Solar Energy Information Data Bank (SEIDB). This is the U.S. national network for solar, new and renewable energy information which is managed by the Solar Energy Research Institute (SERI) in Golden, Colorado. Despite its "data bank" appelation (given to it by the U.S. Congress), SEIDB seeks to integrate a broad range of both the solar technologies and the information sciences into a centrally managed information system. SERI and the SEIDB define "solar" in a broad sense as including active and passive heating and cooling, biomass, wind, ocean thermal energy conversion, photovoltaics, solar thermal and related technologies.

Our approach is to provide those interested in solar energy (from the R&D scientist to the general public) with access to a "one stop information supermarket". SEIDB's central facilities at SERI provide these information services:

- Library loan and reference;
- On-line access to bibliographic data bases;
- On-line access to numeric data bases;
- On-line access to directory data bases;
- Development of reference publications (e.g., bibliographies, directories, etc.);

- Information promotion outreach and dissemination;
- Document distribution and delivery including microforms production;
- Scientific computing services including simulation modeling and data acquisition;
- Computer data base management including information searching and retrieval;
- Vocabulary control, including thesaurus and vocabulary development;
- Development and production of audio-visual materials and displays including motion pictures, slide presentations, audio tapes, and exhibits;
- Technical editing and production of monographs, newsletters, and training materials;
- Telephone, mail, and walk-in public inquiry and referral services;
- Development and distribution of network information standards and procedures; and
- Conduction of training and continuing education seminars in all of the above.

The staff we employ to perform all of these tasks are drawn from virtually all of the information related technologies. We strive to integrate their efforts together into a "total information system" designed to provide the end user with the information services he needs in the way that most satisfies his needs.

It is also interesting, and perhaps indicative of a trend, that the people involved in this broad SEIDB system (including myself) less and less refer to themselves as librarians, computer scientists, data base specialists, or publishing specialists, but more and more as "information managers".

A great many of the cross technology ideas that I have tried to apply to SEIDB stem from my early experience with another integrated information system. This was the pilot Canadian Construction Information System (CIS) that I had the privilege of helping design and test in 1969 and 1970 in Montreal and Ottawa.

Conclusion

The various disciplines that constitute the information sciences have each evolved into relatively discrete and sophisticated techniques and technologies. These include library science, computer science, data base management, publishing and printing, reference service, micrographics, word processing and records management. As this spectrum of technologies further develops and multiplies, the need for broad-based information managers becomes more and more critical. These information managers, or information architects, must be capable of integrating the various technologies into

complete systems responsive to user and management needs.

We can be the architects of these new integrated information systems if we can develop a broad familiarity with the various technologies and an open mind regarding their application to solving information problems.