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# COMMUNICATIONS SUPPORT SYSTEMS: RECOGNIZING THE REALITY

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**<Abstract>**

Computer technology has affected not only the way that organizations process routine transactions and make decisions, but has significantly altered the means by which they communicate. Original efforts to unite computer and communication technology has yielded communication systems that serve to replace existing communication channels However, another possibility exists for this technology that has been relatively unexplored-communication support. Given the significance of communication, a class of systems which supports the communication process appears warranted. This paper investigates the existence, scope, and implications of communication support systems (CSS). Exploration of communication support phenomena in organizations can provide a new frontier for research, discourse, and system development opportunities. Such opportunities span the boundaries of communication, organizations, and computer technology

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# 통신지원시스템 : 현실의 인식

천면중
경영정보학과

**<요 약>**

컴퓨터기술은 조직이 일상적인 거래를 처리하고 의사결정을 하는 방식에 영향을 미치고 있을 뿐만 아니라, 조직이 서로 통신하는 수단을 상당히 변경시키고 있다. 컴퓨터와 통신기

술을 통합하려는 근원적인 노력은 기존의 통신채널을 대신하는 통신시스템을 창출하게 되었다. 그러나 이러한 - 상대적으로 덜 연구되어진 - 기술에 다른 하나의 가능성이 통신지원에 존재하고 있다. 통신의 중요성 하에서, 통신과정을 지원하는 시스템들의 인식이 대두되고 있다. 본 논문은 통신지원시스템의 존재, 범위, 그리고 암시에 대한 연구이며, 조직에서의 통신지원현상에 대한 탐구는 연구, 교육, 그리고 시스템개발 기회를 위한 새로운 장을 제공한다. 이러한 기회는 통신, 조직, 그리고 컴퓨터기술의 영역을 서로 연결할 수 있다.

## INTRODUCTION

Computer technology has affected not only the way that organizations process routine transactions and make decisions, but has significantly altered the means by which they communicate. Original efforts to unite computer and communication technology has yielded communication systems that serve to replace existing communication channels. However, another possibility exists for this technology that has been relatively unexplored - communication support (Calantone, et.al., 1993, Sayeed and Brightman, 1994).

Communication is the activity which comprises the greatest amount of managerial time. Beginning with Mintzberg (1973) and replicated for information system managers by Ives and Olsen (1981), studies have identified the importance and predominant role communication plays in job performance of high-level managers' work. Luthans, et.al. (1988) found similar patterns among a broad sample of managers at all levels of the organization. In a study of communication media choice by managers, Trevino et.al. (1988) reported that managers chose media to match the equivocality of the message. Additionally, Smeltzer (1988) argued that media choice should be an integral component of managerial communication training. Together, these findings underscore the importance of the communication process.

Over the past decade, the decisional process has received substantial attention in information systems Research into "what managers do" has shown that decision making is not the most widespread or frequent job activity. Undeniably decision making and decision support systems (DSS) are important to managerial performance. Given the significance of communication, however, a class of systems which supports the communication process appears warranted. This paper investigates the existence, scope, and implications of such systems.

## CLASSIFYING INFORMATION SYSTEMS

Following Wiseman's (1988) distinction between system function (capability) and the uses made of these functions, a classification scheme for information systems is

developed.

## Information System Functions

In the context of communication, the three basic information system functions of input, process, and output were used as one dimension of the classification scheme. **Input functions** furnish the capability to enter and edit data. **Process functions** supply the capability to manipulate data. **Output functions** provide the capability to "display" data, including audible output.

The process function contains four categories. Each can exist independently, but a more powerful and flexible result occurs when they are used together. Among the most fundamental process functions is the ability to store and retrieve data. This ranges from very basic capabilities to very sophisticated indexing and searching schemes. In fact, entire systems are built around powerful search and retrieval functions.

Transaction processing manipulates transaction data before it is stored and after it is retrieved. Although certain limited calculations in support of transaction processing can be done without storage and retrieval, transaction processing is much more powerful when storage and retrieval functions are available. Decision modeling (assisting or supplanting human decision making) does not require storage and retrieval, but it gains power and flexibility when storage and retrieval functions are available. Lastly, data transmission permits access to additional computer resources in distant locations.

Three output functions were identified. **Transaction reporting** is the typical tabular report type associated with traditional data processing. **Narrative output** is a coherent stream of words either in the form of letters, articles and other textual documents or in the form of spoken messages. **Image output** consists of graphs, pictures, and other types of static and dynamic images.

## Information Systems Uses

One use for computer based information systems is record keeping, distinguished by the use of transaction processing. Record keeping emphasizes transaction input functions and transaction reporting Record keeping uses either basic or advanced storage and retrieval functions; also, it may utilize data transmission and narrative output.

A second use for computer based information systems is decision support. Decision support includes decision modeling functions, either basic or advanced storage and retrieval, and data transmission. Typically, decision support makes heavy use of one type of output function (most likely transaction reporting or image output)

A third information system use is query processing, notable for very heavy use of advanced storage and retrieval. Query processing does not use decision modeling or

transaction processing functions. Sometimes descriptions of decision support systems even omit references to the decision modeling function. Query systems may use data transmission functions and make heavy use of transaction reporting and/or image output functions; but few narrative output functions are used.

A final category of information system use concentrates on heavy word/image input functions coupled with narrative or image output functions. We call these systems "**communication support systems.**" These may use transaction reporting functions, and employ rudimentary storage and retrieval functions (the emphasis is on input and output functions). For example, typical word processing systems allow storage and retrieval of documents by name, but they provide no sophisticated search capability for documents by characteristics or contents Communication support systems also may use data transmission functions. Table 1 presents various information functions and their basic uses by information technology. This table supports the feasibility of a class of systems called "communication support systems."

Table 1. Feasibility of Communication Support Systems

| Information Systems Uses / Information Systems Functions | Record Keeping | Decision Support | Query Processing | Communication Support |
|---|---|---|---|---|
| Storage/ Retrieval Data | X | X | X | X |
| Transaction Processing | X | | | |
| Decision Modeling | | X | | |
| Data Transaction | X | X | X | X |
| Transaction Reporting | X | X | X | X |
| Narrative Output | X | | | X |
| Image Output | | X | X | X |

# SUPPORT FOR COMMUNICATION SUPPORT SYSTEMS

In examining the matrix, note the cluster of functional characteristics that support the classical communication model (encode, send, decode).

Communication Support Systems (CSS) are defined as a class of computer-based information systems that overcome obstacles to one or more of the following processes of communication -- encoding, delivering (transmitting), decoding, and feedback (acknowledgement). This is the "classical" communication model. Overcoming obstacles increases communication efficiency and effectiveness.

Supporting the encoding process are the content input functions. For example, word processing systems provide extensive "word" entry and edit capabilities; this makes editing easier This permits users to revise more than they could using hand-written methods. In effect, the word processing system facilitates the revision process. Furthermore, effective encoding could overcome obstacles to the decoding process

Presentation systems (i.e. graphics systems) create pictures that may help the viewer decode the message hidden in words or numbers. Thus, such a system is a CSS through overcoming obstacles to the decoding process.

In our mobile world, people often have difficulty getting messages to each other. "Telephone tag" is practically the norm. A CSS resolution is electronic mail. Electronic mail messages do not require the receiver to be ready or even present when the message arrives. Thus, electronic mail overcomes obstacles to delivery of information bearing messages; it may further provide feedback to the sender that the message was received or read.

Each of the above CSS examples has a powerful content input function (narratives or images), possibly a data transmission function as in the electronic mail system, and a basic storage and retrieval function Each of these systems fits the functional definition of a communication support system by overcoming obstacles to the communication process. That is, a CSS will be the technological facilitator of interactive business process facilitators within a group and primarily between groups. It will contribute to the generation rather than the evaluation of solution alternatives which essentially is what existing DSSs and group DSSs (GDSSs) usually do. Thus, Huber (1990) admits that 'today's DSSs are almost all designed to serve in organizational settings that can be portrayed most appropriately within the rational (decision making) model' Table 2 shows a comparison between the characteristics of CSS and a DSS/GDSS (Charalambides, 1988).

Table 2. A Comparison of CSS and DSS / GDSS

| Characteristics | | CSS | DSS/GDSS |
|---|---|---|---|
| Function | Output | Relationship(s) among facts making the creation of a solution possible | Fact, i e evidence for support of a solution |
| | Purpose | Improve perception, conceptual modeling and group communication (intra- and inter-group) | Facilitate the evaluation of well-defined solution alternatives |
| | Direct beneficiaries | Managers, i e. users | Organization |
| | Indirect beneficiaries | Organization | Managers, i e users |
| Scope | | Ideally one per stakeholder (public mode) plus one for the individual's own use (private mode) | Ideally one per problem type |
| | | Fits the user(s) | Fits the problem |
| | | Surrogate user(s) not allowed | Surrogate user(s) allowed (even welcomed!) |
| | | Open ended, continuous, short lifetime | Finite, intermittent, long lifetime |
| Form | | Emphasis on the dynamic communication of different problem perceptions and solution arguments | Emphasis on computations, i.e use of a mathematical model |
| | | Relatively heavy user involvement | Relatively light user involvement |
| | | Private and public mode | Public mode only |
| Prerequisites | Conceptual foundations | Emerging | Mature but still evolving |
| | Research | Emerging | Sizable and improving |
| | Organizational receptivity | Potentially warm | Enthusiastic |
| | User preparation | Non-existent | Modest and improving |
| | Builder preparation | Fragmented | Modest and improving |
| | Hardware technology | Recent progress | No problem |
| | Software technology | Computer supported collaborative work S/W such as hypertext, computer conferencing, etc | Minor improvements needed (mainly in the user interface area) |

## THE NEED TO OVERCOME COMMUNICATION OBSTACLES

Most people face obstacles to effective and efficient communications. Unfortunately, some of the obstacles are beyond the reach of technology. Persons who cannot articulate their ideas have an inherent obstacle to effective and efficient communication that cannot be overcome, for example, by a word processing system. Thus, for a CSS to be helpful, the communication obstacles that people face must be those that technology can overcome.

Why do we need systems to overcome communications obstacles? The purpose of overcoming communication obstacles is to increase communication efficiency and effectiveness.

Communication efficiency consists of regulating the movement, amount, quantity, and quality of information received and sent. A receiver should receive all the information needed, as quickly as possible, without receiving more than needed. In part this is done by enhancing the quality of the information sent. Higher quality communication is usually shorter than lower quality communication; because it is shorter and easier to understand, it takes less time to comprehend.

Communication effectiveness consists of getting the right information to the right person, at the right time, in the right format. Electronic messaging systems address the "right person" and the "right time" problems. Word processing systems address the "right format" problem. For the foreseeable future, an intelligent user will have to determine that the right information goes into the system

People should have access to a particular communication support system that overcomes communication obstacles It should provide a net benefit to the organization (assuming that benefits to the person ultimately benefit the organization). Thus, a communication support system for a ditch-digger who always takes verbal orders directly from a crew chief probably is not justified. But, a cellular telephone might well be a cost effective way to overcome communication obstacles for a crew chief who manages several crews in the field.

## USING TECIINOLOGY TO OVERCOME COMMUNICATION OBSTACLES

How do we decide if a communication obstacle can be overcome with the technology? The following is a non-exhaustive list of conditions that indicate obstacles that can be overcome by a CSS. If one or more of these conditions exists, a communication support system may be appropriate.

The first condition is when the communication content is complex. The tools of communication support systems such as outliners, editors, grammar checkers, and spell checkers free the writer to focus on the content Revisions to the text come about without getting bogged down in the physical details of revising; and with complex material, frequent revision is still the principle way of wrestling such material into submission. Tools for constructing diagrams, charts, and graphs also allow the writer to find better ways to present complex material. A writer with minimal drafting skills may avoid drawing diagrams by hand. This same writer could be willing to create them when an effective and easy-to-use tool is available.

A second obstacle that can be overcome by communication support system technology is geographic dispersion. Through the use of various types of messaging systems, messages can be delivered to electronic "mailboxes" in a short amount of time. Of course, the same can be said of the U.S. postal service, and to the extent that it overcomes geographic dispersion obstacles, it serves as a data transmission component of a communication support system. The problem with the postal service is that it delivers paper, and it takes days to do it.

A third obstacle overcome by communication support systems is that of transmission time. The speed of transmission increases the response time Also, because of the short transmission time, people are more inclined to respond to messages quickly so that the delay at either end of the message loop is shorter Increased response times can improve the detail and "richness" of the message since the person contacted may not have forgotten content or, indeed, the very need to respond at all In this way, CSS may improve both the effectiveness and efficiency of communications Communication support systems also offer the advantage of painless "broadcasting" of messages When messages are electronically broadcast, they avoid the costs and handling delays incurred by mass mailings of paper documents.

A fourth obstacle that communication systems overcome is that of asynchronization. With a telephone, for example, both parties must be available at the same time to communicate. Unfortunately, this is often difficult to arrange. People trade "please call" message but no productive communication. By arranging to exchange messages where people do not have to maintain synchronous mode, they can avoid the frustrations of telephone tag Communication support systems, in the form of electronic mail systems, overcome this obstacle by allowing useful messages to be transmitted and held until the receiver can read them. When the sender composes the message at a keyboard or by talking on the phone to a voice message system, the problems of trying to "dictate" a message to a receptionist are removed Thus, when communication patterns are "asynchronous" a CSS may facilitate the process.

# APPLICATIONS

Having discussed a framework for CSS, it is appropriate to investigate several types of applications that fit into the area of CSS. These applications by their design help to overcome the obstacles to communication already outlined

Overcoming encoding and decoding obstacles is a primary purpose of a word processing system. These systems have well-developed "word" input functions and well-developed "narrative" output functions These characteristics help the user to organize and revise complex material. Desktop publishing extends word processing to page composition, including the ability to incorporate graphics into published material Graphics systems alone help the user to organize complex information into formats that are more easily comprehended. Graphics systems have well-developed "image" input and output capabilities and with word processing applications overcome encoding and decoding obstacles. Facsimile is a CSS that overcomes the time and distance obstacles to delivery. Even though facsimile provides no editing or formatting capabilities, it does provide mechanical assistance in converting from one medium (paper) at one location to electronic medium for transmission and then back again to another medium (paper) at another location. Conferencing systems focus on the obstacles to delivery by allowing "group interaction" between geographically dispersed individuals. Audio, video, and computer conferencing provide a method for overcoming obstacles to delivery due to distance, time, and presentation preference.

Additionally, the use of calendaring to leave "messages" about appointments and meetings would qualify as a CSS to overcome delivery obstacles These systems serve the purpose of simplifying communication and coordination among individuals trying to set up meetings and schedules. Electronic and voice messaging systems extend this concept by allowing editing and display functions to overcome the time element of delivery as well as the geographic obstacles. Messages are delivered at the convenience of the sender and the receiver to overcome the time delay obstacle to communication.

Since no system provides well-developed capabilities in all areas, the ultimate CSS would be one that provided intelligent assistance with the encoding of words, images and voice, overcoming delivery obstacles and providing well-developed capabilities for decoding the words, images or voice at the receiving end. For example, what if a system should show a complex diagram, zoom in portions of the diagram on request, and then answer user questions upon request, using audio or text presentation? This ultimate system would greatly improve the efficiency and effectiveness of its users. It should also be noted that there is no lack of potential CSS applications as shown in Table 3 (Charalambides, 1988).

Table 3. A Sample of Potential Corporate CSS Applications

| | |
|---|---|
| General Managers | Communication with staff planners(i.e. facilitators), product developers, project managers, major account service representatives, market researchers, etc. |
| Industrial Sales Staff | Customer and competitor intelligence gathering and dissemination, sales presentations and follow-up in relationship to strategic marketing actions. |
| Personnel Managers | Personnel file preparation and maintenance in relationship to strategic human resource actions. |
| Auditors and Management Consultants | Operational/managerial audits in relation to specific corporate strategies. |
| Commercial Credit Officers | Processing and monitoring of commercial loans in relation to strategic marketing actions |
| Corporate Attorneys Negotiators | Litigation support, Argumentation support of complex negotiations (labor contracts, international trade treaties, etc.) |

## DEVELOPMENT CONSTRAINTS

Several Communication Support System (CSS) development constraints must be recognized so that appropriate users are identified and environments most amenable to generating potential benefits are selected.

One such constraint is cost. MIS practitioners are especially concerned about cost in relationship to incremental benefits received. As noted earlier, a CSS may be configured using a variety of system tools (e.g., word processing software, communications software, LAN, graphics software). Metatools such as integrated software systems that link a limited number of communication capabilities and tools (e.g., PROFS) may also be used to initially configure the CSS While not available yet, the concept of a "CSS Generator" may be the most expeditious option to quickly offer comprehensive communication capabilities. The cost level incurred with each of these configurations should be compared to the benefits received. Anticipated benefits may be measured by the magnitude of the obstacles surmounted. For example, geographic dispersion of corporate units may mandate substantial investments in CSS. Or, integrated operations may in reality be disjointed reactions to isolated activity. Other cost constraints may include current investments in older information technology and realignment of corporate formal and informal structure to gain the potential benefits of communications capabilities not previously attainable. Cultural constraints also limit CSS functional potential and applicability. Native employees of a modern multinational

corporation, for example, may have legitimate communication needs when conducting geographic exploration in their own country. Unfortunately, their educational and cultural background may leave them without the conceptual and mechanical skills required to use the technology.

Transborder dataflow legislation represents a third constraint to CSS development and implementation. Developing and mature countries alike are increasingly regulating communication traffic within and across their borders. Technology has enabled many multinational firms to bypass legal challenges to communications emanating from foreign locations. Governments in maturing countries are also becoming more adept at using that same technology to gain control and increase regulatory compliance. Corporate communication is renown for its high volume and low content. An effective CSS may create an incongruous condition- low volume and high information content. CSSs are conceived to assist human "transmitters" and "receivers" to maximize the amount of information inherent in message flows. While little doubt exists that the technology is available to make substantial inroads to accomplish this goal, human psychological tendencies mandate a phased approach to implementing CSS. Once accustomed to the traditional communication process, both managers and professionals must evolve new communication and receiving behaviors.

A "non-CSS" system, by doing something other than overcoming communication obstacles has a different purpose. For example, it could be argued that a query system is actually a communication support system. A sender could leave messages in the system's database, and the receiver could do a query to receive that message. Such a use of the query system is not a communication support system because the functional profile of the two systems is different. A query system has a sophisticated storage and retrieval capability that operates on the content of the database. Such a system is excellent at retrieving data based on its content. However, the system design would have to be subverted to allow the system to retrieve data based on the identity of an intended receiver. While a query system could be so subverted, it would render much of the storage and retrieval mechanism superfluous. By contrast, the communication support system would not possess a sophisticated storage and retrieval mechanism; it would not need it anyway A CSS would have input and output functions expressly tailored to ease the sending and receiving of messages

## OTHER ISSUES

To completely describe communication support systems requires a number of other issues to be addressed. These include acquisition, spontaneity, solitary use, focus, group use, and value. A brief summary of each is provided.

## Acquisition

Information systems of all types go through a life-cycle of planning, acquisition, maintenance, use, and disposal. Many of the issues discussed above fall under the heading of planning and use The same issues could be reassessed in light of the maintenance and disposal activities. Nothing said above, however, addresses the question of how CSSs are acquired

## Spontaneity

Those systems that involve overcoming the delivery obstacle necessitate the use of networks. These systems require some type of global design and implementation at the organizational level. This implies a coordinated and formal approach. In contrast, systems that are confined to overcoming encoding obstacles (and by implication, decoding obstacles) are often implemented by individuals (e.g., individuals often choose to acquire word processing systems). When this occurs, the spread of such systems is often uncoordinated and informal. While such an approach may work in the short term, as the need to coordinate these systems increases, it becomes more necessary to move to coordinated, formal and organizationally implemented systems. An advantage of most CSSs is that they can be used spontaneously There are certain types of systems, however, that may be used on a scheduled basis. For example, a video-conferencing system is a CSS that overcomes the delivery obstacle when people are geographically dispersed. To be effective, the conference must be scheduled and all members present at the site of the cameras and microphones for such a system to work. Some experiments have been carried out with video-conferencing systems where the conference channel is left open continuously. However, it is not clear what the effects of such a use of this type of CSS are, and the practice is quite rare. Other patterns of use of CSSs include "solitary," such as using a word processing system, versus interactive, as in real-time electronic mail. Systems may be used sporadically, probably the most common use, or continuously. Systems can also be used as formal communication channels, or they may be used for informal communications. Each of the usage patterns may have different implications for the effectiveness and efficiency of communication via CSSs.

## Focus

Use of CSSs may also be viewed based on the focus of the system (Huseman and Miles, 1988). Typical memos and letters communicate specific information about specific topics. We usually think of a well constructed memo as addressing a single topic, but it is also possible to use a CSS to communicate multiple topics, perhaps in the form of an electronic newsletter. CSSs could be used to improve the structure and presentation of multiple topic communications.

In addition to specific information use, some CSSs support general information use.

For example, news service "ticker tapes" (which are now electronic) provide a general stream of information. It is up to the receiver to scan the stream and identify stories of interest.

## Group Use

In addition to focus, the number of people at each end of the communication process must be considered. Most common are systems that focus on one-to-one communication, e.g., most electronic mail systems, telephone systems, and voice messaging systems. Some systems, however, support "broadcasting" one-to-many messages from a single sender to multiple receivers. So-called "presentation systems" would also fall into this category. The single presenter uses the presentation systems to deliver a message in a form more easily understood to an audience of many people. Finally, conferencing systems and bulletin board systems provide examples of CSSs that offer a many-to-many focus.

## Value

When we have installed a CSS, of whatever type, it would be nice if there were some way to evaluate the worth of our investment, some way to assess its performance. This is seldom done. One of the difficulties in doing this is having some criteria to measure against. The definition of CSSs provided here offers the beginnings of such criteria. It is possible to measure the effects of some of the obstacles that we have mentioned. Overcoming delivery obstacles is probably the easiest to measure in terms of time, cost, and convenience of delivering messages.

These measures lend themselves to assessing efficiency. Measuring the overcoming of encoding and decoding obstacles is more difficult. As we find ways to measure this, we will probably find that these measures focus on effectiveness.

Current functions provided by CSSs include text editing, text formatting, graphics construction, graphics display, spell checking, and in some systems, grammar and style checking. All of these focus on fairly mechanical aspects of encoding and decoding. Another form of assistance in encoding that is currently being investigated for written and electronic text messaging is the use of software to help the writer use neuro-linguistic programming to develop rapport with the receiver (Armstrong, 1988). Other types of assistance that might be included in CSSs for messages might include artificial intelligence that would scan incoming messages and prioritize them according to whether or not they needed a reply, who they were from, and subject matter. This would help a person manage the communication load and prevent overload. Another type of system not only scans incoming messages, including voice, but also answers some of them.

## SUMMARY

In summary, communication support systems are a legitimate classification of computer-based information systems. Such a classification is important to help focus explicit effort on an organization's most widespread activity. Exploration of communication support phenomena in organizations can provide a new frontier for research, discourse, and system development opportunities. Such opportunities span the boundaries of communication, organizations, and computer technology.

The primary purpose of communication support systems is to overcome communication obstacles present in organizations. By overcoming these obstacles, communication support systems increase communications efficiency and effectiveness. Such improvements in an organization's most pervasive activity can provide a competitive edge to individuals and to business. Recognizing communication support systems would be beneficial in understanding the role of present systems and determining where future development opportunities exist

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