

PREPARING INFORMATION SYSTEMS PROFESSIONALS FOR A WORLD ECONOMY: CHALLENGING PERCEPTIONS ABOUT TELECOMMUNICATIONS

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This paper presents a systematic analysis of the educational need which a telecommunications course should satisfy, and a comparison of the defined need with current educational practice. The need/or telecommunications education is determined by reviewing what professionals think are important skills to fully utilize and support telecommunications in organizations. The authors then consider the ways in which current IS education is preparing future professionals/or this increasingly important aspect of IS. This is done by examining current telecommunications textbooks, using content analysis. When these course materials are compared to the perceived necessary skill set to perform telecommunications tasks, there is an obvious gap between what is needed/sind what is taught, and these course materials are ~~shown to not address~~ current educational needs. The ~~paper ends with~~ a recommendation about telecommunications curricula, and the direction of future studies to define and improve them.

INTRODUCTION

In the business environment of the 1990's telecommunications has become one of the most significant aspects of the corporate information processing function. There are three primary reasons why telecommunications has become strategically important to businesses. These reasons are related to changes occurring in both the domestic and the

international environments, and the presence of enabling technology. Paralleling the growing importance of telecommunications in the work place should be its increased emphasis in the information systems (IS) curriculum. The purpose of this paper is to examine, in greater detail, the dimensions of this educational need, and to consider the way in which we are currently addressing it.

In the sections to follow, we use recent research to articulate the educational need which a telecommunications course should satisfy. Following that we consider the way in which IS education is preparing future professionals for this increasingly important aspect of the field. This is done by examining current telecommunications textbooks. We then argue that if course materials are any indication, telecommunications is inappropriately addressed in IS curricula. That is, there is a gap between what needs to be taught in a telecommunications course as part of an information systems program and the current orientation of current courses as indicated by textbooks used to support them. We will end this paper with our own recommendations about telecommunications curricula

THE EDUCATIONAL NEED

Recent research results clearly demonstrate the increased importance of telecommunications to business in general and IS in particular. On the domestic front there is

a growing emphasis on integrating the disparate units of the organization through information technology. A recent study of information professionals in the United States revealed some interesting results (Farwell et al., 1992). IS managers and consultants were surveyed about the tasks that will be most important in the future and the skill set needed to support those tasks. Four of the ten most important tasks were: integrate networks, integrate existing business applications; integrate new business applications with existing applications, and support information access and security.

The emphasis placed upon these tasks is consistent with the importance of integrating tasks associated with joint ventures, mergers, downsizing, and reengineering business practices. That telecommunications is a significant aspect of these corporate integration tasks is evidenced in the skill set indicated as important for the future. Once again, four of the ten most important skill areas fall within the domain of telecommunications. They are: networks, telecommunications, systems integration, and distributed processing. These results point to the movement of telecommunications activities and capability to the center stage of IS.

The second reason for the increased emphasis upon telecommunications is the movement toward globalization of business. One can easily argue that globalization of business is not feasible without electronic communications. And yet, Steinbart and Nath state that prior to their research reported in 1992, little was known about the problems involved with developing a global network or about the factors contributing to their success. Among the problems they cite is that of dealing with "politically imposed constraints," such as the requirement to use host country networks or adhere to national transborder data flow regulations. They conclude this discussion in the following way:

The major implication of the existence of politically imposed 'constraints' is captured in one IS executive's advice that companies beginning to develop a global network should not assume that the only difference between a global network and a domestic network is one of size (Steinhart and Nath, 1992, p. 71).

Deans, et al (1991) provide us with some concrete recommendations concerning what must be known about telecommunications In order to operate in a global environment. In their project is identify the most important information systems issues encountered by U.S.-Based multinational companies, they found that twelve of the thirty-two items that resulted were related to telecommunications. In descending order of **importance** to executives of multinational companies, they are: integration of technologies, price and quality of telecommunications, international protocol standards, telecommunications deregulation, changes in telecommunications technology, centralization/distributed processing, regulatory strategies of the PTfs, integrated Services Digital Networks (ISDN), use of value added networks (VANs) by multinational companies, transborder data flow restrictions, interorganizational systems, and

banned usage of telecommunication equipment

The apparent lack of appreciation for the contextual aspects of network use given the obvious centrality of telecommunications to global business points to a clear educational need. In fact, it suggests that American schools' may be in a "catch up" situation. That is, not only must the IS curriculum place more emphasis on telecommunications, the subject must also be treated differently than it historically has been -- from an engineering perspective. As the above research results have shown, contextual factors such as regulatory and political considerations must be addressed as well.

The two trends that have just been described have emerged along with the evolution of enabling technology. That is, the need for electronic communications is being recognized at the same time that the technology is becoming cheaper, better, more diversified, and, hence, more suitable to corporate needs. The range and availability of telecommunications technology is due in no small part to deregulation/privatization of telecommunications in America, the U.K. and elsewhere (Trauth and Pitt, 1992). Greater competitiveness in the telecommunications industry during the 1980's has resulted in an explosion of new technologies such as ISDN to facilitate diversified corporate use of telecommunications.

What, then, is the educational need regarding telecommunications within an information systems curriculum? We believe that the appropriate model to use is the model that is current in information systems education. In the 1970's and 1980's, information systems emerged as a field of study separate from but complementary to computer science, with different emphases and skill sets. Telecommunications, as a topic that is part of an information systems curriculum, should be differentiated from engineering. In an information systems curriculum, the focus is on business needs followed by the contribution of the technology satisfying them. In this framework, the two key components of this relationship to the technology are business analysis and contextual understanding.

For telecommunications curricula, then, the student should be able to: 1) determine the electronic communication needs of an organization based upon analysis of existing and desired business practices; 2) understand what the technology can do through knowledge of current telecommunications applications; and 3) consider the management, use and support issues associated with telecommunications because he or she has an appreciation for the context in which the technology will be used.

This educational framework suggests that there are three **important** components that should be addressed in a telecommunications course for information systems students. The most tangible component is telecommunications applications. Implied in this is also a basic understanding of network structures and technology. The second component is business analysis. It is important to emphasize, here, that the object of the analysis is the organization, not the network. That is, business and information systems students should be

concerned with making sure they are able to understand the business need for the network, not optimal network structure (that is the domain -- and rightly so -- of the engineer). The third component is **understanding** the impact of organizational, national and regulatory context on the design, management, use and support of electronic networks.

CURRENT STATE OF SUPPORT FOR TELECOMMUNICATIONS EDUCATION

Now that we have defined what should be the content in a telecommunications course for information systems students, we come to the current state of telecommunications education. We are inferring this from the assumptions and priorities reflected in materials used to support telecommunications courses.

The method chosen to analyze the data -- the textbooks -- was content analysis of the books available to instructors who are planning such a course. We believed that the content of telecommunications books would reveal the implicit assumptions made about what is important in telecommunications education today. Books are influential: we felt that for many instructors, the books available greatly affected how the subject would be taught and what topics would be covered. Books reflect practice: in many of the books we examined, the authors described the book as being the result of planning for telecommunications courses that they had taught in the past. The books we examined were obtained by calling textbook publishers and asking for "review copies of telecommunications books, current as of Fall 1992. Fourteen books were examined for content and topic emphasis. Seven publishers are represented. Many publishers who were contacted either had no telecommunications books in their catalog, or only one. The publisher who had the most was Prentice-Hall, with five books.

In all of the books, the main emphasis is on the technology of telecommunication. Seven of the books (Bartee, 1991; Fitzgerald, 1990; Beyda, 1989; Fitzgerald and Eason, Helmers, 1989; Moshos, 1989; Stallings, 1991) dealt with purely technical issues. These technical topics include the hardware components of telecommunications networks, the protocols, or rules of transmissions across networks, discussions of the merits of different types of architectures and network designs, specific devices to manage networks, the layouts of topologies of networks, and media on which a message may be transmitted.

Of those books remaining, seven (Coulouris and Dollimore, 1988; McGovern, 1988, DeNoia, 1987; Misra and Belitsos, 1987; Reynolds, 1984; Stallings, 1990; Stallings, 1990a) contained some discussion of what the authors considered to be "management issues" associated with telecommunication. These were maintaining the applications of telecommunications technology (distributed systems, electronic data interchange, videotex, teleconferencing, FAX, and electronic mail). In other words, these authors equate "management issues" with applications maintenance rather than other classic "management issues" such as re-

source allocation, organizational impact, strategic planning, and fit between telecommunications technology and corporate goals.

Further, the amount of discussion that is devoted to these telecommunications applications topics is in general quite small. For example, Stallings (1990) and Stallings (1990a) only one chapter out of the eleven in the book treated these topics. Coulouris and Dollimore (1988) used two chapters out of twelve to describe these activities. DeNoia (1987) devoted three chapters out of eleven total to these topics. Reynolds (1984) had five out of thirteen total chapters, Misra and Belitsos (1987) used six chapters from a total of eleven, and McGovern (1988) used seven chapters from a total of fifteen in the book to discuss these topics.

Business Analysis to determine communication needs and opportunities was treated in only two of the books (Stallings 1990, DeNoia 1987). Stallings (1990a) used only two chapters to explicitly discuss business oriented analysis, but did include a number of short case studies that presented telecommunications design decisions in an organizational problem context. DeNoia (1987) used one chapter to discuss telecommunications business analysis as part of a general systems analysis. The other authors treated analysis purely in the technical sense. That is, their definition of analysis was limited to determining and evaluating the technical capabilities of communications networks, such as the performance of communications devices, media, different protocols, routing methods, and error-checking mechanisms.

"Therefore, it is all the more interesting that these books are described in their prefaces by the authors as nontechnical (Stallings 1990, McGovern 1988, Reynolds 1984, Fitzgerald and Eason 1978). This would seem to imply that the authors do understand that the "reading audience is not necessarily interested in purely technical issues, and these statements are meant to reassure the readers. But the plea of 'a nontechnical approach' is only true if the books are viewed from the perspective of electrical engineering or computer science. No issues that are not dependent on the technology, (i.e., telecommunications planning and policy) are treated. While it is unarguable that telecommunications involves highly technical issues, it is questionable whether these technical issues should be the main focus when discussing telecommunication from a business perspective. The implicit assumptions made by the authors are that it is sufficient to describe telecommunication technologies and that the application of these technologies to specific problems is well understood or obvious. From the perspective of these authors, 'planning and management of telecommunications' is the planning and management of telecommunication technology, not of the telecommunications function, or the relationship of telecommunications technology to business operations. Essentially, they seem to describe technology solutions in search of problems, instead of presenting problems that can be solved with the applications of the technology. This seems particularly evident in the fact that all the books have their chapters arranged so that those

chapters that deal exclusively with telecommunications technology are at the beginning of the book. If business problems are introduced at all, they are in the last few chapters. Whether intended or not, this gives the impression that the emphasis (and importance) should be placed on purely technical issues.

Summary

All the authors in the reviewed books cover the technology of telecommunication. Some authors cover the applications of telecommunication, with varying degrees of emphasis or discussion. When applications are covered, they are equated with management issues. When business analysis is discussed in these books, it is only presented as a way of illustrating a solution, rather than fostering a deep understanding of the underlying business problem.

CRITIQUE AND RECOMMENDATIONS

None of the books touch on the underlying reason or rationale for using telecommunications in a business environment, which is, to improve the position of the business organization by facilitating the exchange of ideas, business information, and data in various ways.

For a student of business in an information systems curriculum, an emphasis on communications technology alone can be frustrating. The managerial activities needed to use telecommunications effectively are complex and involve analytic skills that must be explicitly taught. A student must learn to recognize the opportunities in using telecommunications in a business environment, and be able to cope with problems and devise business solutions.

The idea of developing an information communications architecture needs to be explored. That is, a student must learn what the information needs are likely to be in an organization, and how those needs can be served with the application of communication technology. The technology must include all aspects of communications enabling, including user support for users in their day-to-day use of telecommunications in the context of business problem solving.

Enterprise communications, not just data communications, should be the emphasis. Just as doing enterprise modeling is a good method for developing an information architecture, so enterprise modeling should also be used to develop a telecommunications architecture. It should be recognized that it is business analysis that is the first step to telecommunications network analysis and design.

We must distinguish between the content of communication messages and the technology used to transmit them. In our view, we should care what is being transmitted, and to whom it is being transmitted, not only how it is being transmitted. An example to illustrate this might be the problem of managerial decisions about electronic mail. We must teach our students to be able to develop policies on how

to treat electronic mail. For example, what metaphor should be used to define it? Should electronic mail be treated like ordinary written (and structured) communications like memos or letters, or should they be treated as (unstructured) conversations? The implications for privacy and storage policies are enormous. This is not simply an academic problem. Recent events surrounding the transition of power from the administration of President Bush to that of President Clinton illustrate the importance. The problems arose, in part, because of the different definitions that were used for electronic mail messages. The Bush administration felt that since hard copy memos existed, electronically stored messages could be erased to save storage. A suit was brought to prevent the outgoing administration from erasing these messages. The argument was that the electronic messages constituted a different and more complete body of information than was in the memos. This electronic form of information was of historical interest, and should therefore not be erased. The views of where the information actually resided (in electronic form or hard copy) differed sharply enough to cause some contention. A good working definition of what electronic mail really contains, and what it represents to an enterprise may help managers avoid similar problems. Policies regarding storage, privacy, ownership, and legal standing of electronic documents could be developed more easily. Although this was a telecommunications problem, the details of the technology in this particular case were almost irrelevant.

In most telecommunications books, the focus is overwhelmingly only the technology, and communications planning is described from the standpoint of technical feasibility only. We know from experience with information systems in general that technical feasibility is not the reason for using information systems. Rather, information systems must be designed, used, and supported in the context of organizational functions. It was only when this was recognized, and Management Information Systems was clearly defined as distinct from Computer Science, that we saw the many useful applications of information technology to business problems. The approach to telecommunications systems should also be viewed in this light.

CONCLUSION

The research conducted for this paper shows that the educational need to develop the appropriate knowledge and skills called for in the IS literature is not the same as what is being emphasized in the textbooks. There is a need for research to find out what is currently being taught and to communicate in research journals so that professors are teaching what really needs to be taught rather than what publishers think is important or want to publish. These books are not necessarily bad. There is a need for them somewhere in a telecommunications course of study. We question only whether their orientation is the best for IS students.

We hope that this paper is perceived as controversial so that discussion will arise. It is no longer appropriate that only engineers define a telecommunications curriculum.

NOTES

¹ While what is being stated about telecommunications education may apply to other countries, no claims are being made in this paper to that effect. This is because the authors based their paper on textbooks intended for American students. It would be useful, however, to consider the extent to which the findings present in this paper also apply to other countries.

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