THE IMPORTANCE OF SELECTED TELECOMMUNICATIONS MANAGEMENT JOB FUNCTIONS AS PERCEIVED BY TELECOMMUNICATIONS MANAGERS OF FORTUNE 500 COMPANIES

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TABLE OF CONTENTS

Chapter Page

Chapter Page

LIST OF TABLES

Table		Page

LIST OF FIGURES

CHAPTER I

THE RESEARCH PROBLEM

Background of the Study

"In the past, a city's vitality was contingent on its proximity to natural resources as well as to waterways and rail lines that could transport the city's products to distant localities" (Costigan, 1984, p. 49). Today, a city's well-being may be contingent upon its ability to accommodate another resource: information. Accepted as a major resource by corporations (Kenny, 1986), information and the need to access it has mushroomed. Since corporations recognize the importance of information, they should, according to Daniel Bell, "understand the nature and extent of the powerful technological revolution taking place in communications as well as its potentialities and threats to the ways of doing business" (1979, p. 21).

Unfortunately, some people have focused on "bigger, better, and more powerful hardware" in their race to "capture the Information Age" and have overlooked an important factor: "the wire which networks an information system together" (Caterino, 1986, p. 13). This "wire" which began with the telegraph in 1844 and led to the invention of the telephone in 1876, now includes "new conduits such as glass fibers, microwaves, satellites, laser beams, and the pulsating digital language of computers" (Rosen, 1987, p. 4). Today's telecommunications, in addition to the data and voice transmissions of the past, embrace services that support "telephone calls, the transmission of images of documents, video, and data and text generated by computer equipment" (Lientz and Rea, 1987, p.25).

Growth of the Telecommunications Industry

The phenonmenal growth of the telecommunications industry, especially since deregulation of the telephone industry in 1984, has brought about both confusion and opportunities for businesses. According to a survey conducted in 1985 by the United States Telephone Association, the "telephone industry grew in revenues, new lines and number of calls in the 3rd quarter of 1985" (USTA, 1986, p. 10). Speaking to an International Communications Association conference, Alvin Toffler added detail to the extensive use of telephones. He said there are 600 million telephones in the world, with 450 million in just nine nations (Smith, 1985, p. 25). Referring specifically to telephone usage in the United States, Rosen stated that the United States "leads all other nations in telecommunications expenditures. It accounts for 40 percent, or $142 billion, of the $335 billion worldwide market" (1987, p. 5). Indicating expected growth in the industry, Lou Caterino predicted that although only 40 percent of the 60 million desks and workstations in the United States are currently connected to transmission systems, "over 75 percent will tap into the future by the end of this decade" (1986, p. 13).

Oldham (1986) and Wilder (1985) both agreed that corporate interest in telecommunications is escalating due to the cost factor. Growing salary of telecommunications personnel and network expenses of communications first drew attention of senior management. The drain on investment capital was evident. In the past ten years, according to Oldham, telecommunications costs have risen by a factor of four in many financial and information technical industries (1986, p. 48q). According to Sobczak (1985), the voice costs far exceed that of data, with voice costs representing ninety percent of all telecommunications costs. Consequently, the message to managers who wish to reduce telecommunications costs is to concentrate on the voice area. Despite the costs, the tendency today is to consider telecommunications not only as an expense, but also to develop it into a strategic weapon. Some businesses that are leading the way are "selling their information and communication networks as strategic business weapons, opening new markets, advancing sales and profits" (Kenny, 1986, p. 51).

Effects of Telecommunications on Business

Whether organizations have only a telephone or a sophisticated online computer system, and whether or not organizations use their systems strategically, telecommunications affects all organizations and makes them a part of a powerful, global, interactive network. George Bugliarello (1984) described the pervasive influence of the global network. He said that this

> ...network whose nodes pervade society becomes a far more comprehensive, sensitive and swift device for revealing social, political, economic or other kinds of issues than anything available today through mass media or traditional polls (p. 49).

The telephone, which began as a communications tool that would unite the world, has become difficult to manage. Prior to divestiture of the Bell system, telecommunications managers, if there were any, had to administer rather than manage telecommunications by calling the telephone company for services and by paying the phone bills. Now, telecommunications managers are needed (1) to sort out multiple services, standards, and connectivity that are offered and (2) to select the most suitable for their firms. The growth from "two wires, a phone, and an electromechanical switch...to a confusing array of vendors, products, and services" has created a need to educate people to manage this constantly changing technology (Oldham, 1986, p. 48q).

Historically, the person in charge of telecommunications was in charge of only voice transmissions and services. The data processing department was responsible for the transmission of data. Currently, since the facilities with which these transmissions are made are often identical, voice and data communications management is tending to merge as the responsibility of the telecommunications manager. Consequently, the telecommunications manager is faced with prodigious responsibilities and many potential pitfalls. Sobczak (1985) said the only way the many challenges can be dealt with is to rely on sound business management principles, not by finding applications that fit new technological developments.

The proliferation of personal computers, computer networks, increasingly more reliable data carriers, and new products has combined to create an information deluge that is problematic; humanity has more knowledge than it can handle or assimilate. More problematic for businesses that wish to maintain or gain a competitive edge, however, is the confusion that results from the changing telecommunications technology: "...data systems are now finding themselves competing with an ever more congested communications web" (Kluger, 1984, p. 48). This confusion could prevent attainment of information needed for sound managerial decisions.

Need for Study

The Vital Link

Given that information is a key to corporate success and that telecommunications technology is the avenue through which information is to be attained, many businesses have merged their information systems so that they can "function as an integrated whole regardless of distance, brand of computer, and application" (Van Spyk, "The emergence...." 1987, p. 21). John Naisbitt in his book Megatrends indicated that the combination of technologies that "transmits data and permits instantaneous interactions between persons and computers....will fuel the information society...." (1984, p. 16) by providing cross-functional timely flows of relevant, accurate information. Thomas Quigley also emphasized the importance of data movement. It is not, he said, the processing of data but the movement or communication of information "that's now the more-important and more-vital activity to receive top-management attention and that's in need of urgent redevelopment" (1986, p. 43).

By connecting computers via telecommunications to a corporate data base, better working relationships can exist between individual users and departments. This connectivity can eliminate needless redundancy and facilitate better tactical and strategic decisions (Burch 1986). Shriver (1986) added, however, that integration of office communications systems and services, access to remote data bases, and video and graphic communications demand education.

Need for Telecommunications Personnel

A knowledge of telecommunications technology and management is necessary in order to achieve the greatest potential of the automated office and to reduce telecommunications expenditures. Telecommunications consultants may, with a hardware vendor, plan, develop and implement a system; but the need for telecommunications knowledge does not end here. New communications regulations and new technology combine to change existing systems, and knowledgeable people are needed for advice. Grover stated that "...as industry, commerce, and society have become increasingly dependent on telecommunications the pressure has intensified for users to be able to choose how their own needs can best be met" (1986, p. 160).

Education is needed to fill the void of technical communications people and communications managers as well as to provide office personnel with training to keep them current with changing communications technology. Freud (1986), Riehl (1987), Minoli (1985), Oldham (1986), Stamps (1985), Chester (1987), Blyth (1985), and Kenny (1986) all agreed that there is a shortage of personnel. According to Freud, "overall demand for the telecom professional has currently outstripped supply" (1986, p. 58). Blyth cited three reasons for the shortage:

1. Telecommunications management is just emerging as a profession.
2. A lack of knowledge about telecommunications careers exists.

3. A scarcity of college programs exists in the area of telecommunications.

Chester specified that certain areas of the United States, such as the Midwest, have a more acute shortage of trained communications personnel than do others. Kenny stated that the demand for telecommunications professionals in general will triple the supply. Currently, Kenny (1986) added,

> At companies with more than $1 billion in assets, where information technology is driving the success of the company...annual salaries for information managers are already twice what they were just five years ago (p. 51).

A lack of standards in the telecommunications industry (Oldham, 1986), increasing phone usage in businesses, and the changing nature of telecommunications in business (Jordan, 1986) have created the need for personnel who have a thorough knowledge of the industry as well as substantial foresight and ability to plan for future needs. Oldham stated, however, that present educational programs are inadequate:

> The training opportunities presently available in telecommunications (trade publications, industry conferences, and conventional education) no longer satisfy completely the needs of the telecommunications manager (p. 48r).

Both educators and business people agree with Oldham that educational programs are needed in the area of telecommunications. Although Freud (1986) indicated that at the present time the educational background of a potential telecommunications professional or incumbent has little impact on industrial compensation, he foresaw a change in the near future. In the opinion of Ronald Spears, president of MCI Midwest, "People coming out of good telecommunications programs today are what M.B.A.s were in the 1970s--in great demand" (Parr, 1986, p. 148). In another instance, William E.

Bracker, Jr., Director of Research at the University of Arizona, stated that

> The proliferation of data communications networks has underscored the growing need for in-depth educational programs that focus on the training of future data communications professionals (1986, p. 2).

Although the need for effective telecommunications management is evident, specific weaknesses have been found in regard to that area. As telecommunications merge with data processing, information systems managers must manage their networks more effectively. Chester (1987) stated that many information systems managers cannot troubleshoot and diagnose errors of their networks sufficiently and continue to manage other necessary details of the network. Nolin (1987) and Keller (1986) concurred that a general lack of expertise exists in the area of telecommunications management, and that expertise is needed in order for managers to be successful on the job.

Need for Managerial Expertise

Several reasons exist for this needed managerial expertise. Deregulation acted as a catalyst to transform the telecommunications industry into a free-enterprise system that required tactical management (Wilder, 1985). In pre-divestiture days, the Bell company declared that it would hire only Bell-trained employees. Now that Bell is no longer available for managers´ previous services, managers now find themselves the "one-stop shopping place" that replaced the Bell system (Coopman, 1987, p. 86). Other changes such as developments in Private Branch Exchanges, local area networks, public network services, and the "ubiquity of personal computers" add complexity to telecommunications managers´ roles (Wasserson & Garrett, 1986,

p. 41). In their new roles, they must sort out multiple services, standards, and connectivity; then they must select the most suitable for their firm. Coopman (1987), Watt (1986), and Chester (1987) all said that managers must accept their new responsibilities and refuse to surrender the choices to others. "Never," Chester warned, "give away your network to a sole provider" (1987, p. 40).

Another reason for needed telecommunications management expertise is the changing role of telecommunications. Because of today's competitive business environment, telecommunications must be managed to "aid the business in achieving its strategic goals" ("With careful planning...." 1986, p. 8). David M. Rappaport, director of telecommunications of Arthur Anderson and Co. of Chicago, Illinois, cited the role of telecommunications as a corporate resource:

> Telecommunications represents more than a significant corporate expense; it is also a strategic business resource encompassing the movement of information by way of voice, data, facsimile or video technologies ("With careful planning...." 1986, p. 8).

Van Spyk agreed that "...communications is becoming a fundamental business resource along with capital, people, computers, and production facilities" ("An introduction....," 1987, p. 24). Information, he continued, must not only be generated, but it must be generated at the right time and in the right form, regardless of distance.

According to Parr (1987), the need for qualified telecommunications professionals to manage the new business resource is growing:

> Already the need for qualified managers in the $40 billion telecommunications industry is urgent, and growing. Estimates are that the industry will double, to $80 billion, by 1990, creating some 100,000 management jobs (1987, p. 148).

Educational Trends

The result of the growing need for competent telecommunications managers is that educational institutions are beginning to offer telecommunications management courses. Rosen said, "These programs are designed to supply the job market with desperately needed managers who have technical, financial, and managerial know-how" (1987, p. 71).

James Koerlin, director of the Telecommunications Department at Golden Gate University, said that it is not only the management know-how that is most marketable. He added that "...the degree in telecommunications management is what the future employer is looking for and is commanding the higher salaries" (Underwood, 1985, 31).

In spite of the fact that both industry and academia know of the strategic importance of telecommunications in businesses and of the shortage of expertise in the area, little has been done to combat this shortage. A study of schools accredited by The American Assembly of Collegiate Schools of Business revealed that although the topic of telecommunications has been around a long time, it has not enjoyed the coverage it deserves in Management Information Systems courses (McLeod, 1985, p. 81). For example, an industry curricular model developed by the Data Processing Management Association (DPMA) in 1986 has only one course in the telecommunications area: Distributed Intelligence and Communications Systems (Van Spyk, "An introductory....," 1987, p. 25). This course fails to include, Van Spyk said, references to important telecommunications concerns: the International Standards Organization (ISO); Integrated Systems Digital Network (ISDN); or the role of the Regional Bell Operating Companies (RBOCs).

Reasons for Inadequate Telecommunications Curricula

The lack of adequate telecommunications curricula, however, is due not only to inertia on the part of colleges and universities. It is also due to confusion, lack of funding, lack of industrial consultation, and lack of instructors. Stamps (1985), Bracker and Konsynski (1986), and Clemmenson (1986) pointed to issues that may prevent an adequate number and quality of telecommunications programs from being developed. Stamps and Bracker and Konsynski concluded that telecommunications courses can be found almost anywhere in the collegiate curriculum, from electrical engineering or computer science to schools of business or library science. In addition to the issue of not knowing what departments should teach telecommunications, Bracker and Konsynski mentioned two other important ones: (1) curricular issues are unclear and (2) the priority of data communications curricula is vague. Clemmenson added the following issues: (1) lack of funding (2) concern that universities provide "education," not "training," (3) establishment of educational goals, and (4) accreditation. Stamps included yet other problematic issues for educators: lack of instructors with academic credentials and lack of industrial consultation.

Recent research indicates a trend toward more academic telecommunications programs, but the dilemma of what these programs should consist still persists. As needs in the business world change rapidly, "research is constantly needed as a basis for determining not only how we teach but also what we shall teach" (Nanassy, Malsbary, & Tonne, 1977). Because of the ever-changing nature of the telecommunications manager's job, research is needed to evaluate the current status of the field and provide a basis for curricular changes in business education programs.

Because the business world as well as academia should be involved in the development of educational curricula for telecommunications managers, a clarification of important job aspects by telecommunications managers themselves is necessary. Such a clarification includes both the business management discipline and technical expertise considered important for successful management of telecommunications.

Statement of the Problem

The problem of this study was to determine whether selected Fortune 500 telecommunications managers with varying undergraduate degree specialties and levels of education differ in their perceptions of the value of technical and business management expertise important for success in their organizational roles.

In the investigation of this problem, a number of pertinent questions arise:

1. Do undergraduate degree speciality and level of education interact to affect telecommunications managers' perceived values of technical expertise; business management expertise; and the combination of technical and business management expertise in their organizational roles?
2. Do telecommunications managers with various levels of education hold different opinions about the value of technical expertise; business management expertise; and the combination of technical and business management expertise in their organizational roles?

3. Do telecommunications managers of varying undergraduate degree specialities hold different opinions about the value of technical expertise; business management expertise; and the combination of technical and business management expertise in their organizational roles?

Variables

The study investigated three dependent variables: the opinions of telecommunications managers toward the combined value of business management and technical expertise in their organizational roles; the opinions of telecommunications managers toward the value of business management expertise in their organizational roles; and the opinion of telecommunications managers toward the value of technical expertise in their organizational roles.

The study includes two independent variables: undergraduate degree specialty and level of education.

Sources of variation used in analyzing the results of two-way Analysis of Variance tests in this study include (1) two-way interactions of the independent variables and (2) main effects--undergraduate degree specialty and level of education. Source of variation used in analyzing the results of one-way Analysis of Variance tests includes the effect of level of education on the dependent variables.

The Purpose of the Study

The primary purpose of the study was to provide information which may be used by business departments in colleges and universities as a means of (1) enhancing curricular offerings in the area of telecommunications, (2) preparing telecommunications managers, and (3) counseling potential telecommunications managers.

A secondary purpose of the study was to provide a profile of telecommunications managers that may give businesses greater confidence in their selection of high potential telecommunications managers.

By providing a study of business management and technical qualifications perceived as important by current telecommunications managers, the study could also be used to facilitate decision-making by individuals or groups concerning additional research or industry sponsored educational programs.

Delimitations of the Study

Researcher-defined boundaries include these delimitations:

1. The study was not intended to result in specific curricular guidelines for the instruction of telecommunications managers. It should be a help, however, in providing a basis of the development of future guidelines.
2. No attempt was made to describe future conditions or trends in telecommunications management. Only present job-related business management and technical areas were considered in this study.

Limitations of the Study

Limitations for the study include the following:

1. The study was limited to a sample survey of <u>Fortune</u> 500 companies. These companies may not be completely representative

of all business firms requiring telecommunications departments because firms not listed by Fortune (1988) were excluded from the study. The firms surveyed, however, encompass those which most commonly have telecommunications expenditures reaching $1.5 million annually and employ in-house telecommunications management (Inan, 1985).

2. The selected sample from the Fortune 500 companies may not be representative of the population.
3. The validity of the survey responses is reliant upon the interpretation and sincerity of effort on the part of the respondents.
4. The selected telecommunications managers may not be representative of all telecommunications managers.
5. Data collected may not be the complete record of technical or business management expertise needed for successful management of telecommunications.
6. As a result of the qualitative nature of the collected data, a certain amount of subjectivity in analyzing and making deductions is present. Attempts were made, however, to remain objective.

Assumptions

In regard to the study, the following assumptions were made:

1. It is assumed that the companies from which telecommunications managers responded to the survey are representative of other Fortune 500 companies that rely heavily on telecommunications.
2. It is assumed that the responses of the telecommunications managers who returned the survey are representative of Fortune

500 telecommunications managers not included in the study.

3. It is assumed that the responsibilities of the surveyed telecommunications managers are similar in regard to their need for technical and managerial abilities.

4. It is assumed that the survey instrument is both valid and reliable.

Definitions

The following definitions are intended to clarify terminology used in the study. The terms have a unique use in the study, are subject to varying reader interpretations, or are related to the technical nature of telecommunications.

BOC. "Bell operating companies are 22 local telephone companies spun off from AT&T as a result of divestiture, now reorganized into seven regional Bell holding companies; among the largest of the 1,600 independent local phone companies in the U.S" ("Data Communications Glossary," 1985, p. 100).

Career path. Career path was indicated by telecommunications managers on the demographic survey question regarding their five most previous job positions. This information was then subjectively classified by the researcher.

Carrier services. These services include private (lease) circuit services, measured use services, and other special services.

Central office exchange. The central office exchange is the telephone company switching facility or center at which a subscriber's local loops terminate. The facility handles a specific geographic area, identifiable by the first three digits of the local telephone number.

Centrex. Centrex is defined as "...office communications provided on a tariffed basis through local telco central-office exchanges" (Vandergriff, 1986, p. 45)

Common carrier. "In the U.S., any supplier of transmission facilities or services to the general public that is authorized to provide such facilities or services by the appropriate regulatory authority, and bound to adhere to the applicable operating rules, such as making services available at a common price and on a non-discriminatory basis" ("Data Communications Glossary," 1985, p. 102).

Data communications. Data communications is "The transmission, reception, and validation of data (IBM); data transfer between data source and data sink via one or more data links according to appropriate protocols (ISO)" ("Data Communications Glossary," 1985, p. 104).

Divestiture. Divestiture refers most notably to the splitting up of twenty-two local operating telephone companies of the Bell System. This event, mandated by the federal courts based on an antitrust accord reached between AT&T and the U.S. Department of Justice, effective January 1, 1984, created competition for phone services. It also caused consumer confusion because of the many available telephone services and companies from which to choose.

Facsimile. Facsimile, also called FAX, is a communications process in which graphics or text documents are scanned, transmitted, and reconstructed by a receiver.

FCC. The Federal Communications Commission or FCC is a body appointed and authorized by the President under the Communications Act of 1934 to regulate all interstate telecommunications originating in the U.S.

Fiber optics. Fiber optics is a transmission technology where modulated lightwave signals, generated by a laser or light emitting diode are propagated along a glass or plastic waveguide, then demodulated back into electrical signals by a light-sensitive receiver.

Interface. An interface, in telecommunications terminology, is defined as "A shared boundary; a physical point of demarcation between two devices, where the electrical signals, connectors, timing and handshaking are defined; the procedure, codes, and protocols that enable two entities to interact for the meaningful exchange of information" ("Data Communications Glossary," 1985, p. 110).

ISDN. Integrated Services Digital Network is a project underway for a future network that will allow a variety of mixed digital transmission services to be accommodated.

Level of education. Level of education was defined by respondents as the highest level of education completed: doctoral degree, master's degree, some graduate-level education, four-year baccalaureate degree, associate's degree, some college, vocational certificate program, and no college or certificate program.

Local area network. A local area network or LAN is defined as "A loop network that is usually contained within a single building. The data move around this network in one direction only and there might be

100 or more individual terminal stations connected to it" (Fitzgerald 1984, p. 359).

Local loop. The local loop is the wire pair that connects a subscriber to a phone company end office (central office).

Measured use services. Examples of measured use services include direct distance dialing (DDD); Wide Area Telecommunications Service (WATS); Public Packet Switched Services; and Telex/TWX.

Network analysis. Network analysis involves the "Derivation of the electrical properties of a network, from its configuration, element values, and driving forces" (Parker, 1984, p. 354).

Networks. "Networks are communications-based systems with added software and intelligence to perform business functions" (Lientz and Rea, 1987, p. 25).

Open Network Architecture. "ONA is the overall design of a carrier's basic network facilities and services to permit all users of the basic network, including enhanced service operations of the carrier and its competitors, to interconnect to specific basic network functions and interfaces on an unbundled and equal access basis" (McElveen, 1986).

Opinions regarding business management survey items. Opinions of telecommunications managers toward business management discipline were measured by the mean score of ratings by telecommunications managers on business management items in the questionnaire.

Opinions regarding both business management and technical survey items. Opinions of telecommunications managers toward both business management discipline and technical expertise were measured by the mean composite score of ratings by telecommunications managers on combined job-related items in the questionnaire.

Opinions regarding technical expertise. Opinions of telecommunications managers toward technical job areas were measured by the mean score of ratings by telecommunications managers on the technical job items on the questionnaire.

OSI. Open Systems Interconnection is a logical structure for network standardization within the International Organization for Standardization (ISO). It consists of a 7-layer network architecture that is used for the exchange of information which defines network protocol standards and enables any OSI-compliant computer or device to communicate with other OSI-compliant computers or devices.

Packet-switching. Packet-switching is a switching technique that permits fixed channels to be shared among multiple users. Messages are broken into finite size packets, "each packet coded for identification.... Consecutive packets destined for the same receiver are transmitted on the best possible route, determined by the destination address, the amount of traffic and the performance quality of the available channels" (Charp & Hines, 1988, p. 95).

PBX. These are "customer-premises private branch exhanges (PBXs) for on-site switching intelligence" (Vandergriff, 1986, p. 45).

Private (Lease) circuit service. This service includes voice-grade channels, wide-band services, digital services, satellite services, and point-to-point or multipoint communications network services on a customer's premises. A leased circuit, which offers a higher quality of transmission service, is always available for use on the customer premises.

Protocols. Protocols are a formal set of rules governing format, sequencing, error control, and timing of exchanged messages on a data network. "The exchange of a special sequence of control characters between a computer and a remote terminal in order to establish synchronous communications" (Parker, 1984, p. 45).

PUC. Public utilities commissions are governing bodies authorized by state governments to regulate intrastate telecommunications services.

Real-time. Real-time computer processing is influenced by the results of the processing as it occurs.

RFI. A request for information is a general notification of an intention to purchase communications or computer equipment. It is sent to suppliers to determine interest and to solicit product information.

RFP. A request for proposal follows a request for information. It is sent to vendors to solicit information concerning configuation and prices that meet user requirements.

SNA. Systems network architecture is the layered logical structure, formats, procedures, and protocols that govern information transmission in IBM networks.

Synchronous communications. "The high-speed transmission and reception of long groups of characters at a time, requiring synchronization of the sending and receiving devices" (Parker, p. 516).

Tariffs. Tariffs are formal documents submitted by communications common carriers to government regulatory agencies for review and approval. They also refer to the published rates for specific communications services, equipment, or facilities that constitute a contract between a user and a supplier.

Telco. Telco is an abbreviated form referring either to the telephone central office or the telephone company.

Telecommunications. Telecommunications is "...the electronic process that permits the passing of information from one sender to one or more receivers with the output in a usable form (printed copy, fixed or moving pictures, optical signals). It includes all services, products, media and methodologies used to deliver information electronically, from a simple telephone to sophisticated fiber-optic networks" (Charp & Hines, 1988, p. 94).

Telecommunications manager. The telecommunications manager normally reports to the director or vice-president of telecommunications in organizations large enough to have an in-house telecommunications department. A wide variety of technical, financial, and managerial responsibilities are typical aspects of the telecommunication manager´s job.

Transmission. "The dispatching of a signal, message or other form of intelligence by wire, radio, telegraphy, telephony, facsimile, or other means (ISO)" ("Data Communications Glossary," 1985, p. 125)

Undergraduate degree specialty. Undergraduate degree specialty was defined by respondents having four-year degrees as one of the following: business; liberal arts; information systems/data processing; computer science; engineering; telecommunications; other.

Video technology. Also called full-motion video, video technology is the televised transmission by which images are sent and displayed in real-time; motion is continuous.

Hypotheses Tested

To determine significant variance of interactions and/or main effects, tests of significant differences were conducted to test the following hypotheses:

H_1: Undergraduate degree specialty and level of education do not interact to affect the opinions of telecommunications managers toward the importance of technical expertise; business management expertise; and the combination of technical expertise and business management expertise in their organizational roles.

H_2: Level of education does not affect the opinions of telecommunications managers toward the importance of technical expertise; business management expertise; and the combination of technical expertise and business management expertise in their organizational roles.

H_3: Undergraduate degree specialty does not affect the opinions of telecommunications managers toward the importance of technical expertise; business management expertise; and the combination of technical expertise and business management expertise in their organizational roles.

CHAPTER II

REVIEW OF RELATED LITERATURE

This study was designed (1) to determine the effect of varying educational levels and undergraduate degree specialties on the perceived value of specific business management and technical job tasks of telecommunications managers and (2) to determine the perceived importance of job-related tasks and knowledge areas in the current role of telecommunications managers. The purpose of the study was to reduce confusion regarding the importance of those tasks and to provide a basis for curricular change in the area of telecommunications management. Included in the review of literature are both theoretical research, indicating the growing importance of telecommunications management, and complementary research, which was helpful in designing the current study. Prior to a review of literature, both a search of The Educational Resources Information Center (ERIC) documents and a review of dissertation abstracts were conducted to determine if similar studies had been done. Finding no similar studies, the researcher consulted the business periodical index at the Oklahoma State University library. Many sources unavailable at this library were obtained through interlibrary loan services and through the periodical collection of Oklahoma State University data communications instructor, Professor Dennis Knox. The review of literature from various sources revealed the following information:

(1) the growing importance of telecommunications; (2) telecommunications educational alternatives; (3) industrial and educational research; and (4) the relevance of telecommunications in the university business school curriculum.

Growing Importance of Telecommunications

The importance of telecommunications can be seen both in businesses whose needs include only the integration of business functions and in businesses that require speed of data transfer over vast areas. Falce (1985) said that as business requirements become more interrelated, the information of one department is often needed by another. To solve the problems, telecommunications technology is used to provide connectivity. This connectivity is not restricted, however, to departments within a single location. To realize the full potential of telecommunications and computerization, processed information can be conveyed instantly "...by satellite or along beams of light--across cities, across nations, and around the world in a constantly growing web of global communications" (Rosen, 1987, p. v).

Grover (1986), Lientz and Rea (1987), Bell (1979), Lewis ("Telecommunications...., "1984), and Kenny (1986) reported that businesses are becoming more financially dependent upon communications as a result of the availability of such technology. Kenneth Grover said that "The operational and financial viability of industry and commerce now depend critically on telecommunications" (1986, p. ix). Lientz and Rea (1987) and Daniel Bell (1979) concurred that a firm's profitability depends increasingly upon telecommunications. The former concluded that "The profitability of a firm and its ability to compete are increasingly tied to the wider and more effective use of communications" (1987, p. 7). Confirming this dependency, Bell said, "The success of an enterprise depends in part on the rapid transmission of accurate information" (1979, p. 20). John L. Lewis, senior vice-president for information services at Chemical Bank in New York, further substantiated telecommunications importance by stating that "Moving information rapidly and efficiently is absolutely crucial to our business" ("Telecommunications....," 1984, p. 91). In addition, Matthew Kenny said that "The ability to use telecommunications creatively is already spelling the difference between success and mediocrity" in businesses (1986, p. 51).

U.S. Representative Edward J. Markey, who is also Chairman of the Subcommittee on Telecommunications and Finance, saw even more extensive implications to the importance of telecommunications. The telecommunications industry, he stated, has "already spurred burgeoning growth and has been touted as the United States' best hope to continue its world economic leadership in the 21st century" (1987, p. 27).

Educational Alternatives

In today's information society, "...industrial innovation depends crucially on theoretical knowledge and techniques" (Bell, 1979, p. 20). In spite of this, according to co-director of the National Council on Telecommunications Education, Bennett H. Berman, there is a shortage of collegiate programs in telecommunications education. Collegiate programs are needed, Berman suggested, because "No one supplier, manufacturer or company can train the number of people that this industry will need" (Bracker & Konsynski, Guide...., 1986, p. 2).

Although a shortage of educational programs exists, several alternatives are currently available for the individual who is interested in the management of telecommunications. Both Parr (1986) and Stamps (1985) indicated a range of possibilities: undergraduate degree programs, certificate programs at universities or junior colleges, or graduate Masters of Business Administration programs. Clemmenson noted that some universities such as Harvard, Stanford, and Massachusetts Institute of Technology offer research programs in telecommunications but no certificate or degree programs (Clemmenson, 1986, p. 11).

Other alternatives are expected to arise. Golden Gate University, although it offers an undergraduate degree in telecommunications, a certificate program, and a master's program that focuses specifically on the management of telecommunications services, is considering the possibility of establishing a telecommunications management certificate program in the Washington, D.C., area. Also a possibility for future expansion of their existing program is a training program for the Internal Revenue Service (Underwood, 1985).

The preceding alternatives are college or university programs; however, if telecommunications concerns are not given adequate coverage in these institutions, the needs will be met by other means. Expressing a lack of confidence in a university's ability to teach needed information systems areas--data communications concepts included--Dwight Wainman said, "Universities may be unable to meet our needs. In fact, it may even be unrealistic to think we can do anything except train our students ourselves" (1986, p. 40). Seeing the educational void, a regional bell operating company, BellSouth, has established Bell South Educational Services to offer both technological and management training to business customers or businesses that do not have the resources to train their own employees. The new educational service has been accredited by the Southern Association of Colleges and Schools ("BellSouth....," 1987). Another regional Bell holding company, Northwestern Bell, also holds educational seminars for anyone involved with ordering access services ("Northwestern....," 1986).

Regardless of where it is taught, professionals needing telecommunications expertise will have to find a way to get it. Professional organizations offering seminars and conferences to supplement telecommunications expertise include, among others, the following: United States Telephone Association, Pacific Telecommunications Council, International Communications Association, Tele-Communications Association, Communications Managers Association, North American Telecommunications Association, United States Telecommunications Suppliers Association, Association of College and University Telecommunications Administration, and North Texas Telecommunications Association.

One of these professional organizations, the Tele-Communications Association, became aware of the importance of communications in 1961, the year of its founding. In addition to holding conferences and monthly meetings, it is dedicated to assisting managers, professionals, and company employees who need education and guidance on the subject (Shriver, 1986, p. 144). Another professional organization, the International Communications Association, offers similar services (Clemmenson, 1986). In addition to assisting telecommunications professionals, these two organizations are dedicated to stimulating the creation of university programs in telecommunications and encouraging people to get a college degree ("TCA....," 1985).

Research Surveys

General Surveys

Several research surveys not specifically related to telecommunications indicated either (1) industrial and educational disagreement regarding educational efforts or (2) the increasing importance of telecommunications in management information systems. Two research surveys reviewed were comparative surveys of professional educators and industrial representatives. In Hartog's survey ("Of Commerce....," 1985), interviews of business data processing and university personnel were conducted to determine if a "gap" exists between industrial needs and university programs designed to fulfill those needs. Although the survey was not a telecommunications specific one, the survey results apply to the tendency of business or educational entities to meet each other's needs. In general, each group tended to place the responsibility for deficiencies upon the other. Another survey including industrial and academic professionals revealed that integration of data processing, office automation, and telecommunications ranked third in the top ten management issues (Dickson, et al, 1984, p. 137). In 1985, Curt Hartog and Martin Herbert conducted a similar opinion survey of Management Information Systems managers in Fortune 1000 companies in the United States. From twenty-one selected key management issues, the researchers found that the average company rating on importance rated telecommunications technology as number ten. This issue ranked above fourth generation languages; decision support systems; and expert and artificial intelligence (Hartog and Herbert, 1986, p. 356).

Telecommunications Centered Surveys

Industrial Based Surveys. Riehl (1987), Rhodes and Winkler (1987), and Lybrand and Cooper ("New ICA....," 1987) conducted industrial research in specific regard to the issue of telecommunications. The rationale for Riehl's study was twofold. First, Riehl contended that telecommunications is a "dominant technical component of the complex information system networks that are the heart of modern large-scale business and government operations." Secondly, "...current sources of academic telecommunications education" revealed that the actual educational needs have largely been ignored; consequently, a shortage of people trained in data or telecommunications technology exists (Riehl, 1987, p. 2). Results of the Riehl industry-based research were used to determine educational needs of the Information Systems professional and to develop a curricular model for telecommunications education requirements for the information systems major.

Based upon an Infosystems survey conducted in January of 1987, Rhodes and Winkler concluded that "confusion reigns in the communications realm" (1987, p. 36). The survey indicated a widespread concern about "network management capability," with respondents showing greater concern for "better management discipline and technical expertise than with getting new equipment" (p. 39). Consistently, the respondents indicated the inability of users to plan and implement data communications systems.

Two other industry-based surveys in 1987 were conducted by the firm Lybrand and Cooper. Both involved the International Communications Association (ICA). In one, the ICA commissioned the firm of Certified Public Accountants to survey its membership and develop a profile of telecommunications managers (Heidel, 1987). The resulting profile illustrates educational backgrounds, educational specialties, source of telecommunications training, salary, incentive compensation programs, and management levels. Although the majority of educational specialties was found to be business, two-thirds of all respondents indicated that telecommunications training was received on the job. In a comparison of this survey with a 1984 ICA sponsored survey, a closer relationship was found between data processing/ management information systems and telecommunications ("New ICA....," 1987).

The second Lybrand-Cooper survey combined 500 respondents at two separate conferences: the Office Automation Conference in Houston and an ICA telecommunications conference in Atlanta. Separating responses into categories of vendors and users, levels of categories included professional responsibilities, industry perspective, scale of operation, and organizational role. Predominant problems indicated by the survey include the following, in order of precedence: (1) keeping up with technology, (2) personnel aspects, (3) selling ideas to senior management, and (4) recruiting qualified personnel (Powell, 1987). According to Powell, "Users cannot follow the availability of new telecommunications and office information system products and select those that will provide the most benefit for their organizations" (p. 12). Users also said that sticking with one vendor is easier, but more costly.

Educational Surveys. Surveys of educational institutions conducted by the International Communications Association, Robert Van Spyk, and Technology Research Associates were all done with the intent of determining what current programs are being offered in data or telecommunications. The International Communications Association (ICA) restricted its survey to forty colleges or universities in the United States which met its pre-defined criteria of telecommunications offerings. Of the forty surveyed schools, thirty-seven responded. The responses were compiled to provide an overview of the telecommunications offerings at those institutions (Clemmenson, 1986). Van Spyk concluded from his study of colleges in California that "coverage of data communications in most information systems curricula is cursory...." and that most telecommunications courses in that state are taught in the area of computer science ("An Introductory....," 1987, p. 25). The population of the third study directed at educational institutions, conducted by the Technology Research Associates, included 200 colleges and universities in the United States and Canada that were identified as offering data communications courses (Bracker & Konsynski, 1987). The researchers reported that "Data communications is not a subject taught in one department, but rather a hybrid set of courses crossing many departmental and disciplinary boundaries," and that this lack of clarity as to which departments within an institution should teach the courses constituted a "major hurdle in establishing new curricula" (p. 187).

Relevance of Telecommunications in Business Curricula

A review of literature did not reveal a special need to place telecommunications courses within technical curricular areas such as engineering or data processing, even though those are the schools of study in which most such courses have been placed. Perhaps because of the new strategic position of telecommunications within the business environment and the acceptance of information as an important business resource, a recent trend has been to place telecommunications courses and programs within schools of business in order to comply with the need for potential managers who are proficient not only in technical skills, but also in business skills as well.

Van Spyk (1987), Lientz and Rea (1987), Shriver (1986), Wainman (1986), and Fahey (1987) agreed that schools of business are logical locations for telecommunications programs. Justification for this opinion was found from several sources, which revealed the importance of communication skills, organizational expertise, and business strategy as important aspects of industrial jobs in general and, more specifically, telecommunications management.

Stamps (1985) said that the consensus of both industry and college representatives is that graduates are needed who have good communication skills, not just technical skills. Cotterman expressed the opinion that "...industry requirements for people with organizational expertise in information systems may soon overwhelm the need for people with technical skills" (Hartog, 1985, p. 77). Another similar view held by Wilder was that "Technology must always be subordinate to business strategy" (1985). Parr, on the otherhand, saw the need of a blend of business and technical skills to produce managers. The need is not, he said, for "technical people as such but for people who understand both the technology and business--in short, the demand is for potential managers" (1986, p. 150).

John Freud (1986), Dennis Conroy (1986), and Paula Oldham (1986) agreed with Parr that the telecommunications manager must strike a balance between business and technical skills. Freud added that until recently telecommunications professionals were referred to as technicians, but today the emphasis is on "the combination of technical skills with management and marketing skills" (1986, p. 58). Conroy (1986) said that a balancing of skills for the telecommunications manager is a shifting of emphasis from mostly technical skills to mostly business skills as managerial responsibility arises. As telecommunications professionals climb the management ladder, he said, they shift their focus from mastering technology to understanding the business and objectives of the company and how best to apply the technology. Additionally, Oldham (1986) stated that business skills, along with technical training and strategic positioning capability, are one of the three key ingredients to successful telecommunications management. If telecommunications managers do not understand the business goals of their organization, she continued, they cannot achieve the maximum return on every dollar (1986).

Seeing the need for business skills as well as technical ones, authors have been directing data and telecommunications textbooks and journals at colleges of business since 1985 (Van Spyk, "An introductory....," 1987). If the present trends toward "globalization and trade" continue as a result of telecommunications development, it stands to reason that "business graduates must understand the operational, tactical, and strategic implications of data communications opportunities" (Van Spyk, "The emerging....," 1987, p. 23). Lientz and Rea (1987), Shriver (1986), Wainman (1986), and Van Spyk (1987) agreed that an effective manager of telecommunications must have a "full range of business skills, such as budgeting, human resource management, and planning and marketing" ("With careful....," 1986, p. 8). Well-rounded business graduates, added Van Spyk, must have a "conceptual background required for applying and managing this new business resource" (Van Spyk, "An introductory....," 1987, p. 24).

Telecommunications is a large industry in its own right, and it is an important aspect of every business; consequently, it makes sense to place a telecommunications program in the business school (Fahey, 1987). An advertisement by Bell Atlantic sums up the current attitudes: "The genius of the future lies not in technology alone, but in the ability to manage it."

Summary and Critique

A review of literature revealed an agreement among the academic and business communities that telecommunications technology has a strategic position in both large and small businesses. The review of literature also indicated that present reliance upon telecommunications technology will grow, just as the technology itself continues to change and continues to add confusion to the integrated offices of today. In addition to the consensus of opinion that reliance upon telecommunications technology will grow, a review of past research illustrated that although many colleges and universities recognize the importance of telecommunications, curricular issues must be clarified before new programs can be feasibly developed.

Although previous studies have been conducted to determine the role of telecommunications in business, re-evaluation of the most important job functions is needed to update educational efforts. In addition, a survey of Fortune 500 organizations that often have telecommunications expenditures justifying in-house expertise may reduce confusion as to the importance of possible curricular topics. According to Inan (1985), "The Fortunes are setting the pace for organizations that have yet to begin full-scale integrated planning" (p. 37).

Unlike studies reviewed, the present study was concerned with (1) determining the effects of educational variables on the opinions of telecommunications managers toward the importance of job-related tasks and knowledge areas and (2) comparing the importance of specific business management job tasks with technical ones. Telecommunications managers, the people in the best positions to render judgment, revealed their perceptions of the importance of job-related tasks.

The study compared (1) the effects of educational level and undergraduate degree specialty upon the opinions regarding the importance of job-related tasks and knowledge areas; (2) the interaction of variables which may affect the attitudes of telecommunications managers toward their job functions; and (3) the rated importance of varied job-related items. The purpose of such comparisons was to provide a basis for future guidelines in curriculum development in collegiate business programs.

CHAPTER III

RESEARCH DESIGN AND PROCEDURES

Designed to obtain data from selected Fortune 500 organizations, this study focused on job functions of the person responsible for telecommunications management. Data were obtained from respondents regarding the importance of both technical and business management job functions in their current positions. In addition, the study was designed to determine the effect of undergraduate degree specialty and level of education on the attitudes of telecommunications managers toward job functions.

Descriptions of the procedural steps involved in the study are included in this chapter:

1. Sample selection
2. Development of the survey instrument
3. Preparation of cover letters
4. Collection of data
5. Data analysis
6. Presentation of findings, conclusions and recommendations

Sample Selection

The sample was taken from the population of Fortune 500 companies as identified in Fortune magazine (April 1988). According to a table for selecting sample size (Wunsch, 1986), a sample size of 218 with a response rate of approximately 65% is required to reflect the population, with a confidence level of .05. For this study, the needed sample of 218 was adjusted upward 100%, as suggested by Wunsch. This upward adjustment was done to compensate for the expected low response rate from mail questionnaires, which Dillman said is a problem with the mail method of data collection (1978).

A random sampling procedure was used to identify the sample of 436 corporations. First, the 1988 list of Fortune 500 companies as shown in the magazine's April issue was obtained. Second, four randomized lists of 436 numbers (from 1 to 500) were generated by computer software, Systat, to select the sample. Because Systat randomizes with replacement and more than one list was considered necessary to reveal 436 different numbers, four lists were generated. By manually comparing the computerized number lists with the rankings of Fortune companies, 436 companies were selected for the sample. Three of the generated lists were required to complete the sample selection process.

Development of the Survey Instrument

The study instrument formulated to gather information was in the form of a mail questionnaire designed by the researcher. Several steps were involved in its design and construction. First, literature relating to questionnaire design, literature related to telecommunications management, and research questionnaires developed by others were reviewed. Next, faculty members in the departments of

Administrative Services, Management, and Statistics at Oklahoma State University were consulted in order to develop and refine the original survey instrument. After a review by the doctoral committee, a panel of telecommunications and survey instrument design experts evaluated the original questionnaire and cover letters that were to accompany the questionnaire.

Input from Panel of Experts

According to Isaac and Michael (1987), validity "indicates the degree to which a test is capable of achieving certain aims" (p. 120). The panel of experts evaluated the study instrument for face validity, clarity, and appropriateness of possible responses to increase the validity of the constructed survey instrument. In addition to the evaluation of the questionnaire, telecommunications experts identified survey items that referred primarily to business management or to technical job aspects. (See Tables XIII and XIV in Appendix A for the classification of job-related survey items.) Identification of items according to type of job function was essential in order to test independent variable effects upon two of the dependent variables, business management job functions and technical job functions. The original questionnaire and cover letters were revised according to suggestions and evaluation by the panel of experts.

Contents of the Survey Instrument

The questionnaire was composed of two main sections. The first was related to demographic data; the second was related to the opinions of telecommunications managers toward the importance of job-related tasks and knowledge areas. The two main sections of the questionnaire sent to the telecommunications managers contained the following subsets:

1. Identification number--to facilitate the sending of follow-up mailings
2. Instructions for completing the questionnaire
3. Company information--purpose of business; geographic region in which respondent is currently working (State codes were obtained from the 1983 Rand-McNally Yellow Guide.)
4. Personal information--specific job title; source of majority of telecommunications training; source of additional telecommunications training, if any; highest level of education completed; undergraduate degree specialty, if a college graduate; last five job positions; current annual salary range
5. Request for survey results
6. Job-related tasks and knowledge opinionnaire--fifty items, divided into subsets of three to six

The final survey instrument was printed on five pages of 8 1/2 by 11 inch paper, front and back. Questionnaires for both mailings were printed on green paper. (See Appendix B).

Preparation of Cover Letters

Cover letters designed to encourage participation in the survey accompanied both the first and second mailings of the questionnaire. A blocked, business letter style was used, and the letters were reproduced on College of Business Administration stationery from Oklahoma State University. Cover letters of the first and the second mailings were signed by the researcher and co-signed by the dissertation adviser, Dr. Jeretta Horn Nord.

Using Dillman's (1978) recommendations, the cover letters for each mailing were similar yet not identical. The first letter contained the exact date of the mailing; benefits to the group with whom the recipient of the letter identified; explanation of the study; the individual importance of the respondent to the success of the study; and an assurance of confidentiality. Although the cover letter of the second mailing also contained the exact mailing date and an explanation of the study, it differed in other respects. The first paragraph indicated that the completed questionnaire had not yet been received, and a stronger appeal was made to emphasize the importance of the manager's response to the success of the survey. Additionally, the second cover letter explained the use of identification numbers to give reassurance of confidentiality. (See Appendix C.)

Collection of Data

Mailing Procedures

After revising the original version, the cover letters and questionnaires were typed, using desktop publishing software; prepared for mailing; and mailed to the sample subjects. Addresses of the sample companies were found from several sources: Million Dollar Directory (1988); Standard and Poor's Register of Corporations, Directories, and Executives (1985 and 1987 editions); and Dun's Business Rankings (1985 and 1987 editions).

Cover letters, as discussed previously, were enclosed to explain the purpose of the study and to elicit a favorable response. Identification numbers, which included "01" or "02" for first or second mailing and the corresponding Fortune 500 rank of the company to which a questionnaire was being mailed, were hand written on each of the mailed survey instruments in order to identify respondents and to differentiate the first mailing from the second. Because mail survey response, according to Dillman, "relies heavily on personalization throughout the implementation process" (1978, p. 163), address labels were not used on the envelopes. The addressing process was automated, however, by using word processing software and a near-letter quality printer. The researcher's home address was printed on the envelope for the return address. First-class postage was used for two reasons: (1) to ensure that unreachables would be returned to the sender and (2) to avoid the look of mass mailing and appear more personal. A pre-addressed, postage-paid envelope was included to facilitate the return of the questionnaires. Return envelopes contained the researcher's initials to facilitate routing in the College of Business at Oklahoma State University.

Mailing Schedule

Dillman (1978) recommended mailing surveys on Tuesdays to allow for convenient handling of weekend mail before the surveys are received by the company and to allow time enough for the researcher to get feed-back on unreachables within the week. For this reason, both mailings were sent out on Tuesdays.

The first mailing was sent on Tuesday, July 5, 1988. The deadline date specified for return was July 19, 1988, two weeks following the mailing date. Approximately one month following the mailing of the first questionnaire, August 2, a second questionnaire was sent to sample Fortune companies from whom no response had been received. No response deadline was noted in the second cover letter.

Responses

The response rate for the mail survey was 45.02 percent, as calculated by the following method recommended by Dillman (1978):

$$\text{Response Rate} = \frac{\text{Number Returned}}{\text{Number in Sample} - (\text{noneligible and nonreachable})} \times 100$$

$$\text{Response Rate} = \frac{190 \text{ Returned}}{436 - 14 \text{ nonreachables}} \times 100 = 45.02\ \%$$

Fourteen questionnaires that were returned with no forwarding address were classified as nonreachables. Although five returns were unusable (one cited a company policy against responding to questionnaires; four indicated no telecommunications function), they were included in the return count. If any section of a returned questionnaire was used in data analysis, the questionnaire was classified as "usable." Table I on the following page reports the percentage of returns and non-returns, based upon the corrected sample size.

TABLE I

DISTRIBUTION OF QUESTIONNAIRE RETURNS AND NON-RETURNS

Category	Number	Percent
Total Number in Sample (First Mailing)	436	100.0
Total Corrected Number (Corrected for Unreachables)	422	100.0
Total Returns from the First Mailing	126	29.86
Total Returns from the Second Mailing	64	15.17
Total Responses	190	45.02
Total Non-Returns	232	54.98
Unusable Responses	5	1.18
Total Usable Responses	185	43.84

Data Analysis

After the questionnaires were returned, responses were coded and entered into a computer application software data file, using PC-File. The data text file was merged with a statistical program, Statistical Analysis System (SAS), to tabulate the responses from each questionnaire and to reveal variances or interaction of variances. After conducting statistical tests, data were analyzed and categorized by the researcher into one of two groups, according to the relevance of the data to the main study questions: (1) data revealing sample description and (2) data pertinent to the main study questions.

Data Revealing Sample Description

Hillstad (1972) indicated that all responses from the sample which are not relevant to the main questions of the study should be placed in the procedures chapter. Several survey items falling into this category include the following: information regarding company industry; region in which respondents currently work; specific job title; source of the majority of telecommunications training; training in addition to that majority source; career path as shown by last five job positions; salary; and request for results. Appendix D (page 122) contains tables revealing sample description.

Primary Business Purpose. Table XV reveals the frequencies of responses according to categories of finance, government, service, manufacturing, and other. The category receiving the greatest number of responses was manufacturing, which had a frequency of 147 (80.3 percent of all responses). The next highest categories were other, with a frequency of 33; and service, with a frequency of 3. Neither the area of finance nor government was indicated by respondents as a primary business purpose. Two of the usable 185 returns had no response to this survey item. (See Table XV, Appendix D.) Table XVI illustrates the thirty-three primary business purposes specified by respondents as "other." Purposes specified by respondents as "other" which had frequencies of more than one include the following: petroleum (production, refining, marketing), frequency = 4; energy, frequency = 3; media (publication and broadcasting), frequency = 2; and oil and gas (drilling and exploration), frequency = 2.

Businesses were classified, however, with information other than that obtained from the respondent replies. Among the listings of Fortune 500 organizations, Fortune (1988) provided a listing by industry type. Using this list of twenty-seven industry types and comparing identification numbers (Fortune rankings) of all respondents, both usable and unusable, the researcher identified respondents according to Fortune's industry categories. Because two of the respondents had removed the identification numbers prior to remittance, only 188 of the total 190 responses could be classified. Tabled data, indicating industry type, respondent frequency, and population frequency illustrate the degree to which the population of Fortune companies is represented. (See Table XVII, Appendix D.)

Geographic Region. The questionnaire contained the following categories for respondents to indicate the region in which they were currently working: Eastern; Southern; North Central; Mountain Plains; Western; and other. Because some of the respondents indicated several regions, more than five categories were used in the coding of this question. Using only the 185 usable responses, the greatest number of responses indicated two predominant regions in which respondents were currently working: the North Central region, with a frequency of 60 (32.4 percent); and the Eastern region, with a frequency of 48 (25.9 percent). "Other" had a combined percentage of 13.39. Areas indicating the fewest number of responses were Western (10.3 percent), Mountain Plains (9.2 percent), and Southern (8.6 percent). (See Table XVIII, Appendix D.)

Specific Job Title. Although cover letters were addressed to Managers of Telecommunications, respondents were asked to specify their job titles in an open-ended question. Specific job titles varied greatly. To reduce some redundancy of titles, the researcher grouped very similar job titles together. The result of this data collapsing was a list of seventy-nine different job titles, which are indicated in tabled format to show the variety of respondent titles and the frequency of each. The job title most frequently reported was Manager of Telecommunications or Communications, which was 27.7 percent of the 185 usable responses. The second highest frequency of a specific title was Manager of Corporate Communications, which was 9.8 percent of the usable responses. (See Table XIX, Appendix D.)

Major Source of Telecommunications Training. Respondents were asked to indicate only one of the following categories as the predominant source of their telecommunications training: on-the-job (including seminars, workshops, etc.); telephone company; military; vocational training; and college/university. Analysis of the data revealed that eleven of the respondents indicated more than one source of predominant training. Nonetheless, of the 185 usable responses, 141 respondents (76.2 percent) indicated that the majority of their telecommunications training was received from on-the-job training. (See Table XX, Appendix D.)

Additional Telecommunications Training. Using the same categories for additional training as for major source of telecommunications training, respondents were asked to indicate what additional telecommunications training, if any, they had received. This item, unlike the previous one, allowed for multiple responses. Of the 185 usable responses, respondents revealed the following additional training: on-the-job, 53.5 percent; telephone company, 23.2 percent; military, 5.4 percent; vocational training, 4.9 percent; college/ university, 19.5 percent. (See Table XXI, Appendix D.)

Career Path as Shown by Last Five Job Positions. In order to determine the path by which respondents attained their current positions, an open-ended question was asked that would reveal their last five job positions. The researcher categorized each of the 171 responses (14 respondents failed to answer the question) in two ways. First, respondents were classified as having a traditional (vertical) or a non-traditional (horizontal) career path. If respondents appeared to have "worked their way up" to their present positions, the researcher subjectively classified them as having traditional career paths.

Secondly, the researcher categorized career path by the predominance of functional area in which the respondent worked. Based upon functional areas most frequently listed by respondents, five categories were used to indicate predominant functional area: computing/ MIS/data processing; communications; business; engineering; and miscellaneous. If the last five job positions did not indicate a predominant functional area or did not fit into previously defined categories, they were labeled miscellaneous. Table XXII presents the analysis of this survey question. (See Appendix D.) In both traditional and non-traditional categories, the functional area of communications had the greatest number of responses.

Salary. Respondents were asked to indicate an approximate range of their current annual salary, with the following six ranges: $19,000 or less; $20,000 - $39,999; $40,000 - $59,999; $60,000 - $79,999; $80,000 - $99,999; and $100,000 or more. Of the 177 responses, 44.6 percent reported an annual salary range of $40,000 - $59,999, while 26.0 percent reported an annual salary range of $60,000 to $79,999. (See Table XXIII, Appendix D.)

Respondent Requests for Survey Results. Table XXIV in Appendix D reveals that 64.7 percent of the respondents requested results of the study.

Data Pertinent to Main Study Questions

In order to show the effects of the highest level of education and undergraduate degree speciality on the dependent variables, three statistical tests were conducted for respondents having a minimum of a baccalaureate degree. In addition, to determine the effects of level of education upon the dependent variables, three statistical tests were conducted for respondents not having a baccalaureate degree. The six tests were conducted to show the effects of the independent variable(s) upon the following dependent variables: technical score, business score, and total score.

Usage of statistical tests for analysis of this data was determined by several factors: type of dependent variables; research design; number of independent variables; and levels of independent variables. Based on these factors, the following conclusions were drawn:

1. The dependent variables were ranked with a Likert-type scale from one to five: (1) Not Important; (2) Of Little Importance; (3) Somewhat Important; (4) Important; (5) Very Important. Sub-groupings of rated data (technical items and business items) were aggregated and used as score data.
2. The research design was between-subjects.
3. Two independent variables of various levels were tested for respondents having at least a baccalaureate degree: educational level and undergraduate degree specialty.
4. One independent variable, educational level, was tested for respondents not having completed at least a baccalaureate degree.
5. Three dependent variables were tested: total score, technical score, and business management score.

Although Likert scales are normally used with non-parametric tests, the sub-grouping of survey items may be perceived as representation of score data. Linton and Gallo said that many statisticians recommend Analysis of Variance when the data are not on the interval scale "Although conservative practice limits the use of analysis of variance to interval data," (1975, p. 127). Because the hypotheses were tested to determine the effect of undergraduate degree specialty and/or level of education on telecommunications managers' attitudes toward job functions, both two-way and one-way Analysis of Variance tests were conducted to determine variable effects upon the scores. The tabulation of data pertinent to the main study questions and the interpretation of that tabled data are reported in Chapter IV.

Pearson Correlation Analysis

In addition to the Analysis of Variance tests conducted, a Pearson Correlation analysis was performed to determine the correlation between total, technical, and business management scores. According to Linton and Gallo (1975), "...correlation coefficients may be used when there are two sets of scores (each subject has a score for each variable)..." (p. 341). In addition, Linton and Gallo indicated that for two sets of score data, the most common correlational technique is the Pearson *r*.

Cronbach's Alpha Reliability Test

"Reliability refers to the accuracy (consistency and stability) of a measurement by a test" (Isaac and Michael, 1987, p. 125). In another text, Sonquist and Dunkelberg (1977) added, "The main question at issue when the reliability of a scale or index is being considered is the extent to which the data-generation process is repeatable" (p. 328). Sonquist and Dunkelberg continued that just because a measurement is repeatable, however, does not guarantee the validity of an instrument. Realizing that the validity of the instrument is not guaranteed by reliability and that caution should be taken in the interpretation of reliability tests, a Cronbach's Alpha statistical test was performed on the response data received.

Presentation of Findings, Conclusions and Recommendations

Results of all statistical tests pertinent to the main study questions, the Pearson Correlation Coefficient, and Cronbach's Alpha are reported in Chapter IV. On the basis of the findings reported in Chapter IV, conclusions and recommendations are reported in Chapter V.

CHAPTER IV

ANALYSIS AND INTERPRETATION OF THE DATA

Data were gathered from 185 telecommunications managers from randomly selected Fortune 500 companies. The primary purpose of the study was to provide information that may be used by educators in making curriculum decisions regarding telecommunications within schools of business. In order to acquire the information, the study sought (1) to determine the effects of undergraduate degree specialty and/or educational level upon the opinions of the managers regarding the importance of business management and technical expertise in their present organizational roles; and (2) to determine what aspects of telecommunications management are considered most important by current telecommunications managers. The findings presented in this chapter are the result of analyses of responses to the survey instrument.

Plan for Gathering and Analyzing Data

The Survey Instrument

The two main sections of the study instrument provided a vehicle for obtaining data necessary to fulfill the purpose of the study: demographic data and opinions regarding job-related tasks and knowledge areas. Findings of descriptive demographic data which are not relevant to the main purpose of the study are reported in the previous chapter. Two demographic items that are discussed in Chapter IV deal with educational status: level of education and, if the respondents had a minimum of a baccalaureate degree, undergraduate degree specialty. In general, items in the demographic section were selected to provide a profile of existing telecommunications managers in Fortune 500 companies. The items for the tasks/knowledge opinionnaire were selected from a review of literature, particularly from selected topics of telecommunications conferences. The original items were evaluated for face validity and clarity and then categorized as either business management or technical job-related areas by a panel of experts.

Statistical Tests

A data text file containing both demographic data and responses to the opinionnaire was merged with the computerized statistical program, Statistical Analysis System, to tabulate the responses for analysis. For factorial analysis, a two-way Analysis of Variance was utilized for data analysis of respondents having at least a baccalaureate degree. Because respondents not having a baccalaureate degree did not respond to the question regarding undergraduate degree specialty, a one-way Analysis of Variance was used for analysis of data of those respondents. Results of statistical tests revealed frequencies; means; standard deviations; corrected sample sizes; ratings of job-related topics according to perceived importance; and independent variable effect upon the three dependent variables, all of which are important to the report of the findings. Ratings of the job-related items were used to calculate statistical rankings of each issue. In addition, Pearson's Correlation and Cronbach's Alpha tests were conducted.

Results of the findings relevant to the present study, the Pearson's Correlation test, and Cronbach's Alpha test of reliability are found in the discussion of the findings and in Appendix E.

Data Analysis

Usable responses were received from 185 of the sample 436 companies which were randomly selected from the population of Fortune 500 companies. The analysis of data is divided into the following seven sections:

1. Analysis of the independent variables
2. Analysis of job-related tasks and knowledge areas
3. Analysis of the scores of respondents having at least a baccalaureate degree
4. Analysis of the scores of respondents not having a baccalaureate degree
5. Analysis of a comparison of means
6. Analysis of correlation of dependent variables
7. Analysis of Cronbach's alpha test of reliability

Analysis of Independent Variables

An analysis of the independent variables educational level and undergraduate degree specialty provided an educational profile of respondents responsible for telecommunications management. Table II on page 57 reveals the variables, frequency of occurrence, percent,

TABLE II

ANALYSIS OF HIGHEST EDUCATIONAL LEVEL AND UNDERGRADUATE DEGREE SPECIALITY (n = 185)

Variable	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Highest Educational Degree				
Doctoral Degree	1	0.5	1	0.5
Master's Degree	36	19.6	37	20.5
Some Graduate Level	26	14.1	63	34.2
Baccalaureate Degree	47	25.5	110	59.8
Associate's Degree	18	9.8	128	69.6
Some College	41	22.3	169	91.8
Vocational Cert.	8	4.3	177	96.2
No College or Cert.	7	3.8	184	100.0
Frequency Missing = 1				
Undergraduate Degree Speciality				
Business	45	40.9	45	40.9
Liberal Arts	18	16.4	63	57.3
Information Systems/ Data Processing	3	2.7	66	60.0
Computer Science	5	4.5	71	64.5
Engineering	14	12.7	85	77.3
Telecommunications	1	0.9	86	78.2
Other*	24	21.8	110	100.0
Frequency Missing = 75				

* Areas of undergraduate degree specialty listed as "Other" are found in Table III.

cumulative frequency, and cumulative percent of the independent variables.

For the educational level variable, 184 individuals responded, indicating one missing case. Eight educational levels were listed on the survey instrument, from "doctoral degree" to "no college or certificate program." The greatest number of respondents indicated that they had at least a baccalaureate degree, which constituted 25.5 percent of the 184 responses. The next two highest percentages were found with "some college" (22.3 percent) and "master's degree" (19.6 percent). The frequencies indicate that 110 respondents had at least a baccalaureate degree, while 74 did not. Because only one respondent indicated a doctoral degree, that level was merged with the next highest level, the master's degree level, for later analyses.

Since only respondents having baccalaureate degrees were to indicate undergraduate degree specialty, 75 missing frequencies of the 185 usable responses are noted. On the survey instrument, seven possibilities were listed for degree specialty, with the seventh noted as "other" to allow for degree areas not present on the survey instrument. Of the 110 respondents having baccalaureate degrees, "business" was designated by 40.9 percent as their degree specialty. "Other" was designated by 21.8 percent. The least number of responses was indicated in the "telecommunications" area, with only one of the respondents indicating this as an area of undergraduate degree specialty. Two other degree specialties received low responses: information systems/data processing (3 responses) and computer science (5 responses). To facilitate further analyses, low responses were combined. The areas of information systems and data processing were combined with computer science, while the telecommunications specialty was combined with engineering. Areas of undergraduate degree specialty listed as "other" are found below in Table III.

Table III reveals that seventeen "other" undergraduate degree specialties were indicated by respondents, with frequencies of one to four each. Although some of the responses contained areas specified in the survey instrument, they indicated dual specialties, such as geology and telecommunications systems management or information systems/data processing and physical science. Four responses each were found in the areas of education and math.

TABLE III

AREAS OF UNDERGRADUATE DEGREE SPECIALTY NOT LISTED ON THE QUESTIONNAIRE BUT SPECIFIED AS "OTHER"

Undergraduate Degree Speciality	Frequency
Agriculture	1
Accounting	2
Biological Sciences	1
Business/Liberal Arts	1
Business Computer Systems	1
Communications/Mass Media	1
Economics/Accounting	1
Education	4
Environmental Studies	1
Geology/Telecommunications Systems Management	1
Industrial Technology	1
Information Systems/Data Processing/Physical Science	1
Math/Chemistry	1
Math	4
Physics	1
Psychology	1
Speech and Hearing Science	1
Total	24

Table IV on the following two pages reveals the distribution of major degree area by different degree levels. Frequencies and percents of respondents having specific levels of education are cross-tabulated with undergraduate degree specialties. To accommodate all respondents, the undergraduate degree specialties include "not applicable" as well as the five possible degree areas. The possible degree areas illustrate the combination of computer science with information systems/data processing and the combination of telecommunications with engineering to facilitate statistical testing. Educational levels in the table, indicated by the rows, also illustrate the combination of doctoral and master's degree levels.

The row total for baccalaureate degree reveals that the greatest total number of respondents (47 observations or 25.54 percent) having at least a four-year college degree have only a baccalaureate degree. The column totals on page 62 indicate that of all respondents having at least a baccalaureate degree, the undergraduate degree specialty most cited was business, with 45 total responses (24.46 total percent) of the sample. Although only eight respondents indicated information systems/data processing/computer science as a degree specialty, the column percentages for that degree area (page 61) indicate that this group tended to have higher degrees, with 62.50 percent of the eight having at least a master's degree.

The second page of Table IV contains information regarding respondents who did not have baccalaureate degrees. Because respondents not having baccalaureate degrees were not asked to indicate undergraduate degree specialty, no frequencies were found in

TABLE IV

EDUCATIONAL LEVEL OF ALL RESPONDENTS BY UNDERGRADUATE DEGREE SPECIALITY*
(n = 185)

	Undergraduate Degree Speciality						
Ed. Level	Not Applicable	Bus.	Lib. Arts	IS/DP/ ComSci	Eng/Tel	Other	Total
<u>Doctoral/ Master's</u>							
Freq.		10	6	5	8	8	37
Percent		5.43	3.26	2.72	4.35	4.35	20.11
Row Pct		27.03	16.22	13.51	21.62	21.62	
Col Pct		22.22	33.33	62.50	53.33	33.33	
<u>Some Graduate Work</u>							
Freq.		13	3	1	3	6	26
Percent		7.07	1.63	0.54	1.63	3.26	14.13
Row Pct		50.00	11.54	3.85	11.54	23.08	
Col Pct		28.89	16.67	12.50	20.00	25.00	
<u>Baccaulareate Degree</u>							
Freq.		22	9	2	4	10	47
Percent		11.96	4.89	1.09	2.17	5.43	25.54
Row Pct		46.81	19.15	4.26	8.51	21.28	
Col Pct		48.89	50.00	25.00	26.67	41.67	

* To facilitate statistical analysis, data were collapsed in order to increase cell size. Data processing/Information systems degree specialities were combined with computer science; engineering was combined with telecommunications degree specialities. Respondents with either doctoral degree or master's degree were combined in one cell.

TABLE IV (Continued)

Ed. Level	Not Applicable	Bus.	Lib. Arts	IS/DP/ ComSci	Eng/Tel	Other	Total
	Undergraduate Degree Speciality						
Associate´s Degree							
Freq.	18	0	0	0	0	0	18
Percent	9.78	0.00	0.00	0.00	0.00	0.00	9.78
Row Pct	100.00	0.00	0.00	0.00	0.00	0.00	
Col Pct	24.32	0.00	0.00	0.00	0.00	0.00	
Some College							
Freq.	41	0	0	0	0	0	41
Percent	22.28	0.00	0.00	0.00	0.00	0.00	22.28
Row Pct	100.00	0.00	0.00	0.00	0.00	0.00	
Col Pct	55.41	0.00	0.00	0.00	0.00	0.00	
Vocational Certificate Program							
Freq.	8	0	0	0	0	0	8
Percent	4.35	0.00	0.00	0.00	0.00	0.00	4.35
Row Pct	100.00	0.00	0.00	0.00	0.00	0.00	
Col Pct	10.81	0.00	0.00	0.00	0.00	0.00	
No College or Certificate Program							
Freq.	7	0	0	0	0	0	7
Percent	3.80	0.00	0.00	0.00	0.00	0.00	3.80
Row Pct	100.00	0.00	0.00	0.00	0.00	0.00	
Col Pct	9.46	0.00	0.00	0.00	0.00	0.00	
Total	74	45	18	8	15	24	184
Percent	40.22	24.46	9.78	4.35	8.15	13.04	100.00

Frequency Missing = 1

the undergraduate degree columns except in the column labeled "not applicable."

The greatest number of respondents having less than a bachelor's degree indicated that they had at least completed some college (55.41 column percent). The smallest percentage of respondents in this category (9.46 column percent) indicated that they had completed no college or certificate program.

Analysis of Job-Related Tasks and Knowledge Areas

Responses to Job-Related Tasks and Knowledge Opinionnaire. Responses to the fifty item job-related tasks and knowledge opinionnaire were analyzed to reveal the opinions of respondents regarding each individual topic and to reveal if a difference exists between the rating of items grouped as technical or business management job-related areas. Table XXV, found in Appendix E, reveals the topics, in order of presentation in the survey instrument; frequency; percent; cumulative frequency; and cumulative percent of each rating of the fifty job-related items. Topics were rated on a five-point Likert-type scale, with one denoting "not important" and five denoting "very important."

Although some random items were omitted by respondents without comment, some respondents commented that isolated items were not applicable to their jobs. In other instances, a page of the questionnaire was completely blank. Since all responses that could be used for either demographic data analysis or job-related task analysis were considered usable, missing cases in the analysis of the opinionnaire were anywhere from nine to fourteen in number.

Ranked Importance of Job-Related Items. For purposes of noting the relative importance of each individual job-related topic, Table V depicts the ranking of each item in order of importance, the item number as located in the opinionnaire, the specific topic, and the mean score of each item. In several cases, means appear to be identical which are not, due to rounding error. Items having identical means are noted by asterisks within the table. The top ten rankings, in order of perceived importance, include the following job-related tasks or knowledge areas:

1. (Be able to...) Obtain support of top management
2. (Understand...) End user requirements
3. (Understand...) Company objectives and policies
4. (Be able to...) Select new telecommunications products that will be most beneficial to the organization
5. (Be able to...) Manage voice communications
6. (Be able to...) Manage personnel
6. (Be able to...) Optimize voice communications
7. (Be able to...) Make equipment procurement decisions
8. (Be able to...) Motivate employees
9. (Be able to...) Negotiate with vendors
9. (Understand...) New technology and applications
10. (Be able to...) Forge good vendor relationships

As can be seen in Table V, which follows, or the preceding list of rankings, ties occurred for rankings of several items. Items with identical ranking included number 13, manage personnel, and number 4,

TABLE V

TECHNICAL AND BUSINESS MANAGEMENT JOB-RELATED ITEMS IN ORDER OF IMPORTANCE*

Ranking	Item	Job-Related Topic	Mean
1	46	Obtain support of top management	4.58
2	36	End user requirements	4.48
3	32	Company objectives and policies	4.47
4	5	Select new telecommunications products that will be most beneficial to the organization	4.43
5	38	Manage voice communications	4.34
6**	13	Manage personnel	4.34
6**	4	Optimize voice communications	4.34
7	37	Make equipment procurement decisions	4.32
8	39	Motivate employees	4.21
9**	44	Negotiate with vendors	4.17
9**	23	New technology and applications	4.17
10	6	Forge good vendor relationships	4.16
11	48	Select vendors	4.15
12	11	Cost-justify communications projects	4.15
13	24	Strategic challenges of the job	4.14
14	47	Evaluate equipment and network services	4.13
15	42	Budget communications projects	4.07
16	17	PBX technology and applications	4.07
17	12	Manage a multivendor communications system	4.06
18	8	Recruit qualified personnel	4.05
19	7	Promote a working relationship with MIS/data processing	4.05
20	33	Existing common carrier services	3.95
21	9	Prepare documentation for senior management	3.94
22	50	Design and develop communications projects	3.90
23	21	Network management problems and procedures	3.84
24	19	Financial analysis	3.82
25	1	Evaluate hardware/software maintenance agreements	3.79
26	20	Daily operation of networks	3.78

* Due to rounding, means appearing to be identical are not necessarily the same.

** Items 13 and 4 had identical means; items 44 and 23 also had identical means.

TABLE V (Continued)

Ranking	Item	Topic	Mean
27	10	Minimize the cost of data communications	3.76
28	45	Develop RFPs (Requests for Proposals)	3.66
29	40	Optimize data communications	3.64
30	15	Traffic engineering and network design	3.61
31	29	Communications equipment operation	3.56
32	25	Local network cabling and implementation	3.54
33	43	Design networks	3.53
34	26	Implementation of office automation and technology	3.47
35	22	Telecommunications regulations, policies, and the law	3.47
36	49	Manage data communications	3.47
37	16	Worker concerns for job security	3.44
38	18	Protocols and interfaces	3.39
39	27	Regulation framework for ISDN (Integrated Services Digital Network)	3.31
40	31	Concepts of measured usage	3.29
41	3	Establish network security measures	3.29
42	2	Use management tools in decision making (e.g., modeling, simulations)	3.28
43	14	Tariffs	3.26
44	28	Open Systems Interconnection	3.24
45	34	Current issues at state and federal regulatory bodies	3.22
46	30	Status and development of fiber optics in local exchange networks	3.11
47	35	Fiber optic installation	2.85
48	41	Evaluate the physical, data-link, and network layers of communications systems protocol hierarchy	2.70

optimize voice communications, both ranked sixth in importance. Another identical ranking included items 44, negotiate with vendors, and 23, understand new technology and applications, which were ranked ninth.

In descending order of importance, the five items ranked least important include the following:

1. (Understand...) Open Systems Interconnection
2. (Understand...) Current issues at state and federal regulatory bodies
3. (Understand...) The status and development of fiber optics in local exchange networks
4. (Understand...) Fiber optic installation
5. (Be able to...) Evaluate the physical, data-link, and network layers of communications systems protocol hierarchy

Because some items tied in rank, the lowest possible ranking of the fifty items was forty-eight.

In regard to the job-related survey items, several respondents indicated why their ratings were particularly low in some areas. One comment was "We use a consultant for decisions." In another instance, the respondent indicated the following: "Many of the skills which are not important for my particular job are so because I have staff members who do need those skills." Another respondent said, "My job is 95% IS and 5% telecommunications."

Additional notations by respondents included suggestions of educational concern:

> You also need to teach your students how to cope with change in an environment that has little tolerance for it.

and

> Any communications degree should lead to expertise in one particular area, for that is where the entry level jobs exist. For one example, an overall understanding of voice/data communications with concentration on traffic engineering--case history-type preparation would be useful.

Even more specific information relating to a company's regard for telecommunications was provided by the telecommunications manager from Medtronic, Inc., who mailed a recent press release of an interview entitled "The Role of Telecommunications at Medtronic: An Interview with James A. Parry." (See Appendix F for the press release in its entirety.)

Analysis of Scores of Respondents Having At Least a Baccalaureate Degree

In order to determine independent variable effects upon the three dependent variables, two-way Analysis of Variance tests were used for the data analysis of respondents having bachelor's degrees or above. The test procedure was conducted three times, once for each of the three dependent variables: business score, technical score, and total score. The analysis section of scores for respondents having at least a baccalaureate degree contains a discussion of three aspects of these three tests. These aspects include simple test statistics, cross-tabulation of educational statistics, and factorial analysis statistics.

Simple Statistics. For purposes of comparison, the number of observations, mean scores, and standard deviations for the three statistical tests conducted on technical score, business score, and total score are combined in Table VI on page 69. Simple statistics

TABLE VI

MEANS AND STANDARD DEVIATIONS OF RESPONDENTS HAVING AT LEAST A BACCALAUREATE DEGREE

Variable	N	Mean	Standard Deviation
Technical Score (Mean = 88.4) Possible Score, 24 - 120			
Undergraduate Degree Spec.			
Business	41	89	15.6
Liberal Arts	17	85	17.5
Inf.Sys./DP/Computer Sci.	7	90	9.4
Engineering/Telecommunications	14	92	7.7
Other	21	87	12.7
Degree Level			
Doctorate/Master´s	34	86	13.4
Some Graduate Level	21	91	12.6
Baccalaureate	45	89	15.2
Business Score (Mean = 103.3) Possible Score, 26 - 130			
Undergraduate Degree Spec.			
Business	38	105	14.1
Liberal Arts	16	101	17.2
Inf.Sys./DP/Computer Sci.	8	101	19.2
Engineering/Telecommunications	15	107	8.9
Other	22	100	13.5
Degree Level			
Doctorate/Master´s	35	102	13.5
Some Graduate Level	21	105	12.7
Baccalaureate	43	104	15.9

TABLE VI (Continued)

Variable	N	Mean	Standard Deviation
		Total Score (Mean = 192) Possible Score, 50 - 250	
Undergraduate Degree Spec.			
Business	38	195	29.0
Liberal Arts	16	186	34.0
Inf.Sys./DP/Computer Sci.	7	189	28.4
Engineering/Telecommunications	14	200	13.5
Other	21	188	25.8
Degree Level			
Doctoral/Master's	33	188	26.3
Some Graduate Level	21	196	23.9
Baccalaureate	42	193	30.0

for the varying levels of undergraduate degree specialty and degree level offer a comparison of means between groups. The discussion of simple statistics follows the order of tabled presentation.

With a technical score mean of 88.4 out of a possible 24 to 120, the undergraduate degree specialty having the highest mean score was engineering/telecommunications, with a mean of 92. The second highest mean for technical score was information systems/data processing/ computer science, with a mean of 90. The lowest mean score for this variable was that of the liberal arts majors, with a mean of 85. Of the three degree levels (doctorate/master's, some graduate level, and baccalaureate), the doctorate/master's level had the lowest mean, 86. From a possible 26-130, the business score mean for respondents having bachelor's degrees or above was 103.3. Undergraduate degree specialties having slightly higher means were engineering/telecommunications (mean = 107) and business (mean = 105). The lowest business score mean for undergraduate degree specialty was in the "other" category, which had a mean of 100. As with the technical score, degree level means varied somewhat, with the doctorate/master's level having a lower mean (102) than the other levels.

As can be seen, total score mean was 192, from a possible 50 to 250. The two undergraduate degree majors with the highest means were engineering/telecommunications (mean = 200) and business (mean = 195). Again, the degree level having the lowest mean score was the doctoral/master's level, with a mean of 188.

Cross-tabulated Educational Statistics. For each of the three dependent variables, Table VII on pages 72 and 73 reveals the number of observations, mean scores, and standard deviations of undergraduate degree specialty cross-tabulated with educational level. It may be observed that the number of observations for each cross-tabulation may differ from one test to another. The self-adjusting statistical model used for analysis automatically deletes an observation if blanks occur in the entered data. Despite the variation of means between groups, it should be noted that the sizes of each group are too small to indicate a general tendency.

With an overall mean of 88.4 for technical score, the group with the highest mean, 106, was the information systems/data processing/ computer science majors with some graduate work completed. There was, however, only one individual classified in this category. The next highest group mean score, 95, occurred among engineering/telecommunica-

TABLE VII

CROSS-TABULATED MEANS AND STANDARD DEVIATIONS FOR TECHNICAL, BUSINESS, AND TOTAL SCORES OF RESPONDENTS HAVING AT LEAST A BACCALAUREATE DEGREE

Undergraduate Degree Specialty	Educational Level	N	Mean	Standard Deviation
	Technical Score (Mean = 88.4)			
Business	Doc./Mas.	9	84.11	22.27
Business	Some grad.	11	91.00	14.44
Business	Baccalaureate	21	90.05	13.14
Liberal Arts	Doc./Mas.	6	83.17	9.24
Liberal Arts	Some grad.	2	88.50	21.92
Liberal Arts	Baccalaureate	9	84.89	22.23
Inf.Sys./DP/ Com.Sci.	Doc./Mas.	4	86.75	8.54
Inf.Sys./DP/ Com.Sci.	Some grad.	1	106.00	.
Inf.Sys./DP/ Com.Sci.	Baccalaureate	2	87.50	0.71
Eng./Tele.	Doc./Mas.	7	91.71	5.88
Eng./Tele.	Some grad.	3	89.33	3.51
Eng./Tele.	Baccalaureate	4	95.00	12.57
Other	Doc./Mas.	8	84.00	10.49
Other	Some grad.	4	90.75	10.40
Other	Baccalaureate	9	88.44	15.69
	Business Score (Mean = 103.3)			
Business	Doc./Mas.	9	99.56	19.11
Business	Some grad.	11	104.73	14.66
Business	Baccalaureate	18	108.72	10.33
Liberal Arts	Doc./Mas.	5	100.20	8.23
Liberal Arts	Some grad.	2	112.50	0.71
Liberal Arts	Baccalaureate	9	99.22	21.95
Inf.Sys./DP/ Com.Sci.	Doc./Mas.	5	99.20	16.24
Inf.Sys./DP/ Com.Sci.	Some grad.	1	124.00	.
Inf.Sys./DP/ Com.Sci.	Baccalaureate	2	92.50	28.99
Eng./Tele.	Doc./Mas.	8	110.88	8.59
Eng./Tele.	Some grad.	3	97.00	5.00
Eng./Tele.	Baccalaureate	4	105.50	6.14

TABLE VII (Continued)

Undergraduate Degree Specialty	Educational Level	N	Mean	Standard Deviation
	Business Score (Mean = 103.3)			
Other	Doc./Mas.	8	99.63	9.84
Other	Some grad.	4	101.00	9.62
Other	Baccalaureate	10	99.70	17.88
	Total Score (Mean = 192)			
Business	Doc./Mas.	9	183.67	40.87
Business	Some grad.	11	195.73	28.46
Business	Baccalaureate	18	200.11	21.86
Liberal Arts	Doc./Mas.	5	181.80	14.55
Liberal Arts	Some grad.	2	201.00	22.63
Liberal Arts	Baccalaureate	9	184.11	43.80
Inf.Sys./DP/ Com.Sci.	Doc./Mas.	4	183.25	25.75
Inf.Sys./DP/ Com.Sci.	Some grad.	1	230.00	.
Inf.Sys./DP/ Com.Sci.	Baccalaureate	2	180.00	29.70
Eng./Tele.	Doc./Mas.	7	204.71	10.78
Eng./Tele.	Some grad.	3	186.33	4.73
Eng./Tele.	Baccalaureate	4	200.50	17.86
Other	Doc./Mas.	8	183.63	19.65
Other	Some grad.	4	191.75	19.72
Other	Baccalaureate	9	189.11	33.93

tions majors with baccalaureate degrees, but the deviation from the mean was higher for this educational level of engineering/telecommunications majors than for the others. Although no tendency for mean score can be detected from these scores, the standard deviations for the obvious technical majors are lower than other major fields, with the exception of the previously mentioned engineering/telecommunications majors with baccalaureate degrees.

Business score statistics for cross-tabulated educational variables indicate that the greatest number of respondents were business majors with baccalaureate degrees. With a business score mean of 103.3 for all categories, the following groups tended to have higher mean business scores: information systems/data processing/computer science majors with some graduate work completed (n = 1, mean = 124); liberal arts majors with some graduate work (n = 2, mean = 112.50); engineering/telecommunications with doctorate/master's degree (n = 8, mean = 110.88); and business majors with baccalaureate degrees (n = 18, mean = 108.72).

The total score mean was 192 out of a possible 50 to 250. Groups scoring higher than 200 on the total mean score included information systems/data processing/computer science majors with some graduate work (n = 1, mean = 230); engineering/telecommunications majors with a doctorate or master's degree (n = 7, mean = 204.71); liberal arts majors with some graduate work completed (n = 2, mean = 201); engineering/telecommunications majors with baccalaureate degrees (n = 4, mean = 200.5); and business majors with baccalaureate degrees (n = 18, mean = 200.11).

Factorial Analysis. As previously discussed, factorial analyses were conducted to test the following hypotheses:

H_1: Undergraduate degree specialty and level of education do not interact to affect the opinions of telecommunications managers toward the importance of technical expertise; business management expertise; and the combination of technical expertise and business management expertise in their organizational roles.

H_2: Level of education does not affect the opinions of telecommunications managers toward the importance of technical expertise; business management expertise; and the combination of technical expertise and business management expertise in their organizational roles.

H_3: Undergraduate degree specialty does not affect the opinions of telecommunications managers toward the importance of technical expertise; business management expertise; and the combination of technical expertise and business management expertise in their organizational roles.

The two-way Analysis of Variance procedures performed on the obtained data indicated no significant differences among the means, as can be seen in Table VIII on the following page. It may be noted that although the number of respondents having bachelor's degrees was 110, the corrected total degrees of freedom in each of the three individual tests indicated there were, respectively, 100, 99, and 96 observations within the technical, business, and total tests which were performed. Each of the three tests revealed statistics for main effects and the interaction of those effects.

For technical score, educational level and undergraduate degree specialty did not interact to affect significantly the technical score of respondents having at least a baccalaureate degree (F_{calc} = .23, d.f. = 8 and 85, *p* = .99). In addition, undergraduate degree specialty (F_{calc} = .45, d.f. 4 and 85, *p* = .77) and level of education (F_{calc} = 1.06, d.f. = 2 and 85, *p* = .35) did not affect the technical scores of respondents having at least a baccalaureate degree. Since the obtained *p*-values were greater than the .05 level of significance,

TABLE VIII

TWO-WAY ANALYSIS OF VARIANCE SUMMARY STATISTICS OF RESPONDENTS HAVING AT LEAST A BACCALAUREATE DEGREE
(n = 110)

Source	DF	SS	MS	F-Value	F-Prob.
		Technical Score			
Degree Spec.	4	389	97.2	0.45	0.77
Ed. Level	2	459	229.6	1.06	0.35
Interaction	8	390	48.7	0.23	0.99
Error	85	18360	216.0		
Corrected Total	99	19686			
		Business Score			
Degree Spec.	4	271	67.9	0.33	0.86
Ed. Level	2	386	193.0	0.93	0.40
Interaction	8	1875	234.4	1.13	0.35
Error	84	17416	207.3		
Corrected Total	98	20063			
		Total Score			
Degree Spec.	4	914	228.6	0.29	0.88
Ed. Level	2	1531	765.4	0.97	0.38
Interaction	8	4160	520.1	0.66	0.73
Error	81	63901	788.9		
Corrected Total	95	71297			

* $p < .05$

the researcher concluded that technical score did not depend on level of education or undergraduate degree specialty.

The second factorial analysis performed revealed similar results. Results of the business score test indicated that business scores were dependent upon neither educational variable nor an interaction of the two. The computed values include the following: interaction of educational level and undergraduate degree specialty (F_{calc} = 1.13, d.f. = 8 and 84, p = .35); degree specialty (F_{calc} = .33, d.f. = 4 and 84, p = .86); and educational level (F_{calc} = .93, d.f. = 2 and 84, p = .40). None of the computed p-values for business score was less than or equal to the level of significance, .05.

As with the previous two tests, factorial analysis for total score indicated that total score was not dependent upon an interaction of the two independent variables, degree specialty or level of education. Results of this test revealed the following:

1. Undergraduate degree specialty and level of education did not interact to affect the opinions of telecommunications managers regarding both business management and technical job functions (F_{calc} = .66, d.f. = 8 and 81, p = .73).
2. Undergraduate degree specialty did not significantly affect respondents' perceptions of business management and technical expertise needed for success in their current roles (F_{calc} =.29, d.f. 4 and 81, p = .88).
3. Level of education did not significantly affect respondents' perceptions of the value of business management and technical expertise needed for success in their current roles (F_{calc} = .97, d.f. = 2 and 81, p = .38).

Of the three statistical tests performed to determine the effects of (1) the interaction of independent variables; (2) undergraduate degree specialty; and (3) educational level, no probability value was found to be less than or equal to .05; therefore, the null hypotheses were not rejected, and any differences in mean scores between the groups of respondents having at least a baccalaureate degree were due to chance.

Analysis of Scores of Respondents Not Having a Baccalaureate Degree

Since no degree specialty was requested of the respondents in this category and no variable was present with which to cross-tabulate, a one-way Analysis of Variance procedure was performed on the data of respondents not having completed a baccalaureate degree. As with the respondents having a minimum of a bachelor´s degree, three tests were conducted for each of the three dependent variables: technical score, business score, and total score. It should be noted that although the respondents designating that they had not completed a baccalaureate degree numbered 74, the statistical procedure self adjusts and excludes observations having missing values. The "N´s" of each category, therefore, do not equal the possible 74. Two tables illustrate results of the procedures used.

Simple Statistics. Respondents were asked to identify the highest level of education that they had completed. Educational levels provided for respondents not having completed a baccalaurate degree included associate´s degree; some college; certificate program; and no college or certificate program. As can be seen in Table IX, in each test which was conducted, the tendency was for the mean score to increase as the level of education increased. In addition to mean scores, Table IX on page 80 indicates the comparative educational levels, number of observations within each level, and standard deviations for technical score, business score, and total score.

Analysis of Variance Statistics. Because only one independent variable, educational level, was considered in the data analyses of respondents not having a four-year degree, only one hypothesis was tested in each of the three one-way Analysis of Variance tests:

H_2: Level of education does not affect the opinions of telecommunications managers toward the importance of technical expertise; business management expertise; and the combination of technical expertise and business management expertise in their organizational roles.

The three one-way Analysis of Variance test results, like results of the two-way tests for respondents having at least a baccalaureate degree, are presented in a single table, Table X (page 81), for purposes of comparison. For clarity, means of the levels of education found in Table IX are repeated in this discussion.

In the technical score test, which had a mean of 85.3, the mean scores for the four levels of the independent variable (educational level) were the following: associate's degree, 86.77; some college, 85.67; certificate program, 84.57; and no college or certificate program, 80.40. The Analysis of Variance performed on these data indicated that there were no significant differences among the means (F_{calc} = .22, d.f. = 3 and 57, p = .88). Because the obtained value was not greater than .05, the null hypothesis (restated above) was not

TABLE IX

SIMPLE STATISTICS OF EDUCATIONAL LEVELS OF RESPONDENTS NOT HAVING A BACCALAUREATE DEGREE (n = 74)

Educational Level	N	Mean	Standard Deviation
Technical Score (Mean = 85.3) Possible Score, 24 - 120			
Associate´s Degree	13	86.77	11.14
Some College	36	85.67	16.83
Certificate Program	7	84.57	12.38
No College or Certificate Program	5	80.40	15.26
Business Score (Mean = 100.8) Possible Score, 26 - 130			
Associate´s Degree	12	107.25	14.14
Some College	37	100.14	15.66
Certificate Program	6	97.00	13.08
No College or Certificate Program	3	91.33	9.07
Total Score (Mean = 185.8) Possible Score, 50 - 250			
Associate´s Degree	11	194.18	23.57
Some College	34	184.50	30.36
Certificate Program	6	183.50	24.65
No College or Certificate Program	3	174.00	15.52

TABLE X

ANALYSIS OF VARIANCE SUMMARY STATISTICS OF RESPONDENTS NOT HAVING BACCALAUREATE DEGREES
(n = 74)

Source	DF	SS	MS	F-Value	F-Prob.
			Technical Score		
Model	3	157	52.2	0.22	0.88
Error	57	13251	232.5		
Corrected Total	60	13408			
			Business Score		
Model	3	871	290.3	1.30	0.28
Error	54	12051	223.2		
Corrected Total	57	12922			
			Total Score		
Model	3	1279	426.6	0.54	0.66
Error	50	39498	790.0		
Corrected Total	53	40777			
		15.12888	28.10610	185.78	

* $p < .05$

rejected. Technical score, consequently, was found to be not dependent upon educational level, and any differences among the mean scores of respondents not having baccalaureate degrees were due to chance.

Of the computed business score mean of 100.8 for respondents not having baccalaureate degrees, the analysis of variance revealed the following means for the business score: associate's degree, 107.25; some college, 100.14; certificate program, 97; no college or certificate program, 91.33. From an analysis of test results, the researcher concluded that business score was not dependent upon educational level (F_{calc} = 1.30, d.f. = 3 and 54, p = .28); therefore, the null hypothesis was not rejected. Level of education did not affect business score, and any differences among the means were due to chance.

With a total score mean of 185.8, mean scores of various levels of education in this test included the following: associate's degree, 194.18; some college, 184.50; certificate program, 183.50; and no college or certificate program, 174. With a found p-value of .66, the null hypothesis was not rejected (F_{calc} = .54, d.f. = 3 and 50, $p > .05$); hence, any differences in the mean total scores of respondents not having baccalaureate degrees were due to chance rather than level of education.

Analysis of a Comparison of Means

For comparative purposes, Table XI illustrates the mean scores of respondents having baccalaureate degrees or better and respondents having less than baccalaureate degrees. As was the case for educational levels of respondents in the latter category, the mean scores for the dependent variables technical score, business score, and total score tended to be higher with higher levels of education.

TABLE XI

COMPARISONS OF SCORE MEANS OF RESPONDENTS HAVING AT LEAST A BACCALAUREATE DEGREE AND THOSE NOT HAVING A BACCALAUREATE DEGREE

Degree Status	Mean
Technical Score Possible Score, 24 - 120	
Minimum, baccalaureate degree	88.4
No baccalaureate degree	85.3
Business Score Possible Score, 26 - 130	
Minimum, baccalaureate degree	103.3
No baccalaureate degree	100.8
Total Score Possible Score, 50 - 250	
Minimum, baccalaureate degree	192.0
No baccalaureate degree	185.8

Analysis of the Correlation of Dependent Variables

Conducted to determine the relationship between business management and technical job-related tasks and knowledge areas, the Pearson's Correlation Coefficient statistical test revealed a high correlation between business scores and technical scores (.78). As Table XII on the following page reveals, a strong, positive correlation exists between business scores, technical scores, and total scores. Essentially, this means that respondents who scored high on the business survey items tended to score high on technical items also. This value (r = .78) squared represents a percentage of the determinants each relationship has in common and "becomes an estimate of variance called the coefficient of determination" (Isaac and Michael, 1987, p. 194). The value squared (r^2 = .6084) suggests that approximately 61% of the variance in business scores can be accounted for by the technical scores.

Analysis of Cronbach's Alpha Test of Reliability

According to Sonquist and Dunkelberg (1977), items to be used in constructing an instrument "...should be homogeneous in content and should have high and similar correlations with each other and with the total scale" (p. 331). The authors took the position that measures should have reliability levels of at least .7 or .8 (p. 331).

The alpha test conducted on survey items to determine "the extent to which the data-generation process is repeatable" (p. 328), revealed a coefficient alpha of .9809, which indicates a high level of reliability for the survey instrument. Scale statistics with each item alternately deleted revealed that not any one item drastically affected the reliability of the test instrument.

TABLE XII

PEARSON CORRELATION COEFFICIENTS FOR BUSINESS, TECHNICAL, AND TOTAL SCORES

	Business Score	Technical Score	Total Score
Business Score	1.00	.78	.95
Technical Score	.78	1.00	.94
Total Score	.95	.94	1.00

Summary

Questionnaires were mailed to 436 randomly selected Fortune 500 companies in order to obtain data necessary to determine (1) if significant differences in the mean scores exist between respondents of varying levels of education and undergraduate degree specialty and (2) what job-related aspects are perceived most important by telecommunications managers in their current roles.

Statistical tests were conducted on 185 usable responses to the survey in order to analyze the following:

1. Independent variables
2. Job-related tasks and knowledge areas, according to mean scores for individual survey items and rated importance of each
3. Mean scores of respondents having at least a baccalaureate degree
4. Mean scores of respondents not having baccalaureate degrees
5. Mean scores of respondents having baccalaureate degrees as compared to mean scores of respondents not having baccalaureate degrees
6. The correlation of the dependent variables: technical score, business score, and total score
7. The reliability of the test, as determined by Cronbach's Alpha

Analyses of statistical tests revealed no significant differences between means of technical scores, business scores, and total scores of respondents having varied educational backgrounds. Therefore, the null hypotheses cannot be rejected.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Several factors have combined to bring telecommunications management to the forefront of corporations that recognize the strategic importance of information and the speed with which that information is attainable: deregulation of the telephone industry, a severe shortage of people capable of handling the job, and increasing expense of corporate telecommunications. As of yet, educational institutions have not been able to meet the demands for qualified professionals in the area of telecommunications. If college business curricula are to reflect the increasing corporate concern for the area of telecommunications, educators need timely information that will enable them to implement new programs or enhance existing ones.

In the past, many people have assumed that telecommunications management should be left to a consultant or to personnel with more technical training. By using a factorial analysis on the data collected in this study, the varied educational backgrounds of respondents were removed to see if those with more technical background perceived particular survey items differently. In addition, items within the job-related tasks or knowledge areas were rated, according to mean Likert scale ratings, to reveal job functions considered by current telecommunications managers to be the most important aspects in their organizational roles. Information revealed from this study may be used to facilitate further research or to aid in educational curriculum development.

Summary

Procedures

To obtain data necessary (1) to determine if significant differences between group mean scores were present and (2) to determine relative importance of job-related items according to the opinions of current telecommunications managers, survey instruments were mailed to 436 telecommunications managers of randomly selected Fortune 500 companies. One-hundred-eighty-five usable questionnaires (43.84 percent) were returned that revealed both demographic data and respondent assessment of fifty job-related tasks and knowledge areas.

Demographic data permitted a comparison of the current survey with previous surveys as well as provided a means for classifying respondents into two general groups: respondents having completed at least a baccalaureate degree and respondents not having completed a baccalaureate degree.

In regard to job-related aspects, respondents were asked to rate the job-related tasks and knowledge areas on a five-point scale ranging from "not important" to "very important." This method provided numerical scores for each issue, which were statistically aggregated, allowing a ranking to be calculated for each issue.

Prior to factor analysis, the researcher, based upon suggestions of a panel of experts, grouped the job-related items into two categories: business management topics and technical topics. The 1-5

Likert ratings of each respondent were totaled to reveal three scores: technical score, business score, and total score. To analyze each of the three scores, score data were used in three two-way Analysis of Variance tests for respondents having at least a baccalaureate degree and in three one-way Analysis of Variance tests for respondents not having a baccalaureate degree.

Additional statistical tests performed on the data included two correlation tests. First, Pearson's Correlation Coefficient was conducted to determine the degree of relationship between technical score, business score, and total score. The resultant coefficient squared suggested the percentage of the variance in one dependent variable that can be accounted for by another. The second correlation test, utilized for the purpose of determining instrument reliability, was the Cronbach's Alpha.

Results of the Study

Although not all findings were pertinent to the main problem, the analysis of demographic data enabled the researcher to compare the present study with others. Presented in a summary of study results, therefore, are findings regarding the sample description and findings pertinent to the main study questions. Although comparisons are made between this study and others, caution should be taken in comparative interpretation. Studies varying in regard to technique for acquiring data, the wording of survey items, and sample groups may reveal entirely different results.

Data Revealing Sample Description

As discussed in Chapter III, demographic items not relevant to main study questions include primary business purpose, geographic region, specific job title, major source of telecommunications training, additional telecommunications training, career path, and salary.

Primary Business Purpose. A majority of respondents classified the primary business purpose of their organizations as manufacturing (80.3 percent), while 18 percent classified their organization's business purpose as "other." Classifying organizations according to the Fortune (1988) categories of industry types, however, revealed greater diversity in responses. Of Fortune's twenty-seven categories (one contained no organizations), the current study received responses from twenty-four different industrial types.

Geographic Region. In regard to geographic region in which the respondent was currently working at the time the questionnaire was completed, the greatest percentage of respondents (32.4 percent) indicated that they were currently working in the North Central region; the Eastern region received the second highest percentage (25.9 percent). Regions represented by the fewest respondents were Mountain Plains (9.2 percent) and Southern (8.6 percent).

Specific Job Title. The question revealing the greatest surprise was that of specific job title as indicated by the respondents in an open-ended question. The researcher combined similar job titles in order to reduce the number of distinctly different titles. After combining some job titles, a list of seventy-nine remained. The majority of job titles indicated were "manager of telecommunications (communications)," with a frequency of 51 (27.7 percent).

Major Source of Telecommunications Training. In regard to majority source of telecommunications training, a 1985 International Communications Association survey of 182 member companies ("New ICA...., 1986) revealed that two-thirds of their respondents received on-the-job telecommunications training. The current survey of 185 usable responses revealed an even greater number of respondents who specified on-the-job training as their major source of telecommunications training: 76.2 percent. The second highest primary source indicated was the telephone company, with 11.4 percent of the responses. Only 1.6 percent of the sample indicated college or university as their primary source of telecommunications training.

Additional Telecommunications Training. For additional sources of telecommunications training, the majority of responses again were cited in the on-the-job category (53.5 percent). This question, however, allowed for multiple answers, which explains why higher statistics were found in other categories than was the case with the majority source of training. The second highest percentage of additional training indicated was the telephone company (23.2 percent), which was followed by college/university training with 19.5 percent of the responses.

Career Path. Career path was subjectively defined by the researcher, based upon responses to an open-ended survey question, which asked respondents to list their last five previous job positions. The resultant subjective classification revealed that 137 (78.7 percent) of the respondents attained their current positions through traditional paths (rose through the ranks). This compares with 60 percent of the respondents in the previously referred to ICA survey (Shannon, 1986).

Salary. Figure 1 graphically portrays the approximate annual salary range of the 177 persons responding to the survey item regarding salary. As can be seen in the "exploded" pie chart below, 44.6 percent (79 individuals) indicated an approximate annual salary range of $40,000-$59,999. On the otherhand, the smallest percentage revealed was .6 percent (1 person) for a salary range of $19,000 or less per year.

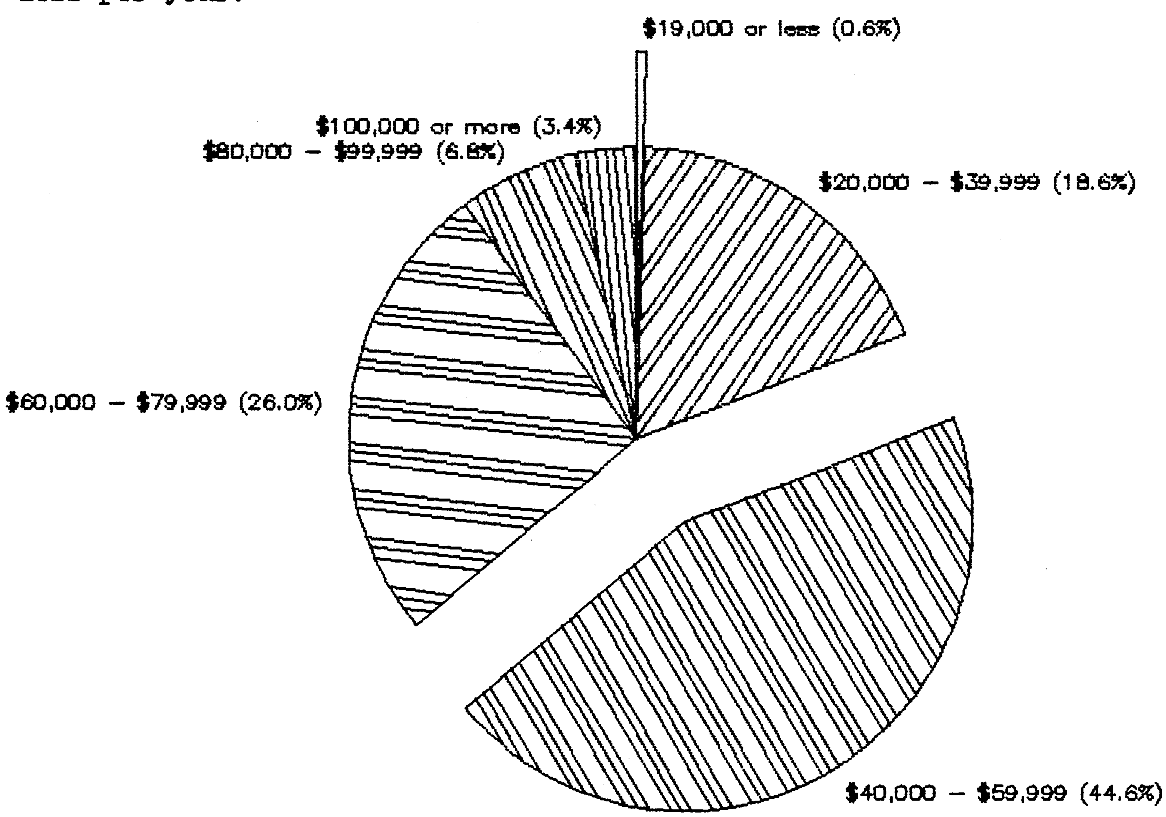

Figure 1. Graphical Representation of the Approximate Annual Salary Range as Specified by Respondents

Data Pertinent to Main Study Questions

Analysis of Independent Variables. Demographic data that were necessary to the main purpose of the study included level of education, to which 184 responded. The second of these variables, undergraduate degree specialty, was responded to only by individuals who had completed baccalaureate degrees.

Although the largest single percentage of respondents indicated that they had completed a baccalaureate degree (25.5 percent), two other groups received high percentages: some college (22.3 percent) and master's degree (19.6 percent). The ICA survey ("New ICA....," 1986) revealed the following statistics: 89 percent, at least some college; 55 percent, at least a four-year degree; 29 percent, some graduate; 4 percent, doctorate. In order to compare current findings with the ICA study, percentages of educational levels were combined with those above it to correspond with the ICA method of presentation. Therefore, in the present study, the percentage of all respondents indicating they had at least some college was 91.8 percent; baccalaureate degree or above, 59.7 percent; at least some graduate work, 34.2 percent; doctorate, .5 percent. Figure 2 on the following page indicates response percentages according to level of education.

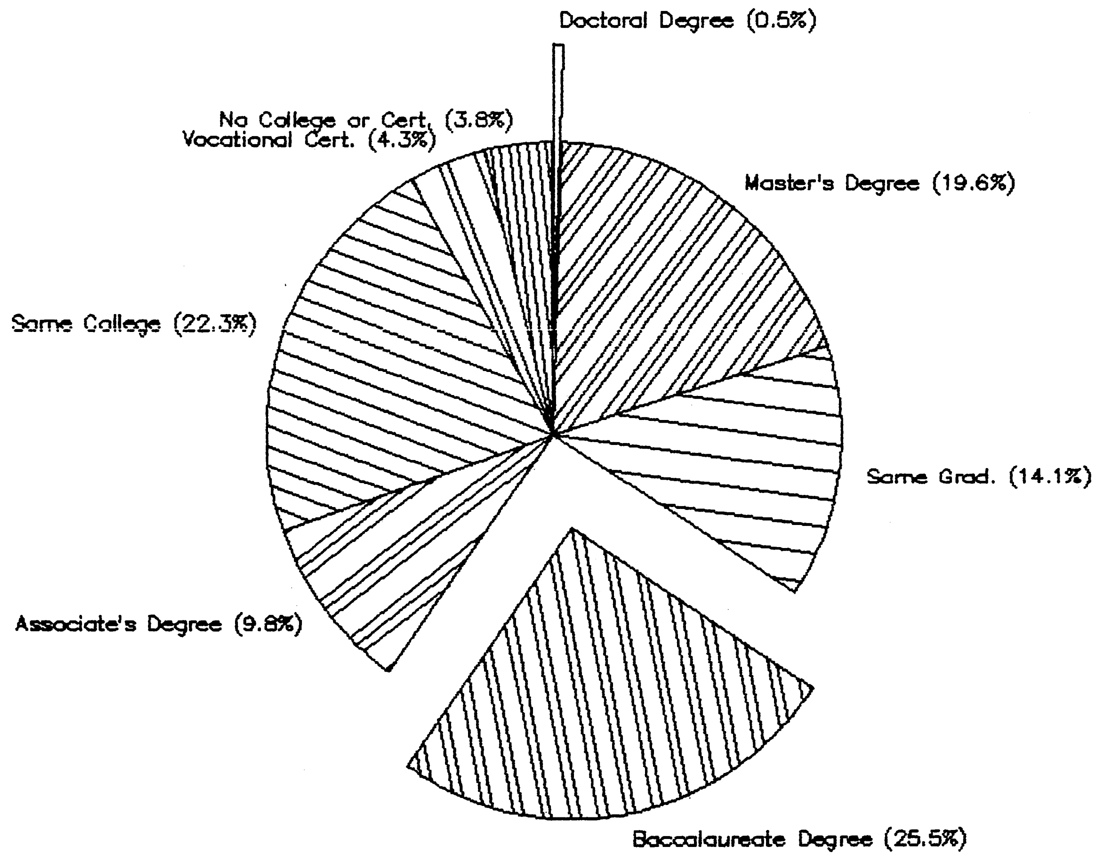

Figure 2. Graphical Representation of the Educational Levels of All Respondents

Undergraduate degree specialty was answered only by respondents having completed baccalaureate degrees. Compared to the 1985 ICA survey, the percentages of the current survey differ in respective categories; however, the ICA educational specialty categories included only respondents classified as vice presidents, directors, managers, and supervisors of telecommunications. The specified job titles of the current survey revealed more varied job positions. ICA's categories and correlated percentages included the following: business, 41 percent; engineering, 17 percent; liberal arts, 12 percent; other, 9 percent; data processing, 6 percent;

telecommunications, 6 percent. Figure 3 indicates the percentages of the 110 respondents in the current study.

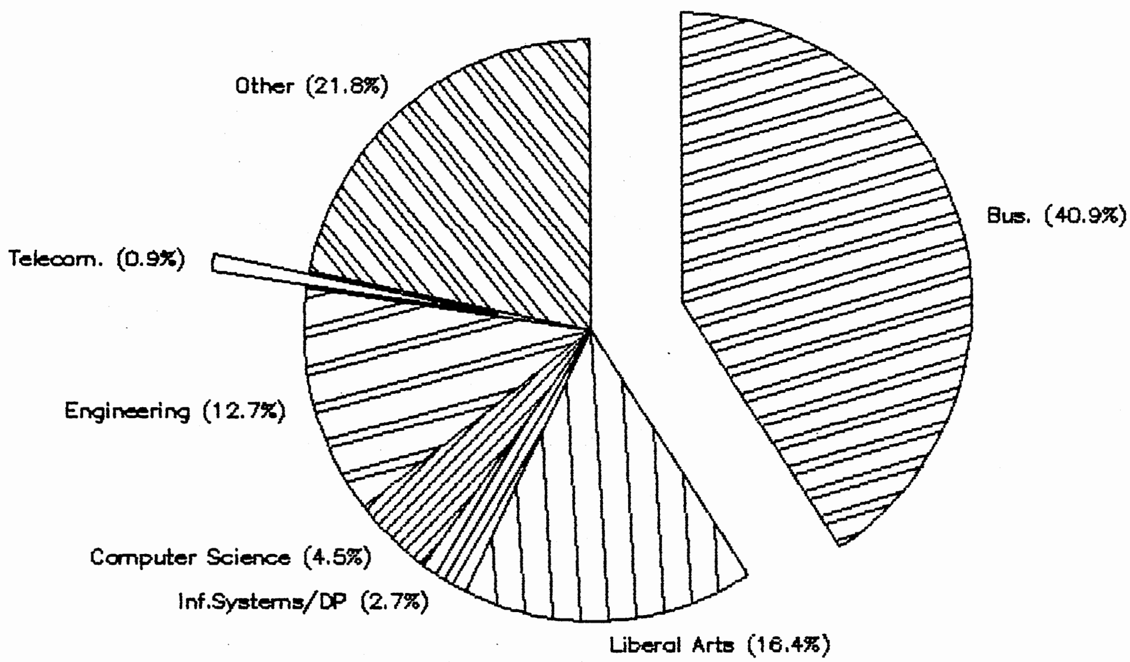

Figure 3. Graphical Representation of Undergraduate Degree Specialty of Respondents Having at Least a Four-year Degree

Analysis of Job-Related Tasks and Knowledge Areas. In order to report the importance of job-related questionnaire items in a meaningful way, statistical ranking was conducted on the accumulated numerical scores for each job-related survey item. The resulting list of items revealed job areas thought to be most important to telecommunications managers in their current organizational roles. The issues ranked in the top ten, in order of rank, include the following: (It should be observed that some items received identical rankings.)

1. (Be able to...) Obtain support of top management
2. (Understand...) End user requirements
3. (Understand...) Company objectives and policies
4. (Be able to...) Select new telecommunications products that will be most beneficial to the organization
5. (Be able to...) Manage voice communications
6. (Be able to...) Manage personnel
6. (Be able to...) Optimize voice communications
7. (Be able to...) Make equipment procurement decisions
8. (Be able to...) Motivate employees
9. (Be able to...) Negotiate with vendors
9. (Understand...) New technology and applications
10. (Be able to...) Forge good vendor relationships

Least important issues, in order of descending importance, include the following:

1. (Understand...) Open Systems Interconnection
2. (Understand...) Current issues at state and federal regulatory bodies
3. (Understand...) The status and development of fiber optics in local exchange networks
4. (Understand...) Fiber optic installation
5. (Be able to...) Evaluate the physical, data-link, and network layers of communications protocol hierarchy

An apparent inconsistency of rankings can be seen by the relative importance placed upon new technology and applications (ranked ninth) and the low rankings of Open Systems Interconnection and the status and development of fiber optics. These and other issues may be compared to the Lybrand-Cooper survey conducted at two different conferences (Powell, 1987). The predominant four issues (stated as problems) of that study include these:

1. Keeping up with technology (comparable to current survey item ranked 9th, new technology and application)
2. Personnel aspects (comparable to current survey item ranked 6th, manage personnel)
3. Selling ideas to senior management (comparable to current survey item ranked 1st, obtain support of top management)
4. Recruiting qualified personnel (ranked 18th in the current survey, recruit qualified personnel)

Analysis of Scores of Respondents Having at Least a Baccalaureate Degree. Three tables are found in Chapter IV which detail tests conducted on data of respondents having at least a baccalaureate degree. The first, Table VI, reveals variables, observations, means, and standard deviations for the three two-way Analysis of Variance tests that were conducted. On technical score, respondents with obvious technical major degree areas (engineering/telecommunications and information systems/data processing/computer science) tended to have higher scores. There was also a tendency for these groups to have higher total scores. Business majors, however, scored relatively high on business score. Respondents who specified "some graduate level" as their highest educational level scored higher than other degree levels.

Greater detail can be seen in the cross-tabulation of undergraduate degree specialty and level of education in Table VII.

One individual with a degree specialty of information systems/data processing/computer science and some graduate education scored well above all others, so the validity of the single response is questionable. Other than that response, the highest technical scores were found from engineering/telecommunications majors with baccalaureate degrees (95) and business majors with some graduate education (91). With the questionable score disregarded, the two highest business scores were liberal arts majors with some graduate level education (112.5) and engineering/telecommunications majors with either a master's or doctor's degree (110.88). High total score means were from engineering/telecommunications majors with master's or doctor's degrees (204.71) and liberal arts majors with some graduate level education (201.0).

Table VIII contains a summary of the factorial test statistics on each of the three tests. Although tendencies to score higher by some groups are indicated by test results, no significant differences were found to exist between the means of respondents on technical score, business score, or total score.

Analysis of Scores of Respondents Not Having a Baccalaureate Degree. Two tables in Chapter IV reveal the statistical results of respondents not having baccalaureate degrees. Table IX reveals the educational level, number of observations in each educational level, mean score, and standard deviation. In each of the three one-way Analysis of Variance tests conducted, individuals with higher educational status scored somewhat higher than others on the same test. The tendency was for individuals not having baccalaureate degrees to score higher as their educational level increased.

One-way Analysis of Variance statistics for the three tests conducted on this group revealed that despite the tendency for more educated individuals to score higher than others, the differences in mean scores were not statistically significant. None of the obtained p values was less than or equal to a .05 level of significance.

Analysis of a Comparison of Means. Figure 4 on the following page pictorially presents the mean scores of the two general groups of respondents: those having at least a baccalaureate degree and those not having a four-year degree. Technical score means, out of a possible 120, were 88.4 for those having baccalaureate degrees and 85.3 for those who did not. Business score means, from a possible 130, were 103.3 for respondents having higher degree levels and 100.8 for the others. Total score means, from a possible 250, showed similar results, with the tendency for college graduates to rate job-related survey items higher. Total score mean of respondents having baccalaureate degrees was 192; total score mean of respondents not having baccalaureate degrees, 185.8.

Analysis of the Correlation of Dependent Variables. A high correlation was found to exist between business score and technical score, with approximately 61 percent of the variance in business scores accounted for by the technical scores ($r^2 = .6084$).

Analysis of the Correlation of Dependent Variables. Cronbach's Alpha Correlation Coefficient for testing instrument reliability revealed a coefficient alpha of .9809.

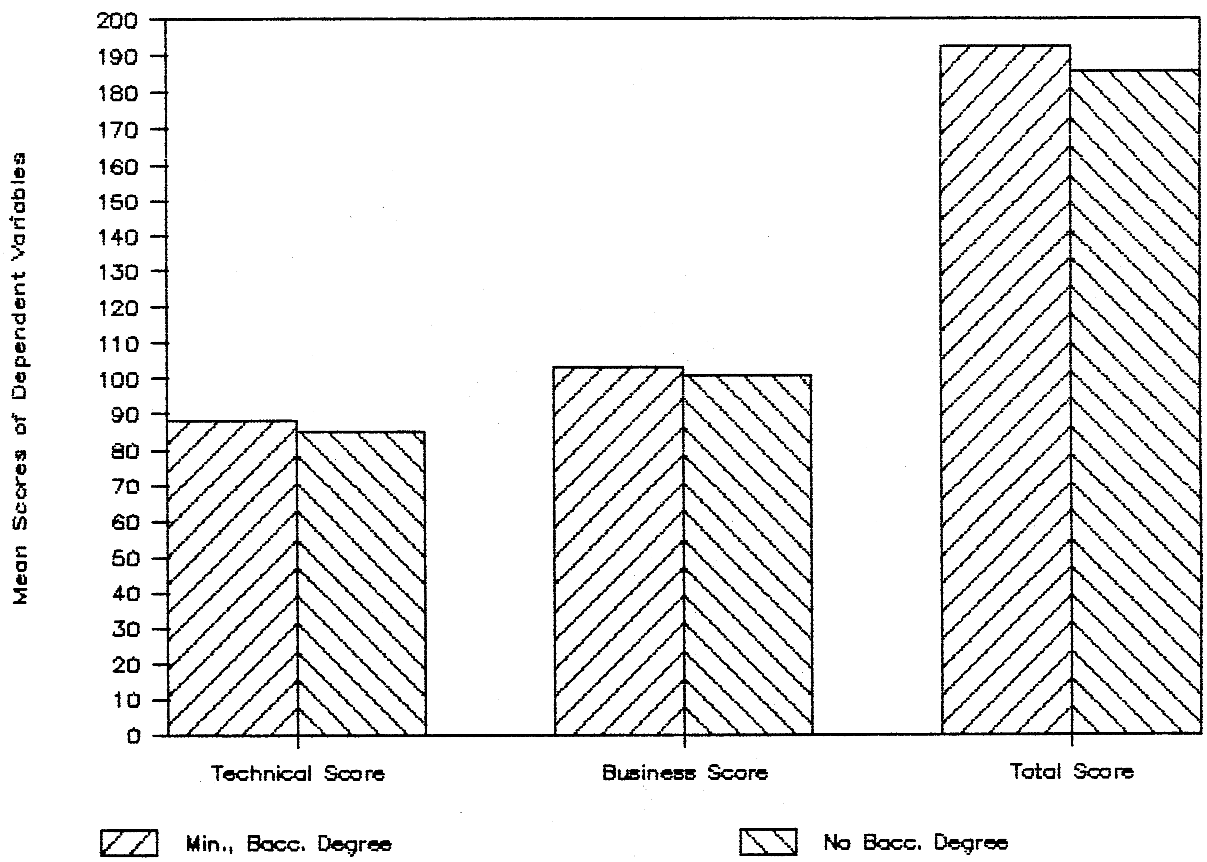

Figure 4. Graphical Representation of Technical, Business, and Total Score Means of Respondents Having at Least a Baccalaureate Degree and Respondents Not Having a Baccalaureate Degree

Conclusions

The conclusions presented here are based upon the descriptive analysis of demographic data of current managers of telecommunications in selected Fortune 500 corporations and respondent assessment of the importance of job-related tasks and knowledge areas for success in their organizational roles.

1. The placement of telecommunications management responsibilities within Fortune 500 companies is not distinctly defined.

2. At the present time, telecommunications training prior to work experience is not necessary for individuals in telecommunications management.

3. Career opportunities exist for individuals of varied educational levels and undergraduate degree specialties who wish to advance in the field of telecommunications.

4. Determination of key telecommunications management issues by persons responsible for telecommunications fills the need for individual and institutional decision-making about research, curriculum, and professional programs.

5. Telecommunications management is closely attuned to broader corporate interests, not just in technical issues, as can be seen in low rankings for newer or more technical issues.

6. Neither undergraduate degree specialty nor level of education is likely to alter the assessment of telecommunications managers toward business management or technical job functions.

7. Based on the strong correlation of business management and technical job items, any telecommunications curriculum should have both strong technical and strong business management components.

Recommendations

Based on results of this study, recommendations have emerged concerning the need for further research, the need for educational institutions to fill the corporate void of pre-trained telecommunications professionals, and the need for organizations to clarify the position of telecommunications in the corporate structure.

Future Study

1. Although the current study revealed assessment of specific job-related areas by managers of telecommunications, the survey instrument may not have contained a complete picture of job functions that are crucial to successful telecommunications management. It is recommended, therefore, that a study be done to elicit more detail of telecommunications management job functions for assessment by managers.
2. In addition, it is recommended that a survey of specific telecommunications managers, identifiable by organizational memberships or corporate job titles, be conducted to lessen the possibility of unqualified responses.
3. Future study should include, for educational use, the perceptions of telecommunications managers toward future trends or expectations in their job capacities, not only the issues that currently affect their job success.

Future Practice

1. In order to fill the void of previously trained telecommunications managers and to prepare other business managers to face the challenges offered by telecommunications, it is recommended that colleges of business consider the possibility of including or expanding the study of telecommunications within their core curriculum.

2. To standardize and clarify the role of corporate telecommunications, it is recommended that organizations utilizing voice or data communications evaluate its strategic importance and redefine job descriptions regarding telecommunications management.

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APPENDIX A

CLASSIFICATION OF JOB-RELATED SURVEY ITEMS

TABLE XIII

BUSINESS MANAGEMENT SURVEY ITEMS

Item Number	Job-Related Item
* Items preceded by "...it is important that I be able to....	
1	Evaluate hardware/software maintenance agreements
2	Use management tools in decision making (e.g., modeling, simulations)
6	Forge good vendor relationships
7	Promote a working relationship with MIS/data processing
8	Recruit qualified people
9	Prepare documentation for senior management
10	Minimize the cost of data communications
11	Cost-justify communications projects
12	Manage a multivendor communications system
13	Manage personnel
* Items preceded by "...it is important that I understand....	
14	Tariffs
16	Worker concerns for job security
19	Financial analysis
22	Telecommunications regulations, policies, and the law
24	Strategic challenges of the job

TABLE XIII (Continued)

Item Number	Job-Related Item
* Items preceded by "It is also important for me to understand...."	
31	Concepts of measured usage
32	Company objectives and policies
34	Current issues at state and federal regulatory bodies
36	End-user requirements
* Items preceded by "...it is important that I be able to...."	
37	Make equipment procurement decisions
39	Motivate employees
42	Budget communications projects
44	Negotiate with vendors
45	Develop RFPs (Requests for Proposals)
46	Obtain support of top management
48	Select vendors

TABLE XIV

TECHNICAL SURVEY ITEMS

Item Number	Job-Related Item
* Items preceded with "...it is important that I be able to...."	
3	Establish network security measures
4	Optimize voice communications
5	Select new telecommunications products that will be the most beneficial to my organization
* Items preceded with "...it is important that I understand...."	
15	Traffic engineering and network design
17	PBX technology and applications
18	Protocols and interfaces
20	Daily operation of networks
21	Network management problems and procedures
23	New technology and applications
25	Local network cabling and implementation

TABLE XIV (Continued)

Item Number	Job-Related Item
* Items preceded with "It is also important for me to understand...."	
26	Implementation of office automation technology
27	The regulation framework for ISDN (Integrated Services Digital Network)
28	Open Systems Interconnection
29	Communications equipment operation
30	The status and development of fiber optics in local exchange networks
33	Existing common carrier services
35	Fiber optic installation
* Items preceded by "...it is important that I be able to...."	
38	Manage voice communications
40	Optimize data communications
41	Evaluate the physical, data-link, and network layers of communications systems protocol hierarchy
43	Design networks
47	Evaluate equipment and network services
49	Manage data communications
50	Design and develop communications projects

TABLE XIV (Continued)

Item Number	Job-Related Item
* Items preceded with "It is also important for me to understand...."	
26	Implementation of office automation technology
27	The regulation framework for ISDN (Integrated Services Digital Network)
28	Open Systems Interconnection
29	Communications equipment operation
30	The status and development of fiber optics in local exchange networks
33	Existing common carrier services
35	Fiber optic installation
* Items preceded by "...it is important that I be able to...."	
38	Manage voice communications
40	Optimize data communications
41	Evaluate the physical, data-link, and network layers of communications systems protocol hierarchy
43	Design networks
47	Evaluate equipment and network services
49	Manage data communications
50	Design and develop communications projects

____
Identification Number

TELECOMMUNICATIONS MANAGERS' SURVEY

Demographic Data

The demographic data requested below is important in profiling the respondents of the survey. Please answer the following questions by placing a check in the appropriate blank.

Company Information:

1. What is the primary business purpose of your firm?

____ Finance (Banking, Insurance, Securities, Credit, Real Estate)
____ Government (Military, Federal, State, Municipal)
____ Service (Business, Education, Medical, Legal)
____ Manufacturing
____ Other ____________________
(Please Specify)

2. In what geographic area of the country are you currently working?

____ Eastern (CT, DC, DE, MA, MD, ME, NH, NJ, NY, PA, RI, VT)
____ Southern (AL, AR, FL, GA, KY, LA, MS, NC, SC, TN, VA, WV)
____ North Central (IA, IL, IN, MI, MN, MO, OH, WI)
____ Mountain Plains (CO, KS, ND, NE, NM, OK, SD, TX, WY)
____ Western (AK, AZ, CA, HI, ID, MT, NV, OR, UT, WA)
____ Other ____________________
(Please Specify)

Personal Information:

1. What is your specific job title?

____

2. Where was the **majority** of your telecommunications training received? **(Check only one)**

____ On-the-job (including seminars, workshops, etc.)
____ Telephone company
____ Military
____ Vocational training
____ College/University

3. Have you had any additional telecommunications training?
____ No
____ Yes
If yes, please check all that apply:
____ On-the-job (including seminars, workshops, etc.)
____ Telephone company
____ Military
____ Vocational training
____ College/University

(Over)

4. What is the highest level of education that you have completed?

_____ Doctoral degree
_____ Master's degree
_____ Some graduate-level education
_____ Four-year baccalaureate degree
_____ Associate's degree
_____ Some college
_____ Vocational certificate program
_____ No college or certificate program

5. If you earned a baccalaureate degree, what was the specialty of that degree?

_____ Business
_____ Liberal Arts
_____ Information Systems/Data Processing
_____ Computer Science
_____ Engineering
_____ Telecommunications
_____ Other ______________________________
(Please Specify)

6. Please list your last five job positions from the earliest to the most recent.

____

____

____

____

____

7. Within what approximate range is your current annual salary?

_____ $19,999 or less
_____ $20,000 - $39,999
_____ $40,000 - $59,999
_____ $60,000 - $79,999
_____ $80,000 - $99,999
_____ $100,000 or more

Request for Survey Results:

Would you like a copy of the results of this questionnaire?

_____ No
_____ Yes

Send To:
____

Address:

____

____

____

(Next Page)

Job-Related Tasks and Knowledge Opinionnaire

Instructions: Please rate the following job-related items based on your perceptions of their importance to your present role in your organization. Circle the appropriate number for each item using the following scale:

Not Important	Of Little Importance	Somewhat Important	Important	Very Important
1	2	3	4	5

In my current position, it is important that I be able to . . .

1. Evaluate hardware/software maintenance agreements	1 2 3 4 5
2. Use management tools in decision making (e.g. modeling, simulations)	1 2 3 4 5
3. Establish network security measures	1 2 3 4 5
4. Optimize voice communications	1 2 3 4 5
5. Select new telecommunications products that will be the most beneficial to my organization	1 2 3 4 5
6. Forge good vendor relationships	1 2 3 4 5
7. Promote a working relationship with MIS/data processing	1 2 3 4 5
8. Recruit qualified people	1 2 3 4 5
9. Prepare documentation for senior management	1 2 3 4 5
10. Minimize the cost of data communications	1 2 3 4 5
11. Cost-justify communications projects	1 2 3 4 5
12. Manage a multivendor communications system	1 2 3 4 5
13. Manage personnel	1 2 3 4 5

In my position, it is important that I understand . . .

14. Tariffs	1 2 3 4 5
15. Traffic engineering and network design	1 2 3 4 5
16. Worker concerns for job security	1 2 3 4 5
17. PBX technology and applications	1 2 3 4 5
18. Protocols and interfaces	1 2 3 4 5
19. Financial analysis	1 2 3 4 5
20. Daily operation of networks	1 2 3 4 5
21. Network management problems and procedures	1 2 3 4 5
22. Telecommunications regulations, policies, and the law	1 2 3 4 5
23. New technology and applications	1 2 3 4 5
24. Strategic challenges of the job	1 2 3 4 5
25. Local network cabling and implementation	1 2 3 4 5

(Over)

Not Important	Of Little Importance	Somewhat Important	Important	Very Important
1	2	3	4	5

It is also important for me to understand...

26. Implementation of office automation technology	1 2 3 4 5
27. The regulation framework for ISDN (Integrated Services Digital Network)	1 2 3 4 5
28. Open Systems Interconnection	1 2 3 4 5
29. Communications equipment operation	1 2 3 4 5
30. The status and development of fiber optics in local exchange networks	1 2 3 4 5
31. Concepts of measured usage	1 2 3 4 5
32. Company objectives and policies	1 2 3 4 5
33. Existing common carrier services	1 2 3 4 5
34. Current issues at state and federal regulatory bodies	1 2 3 4 5
35. Fiber optic installation	1 2 3 4 5
36. End-user requirements	1 2 3 4 5

In my organization, it is important that I be able to ...

37. Make equipment procurement decisions	1 2 3 4 5
38. Manage voice communications	1 2 3 4 5
39. Motivate employees	1 2 3 4 5
40. Optimize data communications	1 2 3 4 5
41. Evaluate the physical, data-link, and network layers of communications systems protocol hierarchy	1 2 3 4 5
42. Budget communications projects	1 2 3 4 5
43. Design networks	1 2 3 4 5
44. Negotiate with vendors	1 2 3 4 5
45. Develop RFPs (Requests for Proposals)	1 2 3 4 5
46. Obtain support of top management	1 2 3 4 5
47. Evaluate equipment and network services	1 2 3 4 5
48. Select vendors	1 2 3 4 5
49. Manage data communications	1 2 3 4 5
50. Design and develop communications projects	1 2 3 4 5

THANK YOU FOR YOUR ASSISTANCE WITH THIS SURVEY.

APPENDIX C

COVER LETTERS

OSU

Oklahoma State University

COLLEGE OF BUSINESS ADMINISTRATION

STILLWATER, OKLAHOMA 74078-0555
BUSINESS 201
405-624-5064

July 5, 1988

Dear Telecommunications Manager:

As a telecommunications manager, you are faced with far more job complexities than many information systems and educational professionals realize. Although industrial and academic efforts are increasing to provide support in helping you deal with those complexities, confusion still remains regarding how to meet your needs.

I am conducting a survey of randomly selected telecommunications managers that explores the value of task or knowledge areas thought to be essential for success in telecommunications management. The survey instructions ask you, the person in the best position to render judgment, to rate the importance of these job-related items in your role as a manager of telecommunications.

Would you help in this effort by answering the survey questions? The results of the study will be reported in group form only, and individual responses will in no way be identified with specific companies or managers.

Please take a few minutes to contribute to this study by completing the survey and returning it in the enclosed postage paid envelope. Please respond by July 19, 1988.

Your cooperation will be greatly appreciated.

Sincerely,

Irene Ackerson

Irene Ackerson
Graduate Assistant

Jeretta Horn

Dr. Jeretta Horn, Major Advisor
Management

Enclosure

OSU

Oklahoma State University

COLLEGE OF BUSINESS ADMINISTRATION

STILLWATER, OKLAHOMA 74078-0555
BUSINESS 201
405-624-5064

August 2, 1988

Dear Telecommunications Manager:

Recently, you or another telecommunications manager in your organization should have received a letter from me, asking for a personal opinion regarding the importance of specific tasks or knowledge areas thought to be essential for success in telecommunications management. As of today, I have not yet received a completed questionnaire from your firm.

Your response will provide data that may be helpful in improving collegiate programs and in preparing future telecommunications managers.

I am writing to you again because of the significance each response has to the usefulness of this study. Telecommunications managers within randomly selected Fortune 500 companies were chosen for this survey, since expenditures on telecommunications within these organizations usually justify in-house expertise. In order for the results of the study to be truly representative of the opinions of telecommunications managers within all Fortune 500 companies, your response is needed.

You may be assured of complete confidentiality. The questionnaire has an identification number for mailing purposes only. This is so that I may check your organization off the mailing list when your questionnaire is returned.

Please join others who have already returned the survey. In the event that the previous questionnaire has been been misplaced or you did not receive one, a replacement is enclosed.

Your cooperation is greatly appreciated.

Sincerely,

Irene Ackerson
Graduate Assistant

Dr. Jeretta Horn, Major Advisor
Management

Enclosure

CENTENNIAL
1890 • 1990

Celebrating the Past . . . Preparing for the Future

APPENDIX D

STATISTICS OF COLLECTED DATA NOT DIRECTLY RELATED TO THE PURPOSE OF THE STUDY

TABLE XV

PRIMARY BUSINESS PURPOSE AS SPECIFIED BY RESPONDENTS (n = 185)

Business Purpose	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Finance	0	0	0	0
Government	0	0	0	0
Service	3	1.6	3	1.6
Manufacturing	147	80.3	150	82.0
Other	33	18.0	183	100.0

Frequency Missing = 2

TABLE XVI

PRIMARY PURPOSE OF BUSINESS SPECIFIED
BY RESPONDENTS AS "OTHER"

Primary Purpose of Business	Frequency
Aerospace/Financial Services/Consumer Products	1
Agri-business	1
Broadcast Advertising Sales	1
Conglomerate: Agricultural, Consumer Products, Chemicals, Pharmaceuticals	1
Energy	3
Farm Cooperative	1
Food Coop	1
Food Processing	1
Investment/Holding Company	1
Management Holding Company	1
Marketing and Distribution	1
Media--Publishing and Broadcasting	2
Mining	1
Oil and Gas (Drilling and Exploration)	2
Oil and Gas Exploration and Production	1
Oil and Gas Exploration and Development/ Real Estate Development	1
Oil and Gas Refining and Marketing	1
Petroleum--Production, Refining and Marketing	4
Petroleum--Refining and Exploration	1
Poultry Processing	1
Publishing	1
Producer and Distributor of Fruits and Related Products	1
Retail/Distribution	1
Social Expression/Greeting Cards	1
Specialty Chemicals	1
World/Corporation Headquarters	1
Total	33

TABLE XVII

ANALYSIS OF INDUSTRY TYPE AS CLASSIFIED BY FORTUNE (1988) AND COMPARED WITH POPULATION
(n = 190 *)

Industry	Respondent Frequency	Population Frequency
Aerospace	6	18
Apparel	4	10
Beverages	4	8
Building Materials	3	16
Chemicals	21	48
Computers (Includes Office Equipment)	10	25
Electronics	19	46
Food	21	47
Forest Products	15	32
Furniture	2	8
Industrial and Farm Equipment	13	34
Jewelry, Silverware	0	1
Leather	0	0
Metal Products	6	19
Metals	9	24
Mining, Crude Oil Production	5	13
Motor Vehicles and Parts	6	17

* Total responses

TABLE XVII (Continued)

Industry	Respondent Frequency	Population Frequency
Petroleum Refining	15	31
Pharmaceuticals	2	17
Publishing, Printing	7	22
Rubber Products	3	11
Scientific and Photographic Equipment	6	17
Soaps, Cosmetics	2	12
Textiles	6	12
Tobacco	0	5
Toys, Sporting Goods	1	3
Transportation Equipment	2	4
	188 *	500

* Of the 190 returns, two companies were unidentifiable because the identification numbers were removed by respondents before remittance.

TABLE XVIII

REGION OF COUNTRY IN WHICH RESPONDENTS INDICATED THEY WERE CURRENTLY WORKING
(n = 185)

Region	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Eastern	48	25.9	48	25.9
Southern	16	8.6	64	34.6
North Central	60	32.4	124	67.0
Mountain Plains	17	9.2	141	76.2
Western	19	10.3	160	86.5
Other				
All States	15	8.1	175	94.6
All States and Other	3	1.6	178	96.2
Southern and North Central	1	0.5	179	96.8
Eastern, Southern, North Central, Mountain Plains	1	0.5	180	97.3
Eastern, Southern	3	1.6	183	98.9
Eastern, Southern, North Central, Western	1	0.5	184	99.5
Southern, Mountain Plains, Western	1	0.5	185	100.0

TABLE XIX

SPECIFIC JOB TITLE AS SPECIFIED BY RESPONDENTS*
(n = 185)

Job Title	Frequency	Percent
Communications Specialist	2	1.1
Supervisor, Telecommunications	7	3.8
Coordinator, Telecommunications	2	1.1
Director, Telecommunications	4	2.2
Manager, Telecommunications Planning and Operations	1	0.5
Supervisor, Communications and Network Services (Voice Projects)	1	0.5
Manager, Network Services	1	0.5
Manager, Telecommunications (Communications) Operations	6	3.3
Manager, Communications Planning	1	0.5
Manager, Telecommunications (Communications) Services	9	4.9
Analyst, Telecommunications (Communications)	5	2.7
Manager, Telecommunications (Communications)	51	27.7
Assistant Director, Corporate Telecommunications	1	0.5
Manager, Corporate Communications	18	9.8
Director, Telecomputing Services	1	0.5

* In some instances, job titles which were very similar were grouped under one job title.

TABLE XIX (Continued)

Job Title	Frequency	Percent
Manager, Telecommunications Design and Technology	1	0.5
Manager, Administration and Telecommunications	1	0.5
Manager, Network Planning and Operations	1	0.5
Supervisor, Telecommunications and Planning	1	0.5
Manager, Telecommunications Technical Services	1	0.5
Section Manager, Telecommunications Systems	1	0.5
Manager, Word Processing and Telecommunications	1	0.5
Director, Corporate Telecommunications	1	0.5
Specialist, Corporate Telecommunications	1	0.5
Technical Manager, Telecommunications	1	0.5
Associate Director, Network Services	1	0.5
Manager, Voice Communications	3	1.6
Supervisor, Teleprocessing Operations	1	0.5
Manager, NCC	1	0.5
Senior Telecommunications Analyst/Project Manager	2	1.1

TABLE XIX (Continued)

Job Title	Frequency	Percent
Manager, Office Services/ Voice Communications	1	0.5
Manager, Corporate Network Planning	1	0.5
Manager, Voice Services	1	0.5
Manager, Data Communications	1	0.5
Manager, Voice/Data Communications	1	0.5
Manager, Programming and Telecommunications	1	0.5
Manager, Office Services and Telecommunications	1	0.5
Teletype/Telecommunications Operator	1	0.5
Vice-President, Communications	1	0.5
Manager, Telecommunications and Network Services	1	0.5
Supervisor, Voice Communications	1	0.5
Manager, Transmission/ Voice Networks	1	0.5
Manager, Telephone Services	1	0.5
Manager, IS Telecommunications	1	0.5
Supervisor, Telex Department	1	0.5
Manager, Host Communications Technology	1	0.5

TABLE XIX (Continued)

Job Title	Frequency	Percent
Manager, Office Services	4	2.2
Manager, Office Operations	1	0.5
Assistant Office Manager	1	0.5
Supervisor, Office Services	2	1.1
Director, Office Services	1	0.5
Manager, Office Services and Personnel	1	0.5
Manager, Corporate MIS	1	0.5
Director, MIS	2	1.1
Director, Computer Utilities	1	0.5
Senior Systems Analyst	1	0.5
Manager, Computer Operations	1	0.5
Director, Data Processing	2	1.1
Corporate Director of Information Services	1	0.5
Senior Systems Programmer	1	0.5
Director, IS	1	0.5
Administrative Manager	1	0.5
Manager, Technical Services	2	1.1
Personnel Assistant	1	0.5
Manager, Company Facilities	1	0.5
Manager, System Services	1	0.5
Supervisor, Building Services	1	0.5

TABLE XIX (Continued)

Job Title	Frequency	Percent
Risk Manager/Office Manager	1	0.5
Manager, Technical Support	1	0.5
Corporate Vice President	1	0.5
Director, Data Processing and Communications	1	0.5
Manager, General Services	1	0.5
Sales Manager	1	0.5
Systems Specialist	1	0.5
Group Controller	1	0.5
Supervisor, Administrative Services	1	0.5
Manager, Corporate Services	1	0.5
Assistant to the President	1	0.5
Director of Operations	1	0.5
TOTAL:	184	

Frequency Missing = 1

TABLE XX

MAJORITY OF TELECOMMUNICATIONS TRAINING
AS SPECIFIED BY RESPONDENTS
(n = 185)

Majority of Training	Frequency	Percent	Cumulative Frequency	Cumulative Percent
On-the-Job	141	76.2	141	76.2
Telephone Company	21	11.4	162	87.6
Military	5	2.7	167	90.3
Vocational Training	0	0.0	167	90.3
College/ University	3	1.6	170	91.9
On-the-Job and College/ University	4	2.2	174	94.1
On-the-Job and Telephone Company	5	2.7	179	96.8
On-the-Job and Military	2	1.1	181	97.8
On-the-Job and Vocational Training	2	1.1	183	98.9
On-the-Job, Telephone Company, and military	2	1.1	185	100.0

TABLE XXI

ADDITIONAL TELECOMMUNICATIONS TRAINING AS SPECIFIED BY RESPONDENTS
(n = 185)

Additional Training	Frequency	Percent	Cumulative Frequency	Cumulative Percent
On-the-Job				
No	86	46.5	86	46.5
Yes	99	53.5	185	100.0
Telephone Company				
No	142	76.8	142	76.6
Yes	43	23.2	185	100.0
Military				
No	175	94.6	175	94.6
Yes	10	5.4	185	100.0
Vocational Training				
No	176	95.1	176	95.1
Yes	9	4.9	185	100.0
College/University				
No	149	80.5	149	80.4
Yes	36	19.5	185	100.0

TABLE XXII

CAREER PATH AS INDICATED BY LAST FIVE JOB POSITIONS AND CLASSIFIED BY RESEARCHER
(n = 185)

Career Path	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Traditional				
Computing/ MIS/Data Processing	34	19.9	34	19.9
Communications	48	28.1	82	48.0
Business	17	9.9	99	57.9
Engineering	5	2.9	104	60.8
Miscellaneous *	33	19.3	137	80.1
Non-Traditional				
Computing/ MIS/Data Processing	11	6.4	148	86.5
Communications	13	7.6	161	94.2
Business	5	2.9	166	97.1
Engineering	1	0.6	167	97.7
Miscellaneous *	4	2.3	171	100.00
	Frequency Missing = 14			

* The last five job positions not indicating a predominant functional area were classified as miscellaneous.

TABLE XXIII

APPROXIMATE CURRENT ANNUAL SALARY RANGE
AS SPECIFIED BY RESPONDENTS
(n = 185)

Salary Range	Frequency	Percent	Cumulative Frequency	Cumulative Percent
$19,000 or less	1	0.6	1	0.6
$20,000 - $39,999	33	18.6	34	19.2
$40,000 - $59,999	79	44.6	113	63.8
$60,000 - $79,999	46	26.0	159	89.8
$80,000 - $99,999	12	6.8	171	96.6
$100,000 or more	6	3.4	177	100.0

Frequency Missing = 8

TABLE XXIV

RESPONDENT REQUESTS FOR SURVEY RESULTS
(n = 185)

Survey Results	Frequency	Percent	Cumulative Frequency	Cumulative Percent
No	65	35.3	65	35.3
Yes	119	64.7	184	100.0

APPENDIX E

RESPONSES TO JOB-RELATED TASKS AND KNOWLEDGE OPINIONNAIRE

TABLE XXV

RESPONSES TO JOB-RELATED TASKS AND KNOWLEDGE OPINIONNAIRE
(n = 185)

Topic	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Hardware/software maintenance agreements				
Not Important	2	1.1	2	1.1
Of Little Importance	16	9.2	18	10.3
Somewhat Important	44	25.3	62	35.6
Important	66	37.9	128	73.6
Very Important	46	26.4	174	100.0
	Frequency Missing = 11			
Management tools in decision making				
Not Important	10	5.8	10	5.8
Of Little Importance	36	20.8	46	26.6
Somewhat Important	53	30.6	99	57.2
Important	43	24.9	142	82.1
Very Important	31	17.9	173	100.0
	Frequency Missing = 12			
Establish network security measures				
Not Important	9	5.2	9	5.2
Of Little Importance	28	16.1	37	21.3
Somewhat Important	60	34.5	97	55.7
Important	58	33.3	155	89.1
Very Important	19	10.9	174	100.0
	Frequency Missing = 11			

TABLE XXV (Continued)

Topic	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Optimize voice communications				
Not Important	3	1.7	3	1.7
Of Little Importance	7	4.0	10	5.7
Somewhat Important	16	9.2	26	14.9
Important	50	28.7	76	43.7
Very Important	98	56.3	174	100.0
	Frequency Missing = 11			
Select new telecommunications products that will be most beneficial to the organization				
Not Important	3	1.7	3	1.7
Of Little Importance	1	0.6	4	2.3
Somewhat Important	15	8.6	19	10.9
Important	54	30.9	73	41.7
Very Important	102	58.3	175	100.0
	Frequency Missing = 10			
Forge good vendor relationships				
Not Important	4	2.3	4	2.3
Of Little Importance				
Somewhat Important	25	14.4	29	16.7
Important	81	46.6	110	63.2
Very Important	64	36.8	174	100.0
	Frequency Missing = 11			
Promote a working relationship with MIS/data processing				
Not Important	5	2.9	5	2.9
Of Little Importance	8	4.6	13	7.5
Somewhat Important	29	16.7	42	24.1
Important	64	36.8	106	60.9
Very Important	68	39.1	174	100.0
	Frequency Missing = 11			

TABLE XXV (Continued)

Topic	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Recruit qualified people				
Not Important	10	5.8	10	5.8
Of Little Importance	12	6.9	22	12.7
Somewhat Important	21	12.1	43	24.9
Important	47	27.2	90	52.0
Very Important	83	48.0	173	100.0
	Frequency Missing = 12			
Prepare documentation for senior management				
Not Important	4	2.3	4	2.3
Of Little Importance	12	6.9	16	9.2
Somewhat Important	35	20.1	51	29.3
Important	63	36.2	114	65.5
Very Important	60	34.5	174	100.0
	Frequency Missing = 11			
Minimize the cost of data communications				
Not Important	12	6.9	12	6.9
Of Little Importance	16	9.2	28	16.2
Somewhat Important	29	16.8	57	32.9
Important	61	35.3	118	68.2
Very Important	55	31.8	173	100.0
	Frequency Missing = 12			
Cost-justify communications projects				
Not Important	1	0.6	1	0.6
Of Little Importance	5	2.9	6	3.4
Somewhat Important	30	17.1	36	20.6
Important	70	40.0	106	60.6
Very Important	69	39.4	175	100.0
	Frequency Missing = 10			

TABLE XXV (Continued)

Topic	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Manage a multivendor communications system				
Not Important	8	4.6	8	4.6
Of Little Importance	13	7.4	21	12.0
Somewhat Important	23	13.1	44	25.1
Important	47	26.9	91	52.0
Very Important	84	48.0	175	100.0
Frequency Missing = 10				
Manage personnel				
Not Important	4	2.3	4	2.3
Of Little Importance	4	2.3	8	4.6
Somewhat Important	14	8.0	22	12.6
Important	59	33.9	81	46.6
Very Important	93	53.4	174	100.0
Frequency Missing = 11				
Tariffs				
Not Important	11	6.4	11	6.4
Of Little Importance	21	12.1	32	18.5
Somewhat Important	71	41.0	103	59.5
Important	52	30.1	155	89.6
Very Important	18	10.4	173	100.0
Frequency Missing = 12				
Traffic engineering and network design				
Not Important	8	4.6	8	4.6
Of Little Importance	14	8.0	22	12.6
Somewhat Important	56	32.0	78	44.6
Important	57	32.6	135	77.1
Very Important	40	22.9	175	100.0
Frequency Missing = 10				

TABLE XXV (Continued)

Topic	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Worker concerns for job security				
Not Important	10	5.7	10	5.7
Of Little Importance	20	11.5	30	17.2
Somewhat Important	53	30.5	83	47.7
Important	65	37.4	148	85.1
Very Important	26	14.9	174	100.0
	Frequency Missing = 11			
PBX technology and applications				
Not Important	4	2.3	4	2.3
Of Little Importance	5	2.9	9	5.3
Somewhat Important	26	15.2	35	20.5
Important	76	44.4	111	64.9
Very Important	60	35.1	171	100.0
	Frequency Missing = 14			
Protocols and interfaces				
Not Important	9	5.1	9	5.1
Of Little Importance	17	9.7	26	14.9
Somewhat Important	66	37.7	92	52.6
Important	63	36.0	155	88.6
Very Important	20	11.4	175	100.0
	Frequency Missing = 10			
Financial analysis				
Not Important	7	4.0	7	4.0
Of Little Importance	13	7.5	20	11.5
Somewhat Important	30	17.2	50	28.7
Important	78	44.8	128	73.6
Very Important	46	26.4	174	100.0
	Frequency Missing = 11			

TABLE XXV (Continued)

Topic	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Daily operation of networks				
Not Important	5	2.9	5	2.9
Of Little Importance	7	4.0	12	6.9
Somewhat Important	56	32.2	68	39.1
Important	59	33.9	127	73.0
Very Important	47	27.0	174	100.0
	Frequency Missing = 11			
Network management problems and procedures				
Not Important	6	3.4	6	3.4
Of Little Importance	8	4.6	14	8.0
Somewhat Important	39	22.4	53	30.5
Important	75	43.1	128	73.6
Very Important	46	26.4	174	100.0
	Frequency Missing = 11			
Telecommunications regulations, policies, and the law				
Not Important	4	2.3	4	2.3
Of Little Importance	21	12.0	25	14.3
Somewhat Important	64	36.6	89	50.9
Important	61	34.9	150	85.7
Very Important	25	14.3	175	100.0
	Frequency Missing = 10			
New technology and applications				
Not Important	3	1.7	3	1.7
Of Little Importance	1	0.6	4	2.3
Somewhat Important	22	12.6	26	14.9
Important	87	49.7	113	64.6
Very Important	62	35.4	175	100.0
	Frequency Missing = 10			

TABLE XXV (Continued)

Topic	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Strategic challenges of the job				
Not Important	3	1.7	3	1.7
Of Little Importance	8	4.6	11	6.4
Somewhat Important	25	14.5	36	20.8
Important	62	35.8	98	56.6
Very Important	75	43.4	173	100.0
	Frequency Missing = 12			
Local network cabling and implementation				
Not Important	7	4.0	7	4.0
Of Little Importance	20	11.4	27	15.4
Somewhat Important	50	28.6	77	44.0
Important	68	38.9	145	82.9
Very Important	30	17.1	175	100.0
	Frequency Missing = 10			
Implementation of office automation and technology				
Not Important	5	2.8	5	2.8
Of Little Importance	16	9.1	21	11.9
Somewhat Important	67	38.1	88	50.0
Important	67	38.1	155	88.1
Very Important	21	11.9	176	100.0
	Frequency Missing = 9			
The regulation framework for ISDN (Integrated Services Digital Network)				
Not Important	7	4.0	7	4.0
Of Little Importance	29	16.5	36	20.5
Somewhat Important	64	36.4	100	56.8
Important	55	31.3	155	88.1
Very Important	21	11.9	176	100.0
	Frequency Missing = 9			

TABLE XXV (Continued)

Topic	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Open Systems Interconnection				
Not Important	9	5.1	9	5.1
Of Little Importance	26	14.8	35	19.9
Somewhat Important	68	38.6	103	58.5
Important	60	34.1	163	92.6
Very Important	13	7.4	176	100.0
Frequency Missing = 9				
Communications equipment operation				
Not Important	7	4.0	7	4.0
Of Little Importance	15	8.5	22	12.5
Somewhat Important	60	34.1	82	46.6
Important	60	34.1	142	80.7
Very Important	34	19.3	176	100.0
Frequency Missing = 9				
The status and development of fiber optics in local exchange networks				
Not Important	9	5.1	9	5.1
Of Little Importance	30	17.0	39	22.2
Somewhat Important	79	44.9	118	67.0
Important	49	27.8	167	94.9
Very Important	9	5.1	176	100.0
Frequency Missing = 9				
Concepts of measured usage				
Not Important	5	2.8	5	2.8
Of Little Importance	30	17.0	35	19.9
Somewhat Important	62	35.2	97	55.1
Important	67	38.1	164	93.2
Very Important	12	6.8	176	100.0
Frequency Missing = 9				

TABLE XXV (Continued)

Topic	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Company objectives and policies				
Not Important	1	0.6	1	0.6
Of Little Importance	2	1.1	3	1.7
Somewhat Important	15	8.5	18	10.2
Important	54	30.7	72	40.9
Very Important	104	59.1	176	100.0
	Frequency Missing = 9			
Existing common carrier services				
Not Important	1	0.6	1	0.6
Of Little Importance	4	2.3	5	2.9
Somewhat Important	40	22.9	45	25.7
Important	87	49.7	132	75.4
Very Important	43	24.6	175	100.0
	Frequency Missing = 10			
Current issues at state and federal regulatory bodies				
Not Important	8	4.5	8	4.5
Of Little Importance	26	14.8	34	19.3
Somewhat Important	76	43.2	110	62.5
Important	52	29.5	162	92.0
Very Important	14	8.0	176	100.0
	Frequency Missing = 9			
Fiber optic installation				
Not Important	14	8.0	14	8.0
Of Little Importance	42	23.9	56	31.8
Somewhat Important	84	47.7	140	79.5
Important	28	15.9	168	95.5
Very Important	8	4.5	176	100.0
	Frequency Missing = 9			

TABLE XXV (Continued)

Topic	Frequency	Percent	Cumulative Frequency	Cumulative Percent
End-user requirements				
Not Important	1	0.6	1	0.6
Of Little Importance	3	1.7	4	2.3
Somewhat Important	13	7.4	17	9.7
Important	53	30.1	70	39.8
Very Important	106	60.2	176	100.0
Frequency Missing = 9				
Make equipment procurement decisions				
Not Important	2	1.1	2	1.1
Of Little Importance	2	1.1	4	2.3
Somewhat Important	17	9.7	21	11.9
Important	72	40.9	93	52.8
Very Important	83	47.2	176	100.0
Frequency Missing = 9				
Manage voice communications				
Not Important	6	3.4	6	3.4
Of Little Importance	4	2.3	10	5.7
Somewhat Important	14	8.0	24	13.7
Important	51	29.1	75	42.9
Very Important	100	57.1	175	100.0
Frequency Missing = 10				
Motivate employees				
Not Important	3	1.7	3	1.7
Of Little Importance	8	4.5	11	6.2
Somewhat Important	25	14.2	36	20.5
Important	53	30.1	89	50.6
Very Important	87	49.4	176	100.0
Frequency Missing = 9				

TABLE XXV (Continued)

Topic	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Optimize data communications				
Not Important	11	6.3	11	6.3
Of Little Importance	21	12.0	32	18.3
Somewhat Important	28	16.0	60	34.3
Important	75	42.9	135	77.1
Very Important	40	22.9	175	100.0
Frequency Missing = 10				
Evaluate the physical, data-link, and network layers of communications systems protocol hierarchy				
Not Important	22	12.7	22	12.7
Of Little Importance	52	30.1	74	42.8
Somewhat Important	62	35.8	136	78.6
Important	31	17.9	167	96.5
Very Important	6	3.5	173	100.0
Frequency Missing = 12				
Budget communications projects				
Not Important	3	1.7	3	1.7
Of Little Importance	10	5.7	13	7.4
Somewhat Important	24	13.7	37	21.1
Important	72	41.1	109	62.3
Very Important	66	37.7	175	100.0
Frequency Missing = 10				
Design networks				
Not Important	10	5.7	10	5.7
Of Little Importance	19	10.9	29	16.6
Somewhat Important	52	29.7	81	46.3
Important	57	32.6	138	78.9
Very Important	37	21.1	175	100.0
Frequency Missing = 10				

TABLE XXV (Continued)

Topic	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Negotiate with vendors				
Not Important	4	2.3	4	2.3
Of Little Importance	4	2.3	8	4.6
Somewhat Important	24	13.7	32	18.3
Important	70	40.0	102	58.3
Very Important	73	41.7	175	100.0
Frequency Missing = 10				
Develop RFPs (Requests for Proposals)				
Not Important	10	5.7	10	5.7
Of Little Importance	9	5.2	19	10.9
Somewhat Important	49	28.2	68	39.1
Important	68	39.1	136	78.2
Very Important	38	21.8	174	100.0
Frequency Missing = 11				
Obtain support of top management				
Not Important	1	0.6	1	0.6
Of Little Importance	1	0.6	2	1.1
Somewhat Important	11	6.3	13	7.4
Important	44	25.1	57	32.6
Very Important	118	67.4	175	100.0
Frequency Missing = 10				
Evaluate equipment and network services				
Not Important	4	2.3	4	2.3
Of Little Importance	2	1.1	6	3.4
Somewhat Important	24	13.7	30	17.1
Important	82	46.9	112	64.0
Very Important	63	36.0	175	100.0
Frequency Missing = 10				

TABLE XXV (Continued)

Topic	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Select vendors				
Not Important	3	1.7	3	1.7
Of Little Importance	1	0.6	4	2.3
Somewhat Important	20	11.4	24	13.6
Important	94	53.4	118	67.0
Very Important	58	33.0	176	100.0
	Frequency Missing = 9			
Manage data communications				
Not Important	16	9.2	16	9.2
Of Little Importance	22	12.6	38	21.8
Somewhat Important	34	19.5	72	41.4
Important	69	39.7	141	81.0
Very Important	33	19.0	174	100.0
	Frequency Missing = 11			
Design and develop communications projects				
Not Important	9	5.1	9	5.1
Of Little Importance	6	3.4	15	8.5
Somewhat Important	40	22.7	55	31.3
Important	60	34.1	115	65.3
Very Important	61	34.7	176	100.0
	Frequency Missing = 9			

APPENDIX F

THE ROLE OF TELECOMMUNICATIONS AT MEDTRONIC

AN INTERVIEW WITH JAMES A. PARRY

The Role of Telecommunications at Medtronic
An Interview with James A. Parry

What should be the role of the telecommunications (telecomm) manager within the modern organization? Within some organizations it is minimizing costs, acting as the long distance enforcer, or making sure that each move or change goes according to plan. During a recent interview Mr. James (Jim) Parry of Medtronic, Inc. declared that it is to [1] "increase earnings per share". This article will overview Medtronic, the current structure, organization and functions of telecommunications, and Jim's thoughts on the future.

Medtronic, Inc. is the world's leading manufacturer of implantable heart pacing systems. Other major products, and research and development efforts, include heart valves, catheters, synthetic grafts, and transcutaneous electronic nerve stimulation (TENS) devices. For the fiscal year ending April 30, 1988 Medtronic reported [2] [3] record earnings of $86.5 million, or $6.32 per share, on record revenues of $653.3 million. Net earnings increased 17.2 percent, earnings per share increased 20.4 percent and revenue 30 percent over the previous year. With sales per employee of over $130,000 and earnings per employee of $17,300, the company is one of the most profitable major corporations in the United States on a per employee basis, and on the basis of return on net assets. With its highly technical products the company has an overwhelming technical and professional orientation. Unfortunately, the average employee is confused and even intimidated by telecommunication problems, as exemplified by those existing in their personal lives in acquiring and maintaining the telephones and wiring for their own residence. Many view systems, and especially the telephone, as a utility that should just always work.

Medtronic has a strong sense of purpose as is typical in organizations where the founder is part of the senior corporate management. Its "culture" can be overviewed in the corporate mission statement created by it's founder, Earl Bakken:

> To contribute to human welfare by application of biomedical engineering in the research, design, manufacture and sale of instruments or appliances that alleviate pain, restore health, and extend life.
>
> To direct our growth in the areas of biomedical engineering where we display maximum strength and ability; to gather people and facilities that tend to augment these areas; to continuously build on these areas through education and knowledge assimilation; to avoid participation in areas where we cannot make unique and worthy contributions.
>
> To strive without reserve for the greatest possible reliability and quality in our products; to be the unsurpassed standard of comparison and to be recognized as a company of dedication, honesty, integrity and service.
>
> To make a fair profit on current operations to meet our obligations, sustain our growth, and reach our goals.

To recognize the personal worth of employees by providing an employment framework that allows personal satisfaction in work accomplished, security, advancement opportunity, and means to share in the company's success.
To maintain good citizenship as a company.

With major facilities in five other countries in addition to its extensive U.S. operations, and sales and technical personnel or representatives in over 100 countries, Medtronic is a multinational company. It operates six continental U.S. PBXs and five PBXs in other locations, with the primary supplier being AT&T. The 1900 stations in the Fridley Rice Creek Campus (RCC) complex and 2500 other telephones provide the voice communication systems for the company's 5,000 worldwide employees. Major data communications systems include U.S. and foreign leased lines, and a large-scale terminal local area network with almost 1000 ports in the RCC. With corporate-wide costs estimated at $4.0 million annually, telecommunications is a major component of the annual budget. Approximately 80% of the costs are associated with voice and related traffic, with data accounting for the remaining 20%. Daily operational support within the RCC campus is provided by a full-time supervisor, one full-time and one part-time employee with primary responsibility for data, and one full-time and three part-time employees primarily supporting voice systems. All of these employees are in the Corporate Information Systems (CIS) organization. Other locations are supported primarily by local contractors of telephone company employees.

As a Medtronic Technical Fellow, Jim is one of a select number of employees who has been so honored. He and four other senior staff members form the Network Systems and Strategic Planning organization, and report to the Director of Corporate Information Systems. Unlike most other CIS employees though, he has direct and frequent access to many senior executives because of the nature and sometimes sensitive information within the functional areas of telecommunications.

Jim believes that there are three major telecommunications functions for a telecomm manager to perform: 1) acting as a consultative resource who "partners" with the requestor, 2) performing periodic audits of major facilities and services, and 3) operational assistance to the line personnel involved in supporting the installed systems. While somewhat idealized, he visualizes the consultative role as primarily assisting in the justification, ordering, and implementation of solutions to the users business problems. The unique reporting relationship provides the opportunity to not champion one cause over another, as is frequently the case in many organizations.

According to Jim, the modern manager also needs to play an important role in strategic and tactical planning, assisting in the decision making process for major changes, acquisition and mergers, and in the introduction of new technology. As with most managers the greatest shortfall between theory and practice is in the area of strategic planning and mergers and acquisitions. That is, while it is ideal to be involved during the formulative period, in reality telecommunications is usually only informed of major decisions. There appears to be no easy fix for this, other than to be consistently a valuable contributor, and respond quickly when invited into the process. Some progress on this has been realized as exemplified in the move currently occurring in the Eastern Region. Tactical planning and execution is effectively the art/science of providing quality at the lowest reasonable cost as typified by the selection between AT&T, MCI and Sprint as a long distance carrier.

There are several sets of skills which a successful telecomm manager needs. Among the management skills needed are [4]: human, conceptual, and technical. Jim feels that the appropriate mix is 60/30/10% for this skill set. Human skills, which include listening to the customer, responding to their needs, and building trust, is seen as the most important skill.

In another dimension is the high importance of a goal orientation. In rank order Jim places them as: functionality, cost, and added value. The reasons for these include, in order: the solution must work, the Medtronic preoccupation with chargebacks for all services, and the difficulty in explaining value before it is experienced. For Jim personally the functions of the telecommunications manager can be summarized as purchasing (10-15%), network operations (20%), consulting (35-40%), and day-to-day operations support (25-35%).

There are many challenges for telecommunications in the future. First, is the need to become business specialists rather than just techies, and assisting in the introduction of new technologies within the organization by translating emerging products and services into solutions for business problems. Telecomm personnel need to be able to assist our customers during this process with not only the installation but also such diverse aspects such as controlling costs and increasing market share. Second, the controllers and accountants who often insist on viewing telecommunications only from a cost perspective need to be made aware that telecomm can be viewed as a solution or tool for profit, and not a problem. Only when they begin looking at the impact of <u>increasing</u> spending and realize that it can be a tool to build the business, will any substantial progress be achieved. Third, the strategic planning process needs to include telecomm. The company's stated goal of FY '90 sales of $750 million, FY '91 sales of $1.0 billion, and FY '95 sales of $2.0 billion, will require a better linkage between planning and execution, especially since it is to be accomplished by substantial internal vertical growth rather than extensive acquisitions. Fourth, senior management needs to be kept aware of the benefits of telecommunications, so that the old paradigm of cost/value can be reshaped.

Jim also predicted that there will be some major changes ahead in the next five years. Within Medtronic there will probably be substantial reductions per employee in the use of U.S. Mail, TELEX services, and travel. Increases are foreseen in almost all other areas, especially voice, with only the use of express mail services and terminals expected to remain at current levels. Future technologies which address the phases of information work by human beings, namely input/processing/output, will be primarily measured by ease of use and the perception that it solves a problem, rather than the older metrics of price and physical size. Products will emerge that will better match human needs other than the traditional processing mode of staring at a CRT and using a keyboard to create input. Within the Medtronic organization he foresees telecommunications becoming more important than data processing. With regards to data communications Jim believes that the major growth areas will be in the software area, and that hardware will not see any major advances. Lastly, he sees Medtronic changing vendors from some of our traditional sources to those who offer a superior solution set to our situation.

Bibliography

[1] Interview with James A. Parry at Medtronic, Inc. on June 13, 1988 by John Gammel

[2] Medtronic press release dated June 6, 1988

[3] Medtronic 1987 Annual Report

[4] Datapro Research, Principles of Telecommunications Management, March 1983

VITA

Roberta Irene Ackerson

Candidate for the Degree of

Doctor of Education

Thesis: THE IMPORTANCE OF SELECTED TELECOMMUNICATIONS MANAGEMENT JOB FUNCTIONS AS PERCEIVED BY TELECOMMUNICATIONS MANAGERS OF FORTUNE 500 COMPANIES

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