

November 24, 1986

M-SPA-TE
Letter.
Original

NO ITEM TO INSERT

NO ITEM TO INSERT

Dear

NO ITEM TO INSERT

:

Enclosed is a report from the 1986 Market Analysis and Planning Service (MAPS) program entitled U.S. Information Services Vertical Markets, 1986-1991, Telecommunications Sector. This report is part of the series entitled Information Services Vertical Markets and should be placed in the binder with the same name.

If you should have any questions, please feel free to call me.

Sincerely,

Victor S. Wheatman
Senior Consultant

VSW:ml

Enclosure



U.S. INFORMATION SERVICES
VERTICAL MARKETS, 1986-1991
TELECOMMUNICATIONS SECTOR

OCTOBER 1986



INFORMATION SERVICES VERTICAL MARKETS, 1986-1991
TELECOMMUNICATIONS SECTOR

CONTENTS

	<u>Page</u>
I ISSUES, TRENDS, AND EVENTS	III-TE-1
A. Introduction	III-TE-1
B. Definitions	III-TE-1
II MARKET FORECASTS.....	III-TE-3
A. Processing Services	III-TE-3
1. Billing	III-TE-3
2. Management	III-TE-7
3. Other Processing Services	III-TE-7
B. Turnkey Systems	III-TE-8
C. Software	III-TE-9
D. Professional Services	III-TE-9
III COMPETITIVE DEVELOPMENTS	III-TE-11
A. Introduction	III-TE-11
B. Mergers, Acquisitions, and Partnering	III-TE-11
C. Vendor Profiles	III-TE-12
1. Advanced Cellular Technologies, Inc. (ACTI)	III-TE-13
2. AGS Computers, Inc.	III-TE-13
3. American Computer and Electronics Corporation	III-TE-13
4. American Management Systems, Inc.	III-TE-14
5. Applied Computing Devices, Inc.	III-TE-15
6. AT&T Network Systems	III-TE-15
7. Auxton Computer Enterprises Company (AUXCO)	III-TE-16
8. Bank of Illinois	III-TE-18
9. Bell Communications Research (Bellcore)	III-TE-19
10. BellSouth	III-TE-20
11. Cincinnati Bell Information Systems, Inc. (CBIS)	III-TE-21
12. Computer Consoles, Inc. (CCI)	III-TE-23
13. Computer Horizons Corporation (CHC)	III-TE-24
14. Computer Sciences Corporation (CSC)	III-TE-25
15. Comshare, Inc.	III-TE-25
16. Data Architects, Inc. (DAI)	III-TE-27
17. Datacomp Corporation	III-TE-29
18. GTE Data Services (GTEDS)	III-TE-30
19. McDonnell Douglas Communications Industry Systems Company (MDCISC)	III-TE-30
20. Rockwell International	III-TE-31



21.	TDS Computer Services	III-TE-32
22.	U.S. West	III-TE-32
23.	Volt Delta Resources, Inc.	III-TE-33
24.	Others	III-TE-34
IV	INFORMATION SYSTEMS DEPARTMENT OUTLOOK	III-TE-45
V	NEW OPPORTUNITIES.....	III-TE-47
VI	RECOMMENDATIONS AND CONCLUSIONS	III-TE-53
VII	FORECAST RECONCILIATION	III-TE-55
	A. Processing Services	III-TE-55
	B. Applications Software	III-TE-57
	C. Turnkey Systems	III-TE-57



INFORMATION SERVICES VERTICAL MARKETS, 1986-1991
TELECOMMUNICATIONS SECTOR

EXHIBITS

		<u>Page</u>	
II	-1	Telecommunications Sector--Industry-Specific Expenditures	III-TE-4
	-2	Telecommunications Sector--Industry-Specific User Expenditure Forecast, 1985-1991	III-TE-5
III	-1	Telecommunications Sector--Total Information Services Market Share, 1985	III-TE-40
	-2	Telecommunications Sector--Processing Services Market Share, 1985	III-TE-41
	-3	Telecommunications Sector--Noncaptive Software Market Share, 1985	III-TE-42
	-4	Telecommunications Sector--Turnkey Systems Market Share, 1985	III-TE-43
V	-1	ISDN Distribution Services	III-TE-49
VII	-1	Telecommunications Sector--Data Base Reconciliation of Market Forecast By Delivery Mode	III-TE-56



I ISSUES, TRENDS, AND EVENTS

A. INTRODUCTION

- The breakup of AT&T continues to create upheaval in this segment, with new network services and new players creating additional information services opportunities.
- Lowering costs of long-haul communications and the growing importance of linkages have led to increasing traffic volumes domestically and internationally. This, in turn, has led to the requirement for tools to plan and manage new communications channels such as satellites, fiber optics, and new types of data networks.
- The industry continues to change. Merger and acquisition consolidations and new technology and deregulatory actions are creating both chaos and opportunity for participating information services vendors.

B. DEFINITIONS

- The telecommunications market is a diverse one. This analysis and forecast focuses on the needs of AT&T, the Bell Operating Companies (BOCs), independent local exchange carriers (LECs), the long-distance interexchange carriers (IXCs), long-distance resellers, and cellular telephone operators.



- Currently excluded from the analysis, but included in the forecast, are the broadcasting and cable television industries, fiber optic and satellite networks, and the domestic operations of the international record carriers.
- A distinction must be made between industry-specific products and services used by the included entities and similiarly functional offerings used by large corporations managing their own telecommunications facilities. While the general business segment represents an expanded market opportunity, this analysis focuses on the telecommunications industry itself, as opposed to telecommunications users in other industries.



II MARKET FORECASTS

- Sales of industry-specific services to the telecommunications industry will total \$717 million in 1986 and will grow to \$1,929 million in 1991, as shown in Exhibit II-1. This represents an average annual growth rate (AAGR) of 22% and is largely driven by industry needs to plan, implement, and manage new services.

A. PROCESSING SERVICES

- Processing services of all forms represent a \$414 million market in 1986 and will grow at an AAGR of 18% to a \$960 million market by 1991 (see Exhibits II-1 and II-2).
- Processing services in the telecommunications sector take two principal forms--billing and management.

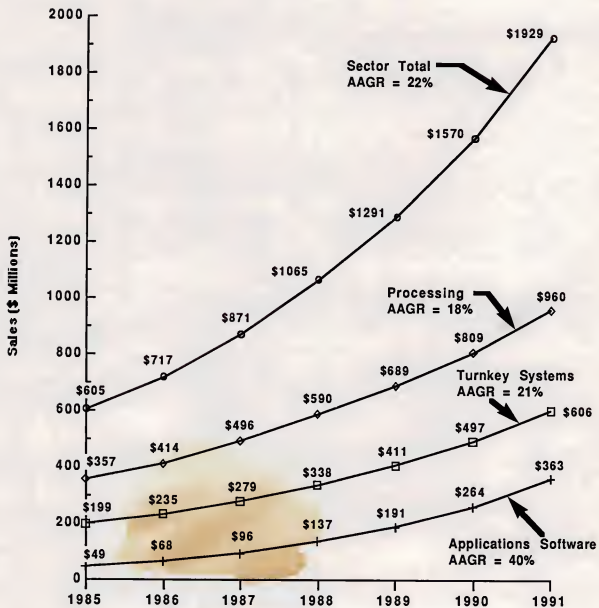
I. BILLING

- The FCC has decided to detariff interstate billing and collections effective January 1, 1987. With requests for reconsideration to allow time to determine the appropriate costing methodology, that date may be delayed.



EXHIBIT II-1

TELECOMMUNICATIONS SECTOR
INDUSTRY SPECIFIC EXPENDITURES



III-TE-4



EXHIBIT II-2

**TELECOMMUNICATIONS SECTOR
INDUSTRY-SPECIFIC USER EXPENDITURE FORECAST, 1985-1991
(\$ MILLIONS)**

SEGMENTATION BY DELIVERY MODE	1985	1985- 1986 Growth (Percent)	1986	1987	1988	1989	1990	1991	AAGR 1986- 1991 (Percent)
Processing Services									
Remote Comp/Batch	\$340	16%	\$394	\$473	\$558	\$652	\$766	\$910	18%
Facility Management	17	18%	20	23	32	37	43	50	20%
Total Processing Services	\$357	16%	\$414	\$496	\$590	\$689	\$809	\$960	18%
Applications Software									
Mainframe/ Mini	\$ 42	36%	\$ 57	\$ 81	\$113	\$156	\$213	\$287	38%
Micro	7	57%	11	15	24	35	51	76	47%
Total Applications Software	\$ 49	39%	\$ 68	\$ 96	\$137	\$191	\$264	\$363	40%
Turnkey Systems	\$199	18%	\$235	\$279	\$338	\$411	\$497	\$606	21%
Sector Total	\$605	19%	\$717	\$871	\$1,065	\$1,291	\$1,570	\$1,929	22%



- The largest portion of telecommunications billing, that required by AT&T, is not available to independent vendors.
 - AT&T is taking over its own billing services, for which it pays close to \$2 billion per year. This means that with a few exceptions (principally independent, i.e., not former Bell System companies, cellular long-distance, and low usage customers), the BOCs which previously provided such services to AT&T will be examining ways to fill newly available capacity.
 - Some of this capacity will be taken up as telephone companies move users from flat, fixed rates to measured services, which are billed on an actual usage basis, thus increasing billing data records.
 - It is likely BOC billing services will be offered to the smaller independent telcos now using regional processing or manual systems. Many, however, are installing turnkey systems, representing a turnkey vendor opportunity.
 - AT&T's costs for former Bell System bill processing are excluded from the market sizing. Prior to divestiture, these expenditures were internal, since AT&T owned the Bell Operating Companies (BOCs). After divestiture, the expenditures are considered captive since revenues are not available to independent vendors.
- Contributing to the growth in bill processing is cellular radio (local, long-distance, and "roamer," by which subscribers access services outside their home territory), an increase in long-distance usage, enhanced services, and increasing data communications.



2. MANAGEMENT

- Two vendors currently dominate the on-line services market for management systems directed at the telecommunications industry--McDonnell Douglas Communications Industry Systems Company, a part of the parent company's Information Services Group, and Comshare.
 - Products in this category include industry-specific inventory tracking, repair and maintenance controls, personnel scheduling, order processing, marketing, and project management.
 - In larger telecommunications companies, these management functions are increasingly being addressed with specialized turnkey systems or with software licensed for internal installation.
 - However, as new projects (such as new consumer- and business-enhanced services, LEC packet data networks, ISDN-related services, and satellite and fiber optic networks) are initiated by existing and emerging entrants, management processing service needs increase, particularly for short-term planning and project management applications which cannot be economically developed or internally installed.
 - Further, as marketing efforts become more critical to telecommunications companies, processing services supporting this function are needed. For example, Control Data's Marksman application is being used by at least one BOC marketing department. IS could not develop a system due to the demands of divestiture and new financial reports required by various regulatory agencies.

3. OTHER PROCESSING SERVICES

- Directory publishing and information systems use data processing, data base management, sales, and publication services. Specialized directories have



emerged, although some have not been successful, suggesting caution in approaching this area.

- Computer Output Microform (COM) processing services will remain strong among the smaller to mid-range companies in this segment, assisting in reducing massive paper data bases to manageable formats and size. However, turnkey COM systems have become more affordable and will eventually impact third-party services throughout the size range.
- One company (DCC Data Service, Inc. of Washington, D.C.) maintains data bases and special mailing lists on cellular and land mobile telephone services.
- Electronic Data Interchange (EDI) services using the EDX electronic industry standard are just beginning to be used in general and in telecommunications specifically, for computerized electronics equipment and components buying. McDonnell Douglas' EDI-Net is providing such services to Bell Atlantic.

B. TURNKEY SYSTEMS

- Turnkey systems represent one of the largest delivery modes, and while there has been considerable activity in this segment, there is evidence of a crowded market. However, there is also evidence that specialist firms in turnkey systems are adapting to the new environment.
- Turnkey systems represent a \$235 million 1986 market, growing at an AAGR of 21%, and are projected to represent a \$606 million market by 1991 (see Exhibits II-1 and II-2). Systems capable of handling network management, maintenance, customer services, and responsibilities formerly handled by AT&T are driving turnkey systems growth.



- Other turnkey systems being sold into this sector include directory assistance, toll positions, inventory, provisioning service/repair bureau systems, and support for enhanced emergency (E911) services.

C. SOFTWARE

- Applications software products, as in most industries, are the fastest growing delivery mode, totaling \$68 million in 1986 and growing to \$363 million in 1991, for a healthy 40% average annual growth rate (see Exhibits II-1 and II-2).
- Continuing strong performance of applications software is expected due to new services being developed by market participants associated with ISDN and offered for sale to user organizations for planning and managing their installations and new service offerings.

D. PROFESSIONAL SERVICES

- Merger and acquisition activity in the telecommunications industry is leading to professional services opportunities as companies seek to consolidate their networks and systems.
- Divestiture demands and the requirements of regulatory and oversight agencies have placed new burdens on telecommunications companies. Requirements for separate subsidiaries with separate bookkeeping systems will lead to professional services needs to develop sophisticated accounting systems able to handle demands of the new environment.



- Educational professional services within telecommunications are also significant, with several vendors running formal technical and strategic seminars, creating video presentations, and publishing training documentation. The industry's need for qualified technical professionals remains high, and existing employees need to be retrained in new technologies and new businesses.
- Professional services are analyzed elsewhere in this volume.



III COMPETITIVE DEVELOPMENTS

A. INTRODUCTION

- Divestiture has partially fractured the Bell System's formerly monolithic market, creating a number of discrete entities with greater individual purchasing discretion. No longer are the BOCs obligated to Western Electric or other AT&T units for services, systems, or equipment. The marketplace continues to adapt.

B. MERGERS, ACQUISITIONS, AND PARTNERING

- Industry consolidations are inhibiting the market somewhat since fewer companies will exist.
 - However, it is important to distinguish between functional mergers and investment positions.
 - For example, GTE and US Telecom have married their separate long-distance and value-added networks, while IBM has taken equity in MCI without such functional integration.
- The regional operating companies are playing a more important role, but they vary in their approaches and capabilities. Traditional information services



vendors are finding their former customers becoming vendors themselves and/or entering into alliances to participate in the new market dynamics. In 1986:

- Nynex purchased Telco Research, a provider of corporate user telecommunications management software and systems, and is working to bundle hardware and software systems for user telecommunications functions.
- Nynex has also purchased IBM's national computer and software retail chain, adding to its earlier retail acquisitions.
- Cincinnati Bell Information Systems, already providing a wide range of telco-specialized software, purchased Cellular Business Systems, Inc., a billing and management systems/services firm, and has joined with McDonnell Douglas Information Systems Group and Auxton Computer Enterprises in providing a cellular clearinghouse to bill users placing calls outside their home area ("roamers").
- Southern New England Telephone's statewide packet network, linked to Tymnet, ITT World Communications, and other LEC Local Area Data Transport (LADT) networks, will likely follow this internetworking approach.

C. VENDOR PROFILES

- This section profiles the leading vendors providing processing services, professional services, and software and turnkey systems to the telecommunications industry.



1. ADVANCED CELLULAR TECHNOLOGIES, INC. (ACTI)

- ACTI, headquartered in Creve Coeur (MO), was formed as a cellular radio clearinghouse designed to authorize and process billing for cellular roamers, i.e., users making calls outside their home system.
- The newly formed company is a joint venture of Auxton Computers, Cincinnati Bell Information Systems, Cellular Business Systems, Inc. (recently purchased by CBIS), and McDonnell Douglas Information Systems Group.

2. AGS COMPUTERS, INC.

- AGS (Mountainside, NJ) provides custom software development, professional services, systems, and applications software for the telecommunications, banking/finance, and computer manufacturing industries.
- Approximately 25% of AGS' 1985 computer services revenue of \$117.4 million was derived from AT&T. AGS employs approximately 2,300.
- AGS Systems Development has provided services to AT&T since 1970 and was engaged in more than 70 AT&T and affiliate projects at the end of 1985. As a result of this association, the unit has a large UNIX consulting staff. Since divestiture, AGS has also supplied UNIX services to other computer companies and large end-user organizations.

3. AMERICAN COMPUTER AND ELECTRONICS CORPORATION

- This Gaithersburg (MD) company primarily provides software and systems, but also operates an RCS for telecommunications departments such as those found in universities.
- The RCS service principally processes call records. Systems are sold to telcos and to telecommunications departments for equipment inventory manage-



ment, call record processing, automated directories, and plant cable management.

- The company-written software operates on DEC VAX and Texas Instruments hardware.
- The privately-owned company attributes 30% of its revenues to telco sales, 30% to telecommunications departments, 20% to RCS functions, and the balance to consulting services.

4. AMERICAN MANAGEMENT SYSTEMS, INC.

- In 1985, AMS (Arlington, VA) acquired the rights to a software package developed by Pacific Telecom, Inc. for its telephone operating companies and also used by 29 telcos in the Alltel group.
 - The package, called Carrier Access Billing System Plus, has been enhanced with updated tariff information.
 - It is targeted to local telcos to generate reports and handle billing for interexchange carriers accessing local telco networks.
- For ten years, AMS has been providing systems development and support services for MCI in order processing, billing, accounts receivable, and collections.
- The company provides services and software to this segment as well as financial services institutions, government agencies, and utilities.
- AMS reported 1985 revenues of \$112.2 million, with \$3.1 million from the telecommunications industry. It has established a revenue growth goal of 15-20% annually.



- One part of AMS' strategy is to work contractually and jointly with clients in software development projects.

5. APPLIED COMPUTING DEVICES, INC.

- This privately held Terre Haute (IN) company provides operational data support systems with surveillance and control functions, bill processing services, and turnkey systems for directory assistance, inventory control, maintenance, and traffic information management systems.
- Customers include telcos, other common carriers (MCI), and EDS.
- The company was formed in 1974, employs approximately 150, and had estimated 1985 revenues of \$11 million.
- The Indiana Center for Telecommunications Technology is a subsidiary involved in custom research and development.

6. AT&T NETWORK SYSTEMS

- This group is responsible for the design, manufacture, marketing, engineering, and installation of telecommunications networking equipment, much of which incorporates software.
- Major customers include Regional Bell Operating Companies, AT&T Communications, independent telcos, non-Bell cellular telephone companies, and other common carriers, both domestic and international.
- Equipment offered with supporting software includes:
 - Central office switches such as the 5ESS, Centrex systems, and Business and Residential Custom Service packages.



- The ACORN Network Control System.
- The Billdats data collection system providing automated bill data collection in association with central office equipment.
 - Configured on an AT&T 3B20 or 3B5 UNIX computer, the system automatically transmits billing information from up to 36 central offices (24 simultaneously) to a central customer billing center or to a billing service, eliminating physical transportation of computer tapes.
 - The data is placed on disk storage, processed, and transferred to computer tapes in the standard Automatic Message Accounting Standard Entry (AMASE) format used by most billing computers.
 - According to AT&T, the system can work with almost any central office switch, including non-AT&T equipment.
 - The format of the billing data will reportedly accommodate future calling features. The system is modular and can grow with billing data volume.
- Professional services include systems equipment engineering, installation, maintenance, and remote diagnostics.

7. AUXTON COMPUTER ENTERPRISES COMPANY (AUXCO)

- AUXCO (Maitland, FL), formed in 1969, specializes in services and systems for the telecommunications industry.
- In addition to management consulting and customized software, the firm offers processing services for long-distance carriers, resellers, cellular operators, and paging services.



- Compu-Network provides calculation of service charges, billing, adjustments, and customer records maintenance as well as payment processing and collections, with credit information integrated into the customer data base. Volume or percentage discounts can be calculated.
- Compu-Cellular handles similar functions, includes order processing, repair tracking, and inventory management, and can provide market analysis information.
- The company is also developing software for a planned cellular clearinghouse for roaming applications and is participating with Cincinnati Bell Information Systems and others in forming such a clearinghouse.
- In late 1986, AUXCO announced agreement with AT&T Communications to provide processing services for long-distance toll calls placed by cellular users under equal access rules. Services covered include toll rating, billing, collections, toll investigations, and customer inquiry services.
- AUXCO software available for customer IBM processors includes:
 - Socrates (Service Order Customer Record and Terminal Entry System).
 - LUCAS (Line Utilization Cable Assignment System) for data conversion to create the facility's data base, service order processing, cable throw information, repair processing, inquiry support, and management reports.
 - COEI (Central Office Equipment Inventory), providing telephone number and frame management.



- EWO (Engineering Work Order) for inventory information of outside plant cable.

 - The company is currently processing for more than 14 cellular companies, including the subsidiaries of Bell South, Southwestern Bell, Contel, Pacific Telesis, United Telecommunications, and others representing more than 34 systems. The company claims nearly half of the wireline (i.e., LEC affiliated) cellular processing business.

 - Other clients include long-distance resellers for billing and processing services.

 - The company sees its cellular expertise as a principal strength along with service and product quality.

 - AUXCO reported 1985 revenues of \$28 million, with 65% derived from professional services consulting, 23% from processing services, and 12% from applications software products sold to the telecommunications industry. It employs approximately 385.

 - Revenue for the three months ending March 31, 1986 was \$7.7 million, a 19% increase over the same quarter in 1985.

 - AUXCO is currently developing a software package to support the administration and operation of private networks. The package is targeted to Fortune 500 companies, the military, universities, and other large organizations. Beta testing is expected to begin in January 1987.
8. BANK OF ILLINOIS
- The Champaign (IL) bank operates a data center which provides processing services to telecommunications and other entities.



- Regional independent telephone companies and cellular operators currently use its billing and other services.
- The bank sees its major competitive strength as its stability. Backed by a financial institution, it is able to expand without needing external resources.
- It also competes based on price and service. For example, to schedule the necessary programming changes, bank personnel work with cellular marketing departments to provide insight into the data processing required due to service pricing changes.

9. BELL COMMUNICATIONS RESEARCH (BELLCORE)

- Bellcore was formed from AT&T's Central Services Organization (CSO) after divestiture to provide technical and other support to the Bell Operating Companies and their regional affiliates. Each of the seven RBOCs own a share of Bellcore. The company also participates in international standards forums and administers the North American Numbering Plan.
- Among the professional services provided are applied research in evolving technologies, ISDN and other new services planning, software, documentation, training, and field support.
- Bellcore is a leading provider of telecommunications software to the BOCs, supporting over a hundred individual systems from large mainframe programs to microcomputer applications.
- A catalog of software, documentation, and training materials (called "intellectual properties") is maintained by Bellcore; the software is available for licensing.
- Under the Modified Final Judgement (which led to divestiture), Bellcore is permitted to develop software products for its customers (i.e., the RBOCs) but cannot manufacture or market hardware.



- Software is available covering the full scope of BOC activities including:
 - Cost and financial analysis, including software to prepare tariff rate changes and other regulatory agency reports.
 - Customer services, including marketing tools, order entry, inquiry, tracking, and control.
 - Network planning and engineering, including network configuration, loading analysis, and forecasting.
 - Provisioning, covering inventory, equipment and facilities assignment, circuit design, and personnel management.
 - Development and testing tools.

10. BELLSOUTH

- This RBOC was granted a waiver to market proprietary software previously used internally.
 - BellSouth Services, Inc. sells the modular Current system for handling telephone service orders, billing, maintenance, and inventory.
 - Also available is the Telecommunications Information Processing Software System (TIPSS) with modules for on-line directories, call accounting, inventory management, and shared tenant or corporate telecommunications services.
- Both sets of products are targeted to large companies managing their own networks.



- BellSouth Services also offers the E911 SALI (for Enhanced 911 Standalone Automatic Location Identification) software system providing emergency call functions to small municipalities. This system identifies the number and address of the calling party for emergency responses.

II. CINCINNATI BELL INFORMATION SYSTEMS, INC. (CBIS)

- CBIS (Cincinnati, OH) provides telecommunications software and services to BOCs, independents, and offshore telecom companies for billing and outside plant management, and has ventured into processing services with a cellular radio offering.
- Among its software products and services are:
 - Customer Records Information System (CRIS) for customer billing and recordkeeping.
 - A customer order entry and distribution system (OS/ORDER) providing interactive on-line entry, correction, and updating.
 - Message Processing System (MPS), a consolidated toll message and usage billing system which can handle all types of services, including access charges, mobile and cellular service, WATS, coin service, and local service.
 - A mechanized exchange customer cable record system (OS/PLANT) for outside plant administration.
 - Centralized Online Customer Records Information System (COCRIS) for customer inquiry, adjustments, service denial/restoration orders, and other related tasks.
 - A construction force management system (OS/FORCE-PLUS).



- Cellware, an integrated cellular message processing, account management, and customer billing system for cellular operators and resellers which rates calls and supports other on-line features such as order entry, bill adjustments, and management reporting.
- Cincinnati Bell is CBIS' primary telco user, along with AT&T Communications, for Megacom billing, a WATS-type service, and other new services.
- CBIS has acquired several entities to bolster its service and software offerings. For example:
 - Cellular Business Systems, Inc. (CBSI - Park Ridge, IL), was acquired in 1986 as a division of CBIS.
 - CBSI's professional and processing services and software support a variety of industry-specific applications such as customer data base and telephone number management, call rating and billing, charge reconciliation, and billing for car rental cellular services.
 - The combined companies provide billing services in most of the top 30 cellular markets, billing in excess of 200,000 cellular users.
 - CBIS, its new CBSI division, Auxton Computer, and McDonnell Douglas Information Systems Group have formed a cellular clearinghouse headquartered in Creve Coeur (MO) called Advanced Cellular Technologies, Inc.
 - Creative Management Systems, Inc. (McLean, VA), a designer of telephone call accounting software systems, was acquired in 1985.



- CBIS has also purchased the Commtrack unit of United Information Services. UIS (Overland Park, KS), once part of United Telecommunications, was sold to Control Data Corporation in 1983. Commtrack's services are used by large telecommunications users, resellers, two independent telcos, and two BOCs for internal Station Message Detail Recording (SMDR).

12. COMPUTER CONSOLES, INC. (CCI)

- CCI, a major provider of turnkey systems, experienced declining revenues in 1985, attributed to various factors including overly optimistic sales projections, inadequate marketing resources to support diversification efforts, and organizational and internal communications problems.
 - After 10 years of steady growth, revenues declined 15% from \$131.2 million to \$111.9 million, representing a net loss of \$41.9 million.
 - However, CCI is making progress with a return to profitability expected in 1986 due to new marketing strategies, cost control measures, restructuring, and new management.
- CCI has cut its workforce and now employs approximately 1,200. Development and manufacturing are being geographically consolidated and product development is being downscaled.
- The company is expanding its focus from the telephone industry to integrated office systems, which will be sold along with other large customized turnkey systems to telcos, the federal government, and special vertical markets such as law firms.
- In late 1986, CCI announced a development agreement for an interface between CCI's directory assistance/enhanced listing services data base and Northern Telecom's digital central office switches supporting the Traffic Operator Position System (TOPS).



- The agreement, said to be the first between a directory assistance data base supplier and a digital switch maker, is expected to result in development of a system enabling telcos to handle both information and toll/operator assistance calls simultaneously.
- In addition to information and toll calls, Northern Telecom's "universal service position," competitive with a U.S. West product, enables an operator to handle access to electronic yellow pages, automated list services, nonpublished call back, and message delivery services.

13. COMPUTER HORIZONS CORPORATION (CHC)

- This New York-based firm is primarily involved in custom software analysis and design and programming services to the communications industry as well as other industries.
- Fiscal 1985 (year ending February 28, 1985) results show that an estimated 46% of the company's operating revenue of \$44.4 million was derived from the communications industry, with the company maintaining a compound annual growth rate in revenues of 35%.
- Fiscal 1986 results show revenues of \$50.9 million (a 15% increase), with only modest growth (to 43% of total revenue) reported in the communications sector primarily due to a business downturn in the Orlando AT&T IS operation and also due to continuing pricing pressure from clients.
- CHC is diversifying into other areas due to slowed growth in the communications segment while maintaining its long-term relationships with AT&T and the divested BOCs.
- The company's future strategy is to leverage its communications and financial segment experience in new markets such as utilities, defense, and manufac-



turing, where it has experienced its fastest growth rates over the past two years.

- Projects in 1984 included design and development services for various aspects of new telephone billing systems created by AT&T's reorganization as well as other administrative and financial information systems.
 - However, AT&T's internal consolidation efforts have affected CHC's business.
 - AT&T administrative offices have been closed, and AT&T asked for volume discounts from its vendors. AT&T's need for services is expected to continue growing despite these measures.

14. COMPUTER SCIENCES CORPORATION (CSC)

- In late 1983, CSC (El Segundo, CA) was awarded a five-year contract, with an estimated value of \$30 million, to continue maintenance and enhancement work on what it calls "the largest applications system in commercial use" for AT&T Communications. The Trunks Integrated Records Keeping System (TIRKS) automates provision and planning management of telephone circuits, facilities, and equipment.
- TIRKS incorporates more than 350 data bases and over 18,000 software modules.

15. COMSHARE, INC.

- Comshare (Ann Arbor, MI), founded in 1966, is one of the earliest companies to offer commercial timesharing services.
- While processing services are still a major business, the company has enacted a new decision support strategy (DSS).



- Comshare specializes in several RCS markets, including telecommunications, human resources administration, and data base management systems.
- The telecommunications industry applications are called 4.1.1. They include an integrated system for telcos to control administrative activities such as telephone number assignments and voice traffic load balancing.
- Comshare recognizes that the deregulation of AT&T has opened additional markets in selling this type of service to independent telephone companies. Also, Comshare has found new customers for System W, an integrated DSS mainframe and micro product. System W combines business reporting, modeling, forecasting, statistical analysis, spreadsheets, data management, graphics, communications, and interfaces for data acquisition for external software products.
- The principal 4.1.1. product is MIDAS (Mechanized Dial Assignment), which changes office records when a service order is written and dynamically recalculates load balance when equipment or circuits are added or removed from service. On-line status reporting is provided, among other capabilities.
- Incorporated in MIDAS are several modules for equipment balancing as well as modules to support analog-to-digital central office switch conversions and translations, to manage the main distribution frame, and to manage outside plants.
- All applications are available through remote computing and can be licensed for IBM MVS environments.
- The company sells a single turnkey system for directory assistance which operates on Data General minicomputers.

1. The first part of the document discusses the importance of maintaining accurate records.

2. It then outlines the various methods used to collect and analyze data.

3. The results of the study are presented in the following section.

4. Finally, the document concludes with a summary of the findings and recommendations.

5. The following table provides a detailed breakdown of the data collected.

6. The data shows a clear trend in the number of cases over time.

7. This trend is consistent with the theoretical model proposed in the introduction.

8. The results also indicate that there are significant differences between the two groups.

9. These differences are likely due to the varying levels of exposure to the risk factors.

10. The study has several limitations, including a relatively small sample size.

11. Despite these limitations, the findings provide valuable insights into the phenomenon being studied.

12. Further research is needed to confirm these results and explore the underlying mechanisms.

13. The study has important implications for public health and policy-making.

14. It highlights the need for continued monitoring and evaluation of the situation.

15. The authors would like to thank the following individuals for their assistance:

16. Dr. John Doe, Department of Health Services, University of California, Berkeley.

17. Ms. Jane Smith, Research Assistant, National Institute of Environmental Health Sciences.

18. Mr. Robert Johnson, Data Analyst, Centers for Disease Control and Prevention.

19. The authors also acknowledge the support of the National Science Foundation.

20. Finally, we thank the participants who made this study possible.

21. The following references were consulted during the preparation of this document:

22. Smith, J. (2001). *Environmental Health and Safety*. New York: Wiley.

23. Doe, A. (2002). *Public Health and the Environment*. Washington, DC: American Public Health Association.

24. Johnson, B. (2003). *Environmental Epidemiology*. London: Taylor & Francis.

25. The authors have no conflicts of interest to declare.

26. Correspondence should be addressed to the lead author at the following address:

27. Dr. Jane Doe, Department of Environmental Health Sciences, University of California, Berkeley, CA 94720.

28. Email: jane.doe@ucberkeley.edu

29. This document is a preliminary report and should not be used for policy-making.

30. The second part of the document discusses the importance of maintaining accurate records.

31. It then outlines the various methods used to collect and analyze data.

32. The results of the study are presented in the following section.

33. Finally, the document concludes with a summary of the findings and recommendations.

34. The following table provides a detailed breakdown of the data collected.

35. The data shows a clear trend in the number of cases over time.

36. This trend is consistent with the theoretical model proposed in the introduction.

37. The results also indicate that there are significant differences between the two groups.

38. These differences are likely due to the varying levels of exposure to the risk factors.

39. The study has several limitations, including a relatively small sample size.

40. Despite these limitations, the findings provide valuable insights into the phenomenon being studied.

41. Further research is needed to confirm these results and explore the underlying mechanisms.

42. The study has important implications for public health and policy-making.

43. It highlights the need for continued monitoring and evaluation of the situation.

44. The authors would like to thank the following individuals for their assistance:

45. Dr. John Doe, Department of Health Services, University of California, Berkeley.

46. Ms. Jane Smith, Research Assistant, National Institute of Environmental Health Sciences.

47. Mr. Robert Johnson, Data Analyst, Centers for Disease Control and Prevention.

48. The authors also acknowledge the support of the National Science Foundation.

49. Finally, we thank the participants who made this study possible.

50. The following references were consulted during the preparation of this document:

51. Smith, J. (2001). *Environmental Health and Safety*. New York: Wiley.

52. Doe, A. (2002). *Public Health and the Environment*. Washington, DC: American Public Health Association.

53. Johnson, B. (2003). *Environmental Epidemiology*. London: Taylor & Francis.

54. The authors have no conflicts of interest to declare.

55. Correspondence should be addressed to the lead author at the following address:

56. Dr. Jane Doe, Department of Environmental Health Sciences, University of California, Berkeley, CA 94720.

57. Email: jane.doe@ucberkeley.edu

58. This document is a preliminary report and should not be used for policy-making.

- The company sells to all major independent telcos including Contel, GTE, and United companies, several Caribbean telcos, and many smaller domestic telcos including Standard Telephone and Enterprise, for a total of between 25-30 companies.
- Comshare has had difficulty selling into BOC environments because of competitive software products from AT&T and Bell Communications Research (Bellcore) which had previous involvement with the BOCs for these types of applications.
- The company claims 1985 revenues for 4.1.1. products of between \$9-10 million. Its major strengths are its software for IBM systems configurable to any central office switch. Its major competitors (AT&T and Bell Communications Research) require telcos to use AT&T or other hardware for software installation, while 4.1.1. products are available both as software or as remote computing services.
- Comshare also has professional services available for large, one-time applications as well as field services for routine consulting and maintenance.

16. DATA ARCHITECTS, INC. (DAI)

- DAI (Waltham, MA) believes the growth in demand for voice and data telecommunications services has led to major communications network expansions by carriers and new requirements for automated support systems to collect billing information, manage switched networks, and market new services.
- In January 1983, GTE Sprint (now U.S. Sprint) awarded DAI a contract to develop and install the Call History Information Processing System, a nationwide network of more than 30 Tandem NonStop computers located at each major voice switching center. The system collects, processes, and relays the records for all toll calls to national centers.



- In 1985, DAI completed two major business support systems for RBOCs.
 - For U.S. West, it built the SONAR system (Service Order Negotiation and Retrieval) which automates the service order process for ordering phone and line equipment with interfaces to all associated computer system applications such as inventory, billing, customer records, and scheduling.
 - For the British Columbia Telephone Company, it built the NICS (Network Information and Communications System) network management support system, which takes data from 12 different types of voice network switches to help monitor and manage traffic patterns.
 - DAI maintained exclusive marketing rights to the two systems and has a letter of intent with an eastern RBOC to install the SONAR system.
- While 45% of DAI's business comes from the banking industry and 35% from insurance, telecommunications products and services represent 20% (or \$4.2 million) of its 1985 revenues of \$20,945,000, a 35% increase over 1984.
- Overall, professional services, including consulting and custom system services, accounted for 70%, or \$14.7 million, of 1985 revenues.
- DAI's 1985 net income increased 108% to \$1.25 million.
- DAI's corporate goal is to become a leading supplier of business applications, primarily to the financial services and telecommunications industries. It expects to double current revenues and increase software product revenues to more than 50% of total revenues by 1990.
- The company sees its consulting and custom work as contributing to its experience with advanced technology, building a staff of technologists and



managers, and leading to the development of software which can be resold in its target markets.

17. DATACOMP CORPORATION

- This privately held Philadelphia (PA) company is a subsidiary of the Grantz Group, which includes Data National, Dataserv, and TechSouth corporations. It has been in operation since 1971.
- The company provides processing services and software for telcos, primarily for data base management, photocomposition, and display and composition associated with white and yellow page directories.
- Datacomp also writes custom software for BOCs, provides training, and produces turnkey systems for small independent publishing companies. In addition, the company is involved in direct mail and telemarketing with list management services.
- Specific products are:
 - Datatrac, a data base management service order processing system.
 - Page-Graphix for page composition.
 - Contrac, supporting contract and sales management by directory publishers.
- All systems operate on DEC computers.
- The company has introduced a new toll-free directory assistance service available in the Princeton (NJ) area. Called the Yellow Pager, it is supported by advertisers.



- Revenues for 1985 were \$16.2 million, with an estimated 90% derived from processing services, 5% from software, and 5% from professional services (primarily software development). The company has approximately 400 employees.

18. GTE DATA SERVICES (GTEDS)

- This Tampa (FL) data processing subsidiary of GTE performs most of its processing and facilities management work for GTE domestic and overseas telephone companies (i.e., captive processing) through its proprietary SNA network connecting approximately 10 data centers.
- GTEDS also handles long-distance landline and cellular bill processing for AT&T Communications traffic within GTE's territory.
- The company is working to market software and services to other telephone companies and to leverage its experience in data center facilities management for commercial markets beyond telecommunications. GTEDS has approximately 200 employees.

19. MCDONNELL DOUGLAS COMMUNICATIONS INDUSTRY SYSTEMS COMPANY (MDCISC)

- McDonnell Douglas acquired Computer Sharing Services (a division of Rio Grande Industries) of Denver in January 1984 and Tymshare in April 1984. These companies' services were combined with some of McDonnell Douglas' mainframe products and services to form this new company, a part of McDonnell Douglas Automation Information Services Group (ISG) consolidating overlapping products and sales forces.
- The company offers processing services directed to both independent telcos and BOCs. These include adaptations of general services as well as those especially designed for the industry.



- The Outward Telephone Information System (OTIS) tracks telephone set inventory, movement, and performance.
- The Pricing and Loading system (PAL) assists in managing the repair and maintenance of switching equipment.
- Several facilities administration applications are included in the Management Scheduling and Control System (MSCS), adapted for telephone applications. It is an integrated system for analog to digital switch conversion and is used for other large-scale project management tasks. Modules cover cost planning, materials management and purchasing, personnel scheduling and forecasting, marketing, traffic reporting and measuring, and plant administration.
- MDCISC is the largest processor for the industry outside the former Bell system, with all 22 BOCs, the RBOCs, and AT&T as well as the major independents as customers. The company has managed the equal access balloting system for several of the BOCs to control consumer long-distance service selection.
- McDonnell Douglas is participating with Cincinnati Bell Information Systems and Auxton Computer to develop a cellular telephone clearinghouse.

20. ROCKWELL INTERNATIONAL

- Rockwell's Common Carrier Systems, Switching Systems Division (Downers Grove, IL) markets a digital Service Node with enhanced 911 software. This system routes emergency calls from several central office areas to public safety answering points, regardless of serving area, municipal, or service agency boundaries. The system also forwards automatic number identification data allowing rapid identification of the calling party and location.



21. TDS COMPUTER SERVICES

- TDS, based in Madison (WI), is a wholly-owned subsidiary of Telephone and Data Systems (TDS), a telephone operating group.
- The company primarily services TDS companies including 70 telcos, 16 CATV firms, and paging and mobile telephone companies throughout the midwestern and eastern states.
- TDS Computer Services claims 1985 revenues of approximately \$7 million.
- TDS says it is developing distributed systems; however, in the case of long-distance billing, it sees economies of scale in maintaining centralized processing.

22. U.S. WEST

- This Denver-based RBOC sells telecommunications software for PCs through the Information Systems Division.
- The Knowledge Engineering Division sells an IBM XT-based Multiple Purpose Operator Workstation (MPOW), designed to Bellcore specifications, which is compatible with digital toll switches.
 - MPOW features enhanced graphics and handles toll, directory assistance, and supervisor functions, with access to LAN-based data bases for rate and route information.
 - Because it is a DOS-based system, it will also operate telco-developed applications.
 - The company cites the system's adaptability to changing switches, information, and software as a key benefit over competitive products



based on minicomputer-hosted dumb terminals. Another benefit is faster response time.

- Systems have been sold to BOCs and independent LECs.

- Landmark, U.S. West's publishing company, has purchased several other telephone directory publishers to expand its directory operations. The company and its subsidiaries publish some 800 telephone and city directories in 42 states.

23. VOLT DELTA RESOURCES, INC.

- This New York City subsidiary of Volt Information Sciences, Inc. (VIS) designs, markets, and maintains customized turnkey systems and provides professional services, custom software development, and consulting for the telecommunications industry. Volt Delta employs approximately 300.
- Fiscal 1985 revenues were \$19.7 million, a 42% decrease from 1984, with a net loss of \$4.9 million. This decrease was attributed to a reduction in contract work and delays on a major contract. The company plans to broaden its focus beyond its traditional markets.
- The parent firm (VIS) provides technical services, temporary personnel, electronic publication (including typesetting systems), technical publication, and consulting services. It reported fiscal 1985 revenues of \$390 million.
- Volt Delta's customized turnkey systems are based on DEC VAX and PDP hardware using proprietary software. These systems are used for printed and electronic telephone directories and directory assistance systems.
- In association with United Telecom, Volt is offering The Information Line in the Kansas City area. This is an information retrieval system enabling an operator to provide callers with information on local business advertisers.



- Recent custom software consulting projects include enhancements of previously installed electronic directory assistance systems to include automated voice response capability and a yellow- and white-page directory publishing project in support of a subsidiary's production center in Uruguay.

24. OTHERS

- Smaller firms selling to the telecommunications market are:
 - Allied Data, Inc. (Olympia, WA) is owned by U.S. Intelco Networks which, in turn, is owned by 160 independent telephone companies. The company provides processing services and has several software packages called Telco:Allied for billing, general ledger, payroll, customer service, and other related functions.
 - Butler Computer Graphics (Denver, CO) markets the Telephone Data Management System designed for accounting, engineering, and mapping applications related to telco facilities distribution networks. The system runs on Data General MV Series minicomputers.
 - Celltech, Inc. (Houston, TX) sells a billing and account system for cellular, mobile radio, and paging companies and for long-distance resellers.
 - Commercial Software, Inc. (New York, NY) provides several software packages for cost allocation, telecommunications equipment management, on-line inquiries and credit card authorization, trouble reporting, network management, and network optimization and design, primarily for DEC VAX processors, but also provides services to industries other than telecommunications. The private firm had 1985 revenues of approximately \$2 million.



- Commonwealth Communications (Wilkes-Barre, PA) offers a cellular billing service bureau and an internal system for account management and bill generation.
- Communications Software, Inc. (Atlanta, GA) provides turnkey systems for radio common carriers, telephone answering services, and mobile radio companies.
- Computer Generation (Atlanta, GA) is selling a DEC-based system to support measured local services to the Regional Bell Operating Companies.
- Computer Innovations (Chicago, IL) provides professional services, including utility program development, for Bell Labs and GTE. Estimated revenue from telecommunications companies for the privately-held firm is under \$1 million.
- ComputerWare, Inc. (Dallas, TX) sells a turnkey system and provides a service bureau for telecommunications facilities recordkeeping. Functions control billing, accounting, order entry, trouble reporting, cable records and other operations.
- ComputoService, Inc. (Mankato, MN) is a processing service owned by the Mankato Telephone Company.
- Computel (Blair, NE) is a processing service affiliated with the Great Plains Telephone Company, which owns several independent telcos in the state and recently acquired the Nebraska holdings of Continental Telephone.
- Comtech Systems, Inc. (Columbus, OH) has performed systems design, analysis, and programming work for AT&T and Bell Labs. Estimated revenue for the privately held firm from telecommunications companies is under \$2 million.



- Datamap, Inc. (Eden Prairie, MN) provides mapping services, primarily for AT&T, to establish standard cellular service mapping and for use in marketing applications. The public firm had 1985 revenues of approximately \$.6 million, with approximately 10% derived from telecommunications companies.

- Decision Focus, Inc. (Palo Alto, CA), a private software and professional services firm, developed a pricing model used for preparing rate case submissions and internal pricing studies for Pacific Bell. The company claims 5-10% of its revenue (estimated at \$6 million) comes from telecommunications.

- Digital Communications Associates (DCA) (Alpharetta, GA) is best known for its "Irma" micro-mainframe hardware and software links. Its Line Pricer software has been used by several interexchange carriers to calculate rates for voice and data networks. The company also offers network management tools and packet switching interfaces. The company additionally provides professional services, with accounts including Ameritech, Pacific Bell, U.S. West, and the Lincoln Telephone Company as well as overseas telecommunications companies.

- Evans, Griffiths and Hart, Inc. (Lexington, MA) provides software and professional services to the industry as well as other industry sectors. Its products include a package which analyzes service orders by telephone number and a traffic data base for directory assistance. The company has revenues under \$2 million, with telecommunications accounting for approximately one-third.

- Geographic Systems, Inc. (Andover, MA) provides marketing software for geographical analysis and forecasting which is used by New England Telephone for planning wire centers and telephone exchange capaci-



ties. The company also performs professional services, with estimated revenues under \$2 million.

- In-Touch Management Systems (Elmont, NY) provides a management system for radio common carriers and telephone answering services.
- Mid-America Computer Corporation (MACC) (Blair, NE) provides billing services and sells a turnkey system. MACC is the national data administrator/billing center for the Air-Ground Radio Automated System (AGRAS) which provides dial-up telephone service to general aviation (private) pilots.
- North Central Data Cooperative (Mandan, ND) is a data processing cooperative servicing member telcos and other independents as well as electric and other rural utility companies. The cooperative sells turnkey systems based on Burroughs processors. Software maintenance and consulting services are also available.
- Performance Systems, Inc. (Rockville, MD) markets a planning package for projecting hardware, software, and network performance used by several telephone companies.
- Progressive Automation and Computer Evaluation, Inc. (Lafayette, IN) has recently introduced a modular, integrated telephone computer management system, dubbed Phase I, for DEC PDP-11 computers.
- Quintrex Data Systems (Cedar Rapids, IA) sells a IBM-based turnkey system designed for small independent telephone companies with 500 to 18,000 subscribers.
- Saztek (Rolling Hills Estates, CA) provides programming, processing, professional services, electronic publishing, and related services. It has developed several telecommunications-specific packages for cable



status reports, customer records, loop maintenance, and other telco tasks.

- Systemation, Inc. (Cleveland, OH) provides professional services and applications software. It has developed customer billing, toll credit card, network administration, and directory order entry systems for clients such as Ameritech and United Telecommunications. Systemation reported total 1985 revenues of \$16.7 million, with \$2.4 million from telecommunications work.
- Teknowledge, Inc., a Palo Alto (CA) professional services and software firm, provides educational services and artificial intelligence/expert systems software and development services for diagnostic applications. An estimated \$1.25 million of its \$6.2 million 1985 revenue was derived from the telecommunications industry.
- Telecalc, Inc., a public (OTC) firm located in Bellevue (WA), has sold a micro-based management information system to Pacific Telesis for use by Pacific Bell and Nevada Bell. The company reported six-month earnings to July 1986 of \$1.3 million, with a deficit of \$1.24 million, compared to income of over \$3 million in the same period during 1985, and net income of \$311,000.
- Telecom MIS, Inc. (Upper Darby, PA), recently separated from its parent firm, United Technologies, targets shared tenant services and long-distance resellers.
- Teltone Corporation (Kirkland, WA), a 17-year-old company, provides equipment, engineering services, and application support and offers the Local Measured Service system for electromechanical (i.e., older) central offices. The vendor claims 100 installations.

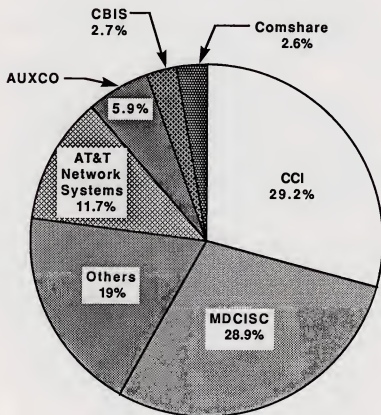


- Vistacom (Owings Mill, MD) is an affiliate of long-distance reseller Telesaver. It sells an integrated system called Telcro to resellers for direct billing output.
- Universal Data Processing, Inc. (UDP) (San Antonio, TX), in addition to processing, sells turnkey systems using its own software.
- Exhibits III-1 through III-4 show the leading vendors in the telephony telecommunications segment and their market shares in the entire market and within their primary delivery mode categories.
- As shown in the above profiles, several telephone company subsidiaries as well as Bell Communications Research are now providing software, systems, and services for other telecommunications entities (and for large telecommunications users), creating a heated competitive environment.



EXHIBIT III-1

TELECOMMUNICATIONS SECTOR*
TOTAL INFORMATION SERVICES
MARKET SHARE, 1985

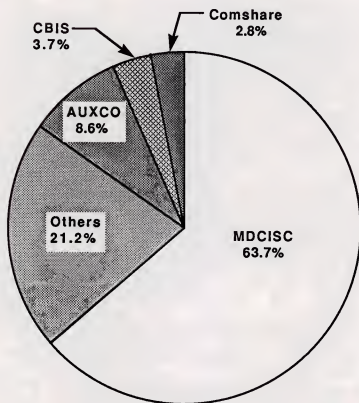


*Telcos, IXCs, Cellular, and Resellers.



EXHIBIT III-2

TELECOMMUNICATIONS SECTOR*
PROCESSING SERVICES
MARKET SHARE, 1985

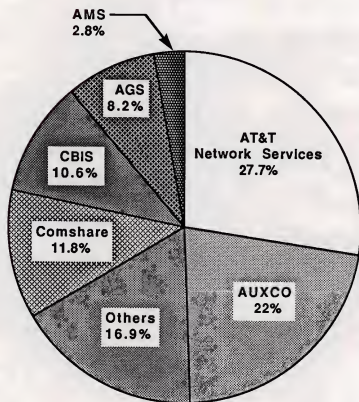


*Telcos, IXCS, Cellular, and Resellers.



EXHIBIT III-3

TELECOMMUNICATIONS SECTOR
NONCAPTIVE SOFTWARE
MARKET SHARE, 1985

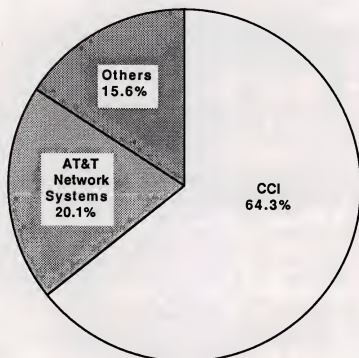


*Telcos, IXCS, Cellular, and Resellers.



EXHIBIT III-4

TELECOMMUNICATIONS SECTOR*
TURNKEY SYSTEMS
MARKET SHARE, 1985



*Telcos, IXCS, Cellular, and Resellers.





IV INFORMATION SYSTEMS DEPARTMENT OUTLOOK

- An industry association's research found telecommunications companies realizing revenue increases of 7.6% between March 1985 and March 1986 while employment dropped over 6%. Increased productivity per employee is due in part to the use of automated systems.
- However, INPUT's research found that in most cases, the IS department is expected to grow to meet increasing demands, although in the longer term, new technologies are expected to reduce personnel needs. In addition to larger staffs, higher IS budgets are being requested due to increasing vendor costs.
- In some cases, IS departments at telecommunications entities have been overloaded due to the demands of divestiture, a more competitive environment, and regulatory agency requirements for accurately reported data.
- This has sometimes led units within the company to seek independent solutions to departmental problems. For example, the marketing department of one BOC signed with a computer services vendor for a marketing application which incorporates vendor software on a minicomputer tied to the remote computing service for additional capabilities.
- Not surprisingly, all telecommunications companies interviewed identified deregulation and divestiture as the two key drivers of change within the industry. Deregulation has led to more competition. As one respondent said,



"We have to get out there and hustle for customers." Furthermore, IS is being asked by the marketing department for more customer information to identify prospects for new services and for planning purposes.

- In addition to reducing staffing needs, new technologies are being investigated to permit telecommunications companies to provide not just better but more rapid service to customers. The threat of more flexible competitors is changing attitudes in the formerly monopolistic environment.
- IS departments reported that management of their own, internal telecommunications systems and incorporating all media--voice, data, facsimile, and video--has become more important. This is an indicator of the continuing merger of voice and data responsibilities into one department, although there is a question about the amount of voice/data integration that will actually take place.
- Respondents report looking to companies outside the industry to identify models for using information services to competitive advantage.
- Several users indicated that vendors have yet to adequately adopt standards to accommodate an open systems environment.
- New applications being implemented include billing and toll systems to replace outdated ones.



V NEW OPPORTUNITIES

- One challenge facing BOC-affiliated vendors is to secure business with other industry companies who may consider the vendor a rival.
 - This factor is a market inhibitor, based on both emotional and business grounds, which translates into opportunity for independent firms, at least in the near term.
 - Partnering with or acquisition of independents may be colored by the affiliation. It is uncertain if such alliances will be beneficial or detrimental to the parties involved in attempts to sell in the telecommunications environment.
 - However, the motivation for such partnering is usually to enter broader information service markets, not merely telecommunications itself, in which case benefits accrue by providing the BOC partners with the ability to provide software and services to their customers, becoming a one-stop source of IS solutions.
- INPUT believes that telco entry into broader information service markets is slowly subsiding, in part due to the rapid involvement of the BOCs and the need for an evaluation period. However, fewer "independent" firms will maintain a presence into the 1990s. Those that will remain will often do so because they have found profitable and highly specific market niches and have entered into successful marketing and distribution agreements with telco subsidiaries.



- Technological change is creating new opportunities in the telecommunications segment. Many of the BOCs are installing local packet switching networks and are positioning themselves to offer protocol conversion services when the regulatory climate permits. These new networks will require tracking and bill accounting systems.

- Software and systems supporting security functions within data and voice services are needed. Software is being developed to spot "hackers" attempting to test access codes against long-distance exchanges. Once detected, the next attempt is permitted, the line trapped, and the call traced to the violator.

- The Integrated Services Digital Network (ISDN) is currently being tested. When implemented, ISDN-related applications will be needed. Examples include messaging, teleconferencing, data base information services, transactions and telemetry applications for alarms, equipment monitoring, and utility management. ISDN thus represents opportunities for software development, professional services, information providers, and third-party services. Exhibit V-1 presents the range of ISDN distribution services.

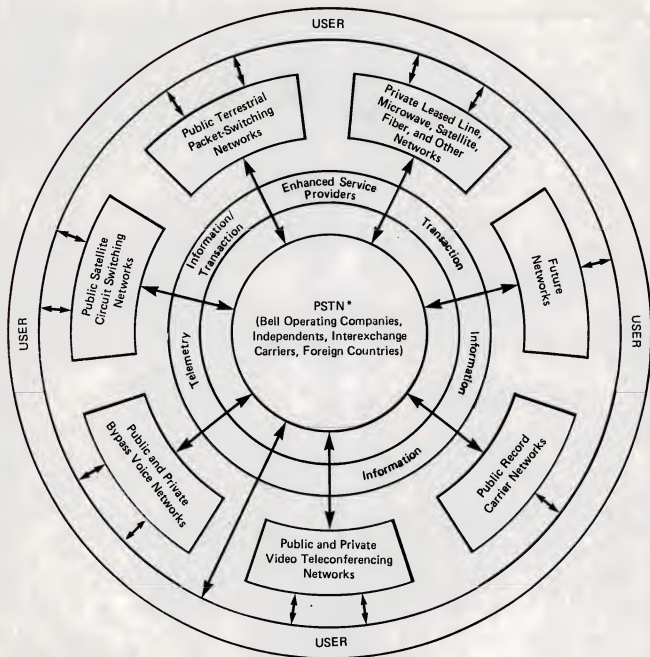
- Opportunistic enterprises in information services (such as 976-exchange audiotex services), cellular telephone, long-distance, reselling, shared tenant services, and satellite services have arisen.
 - These newer participants often approach business with financial and marketing concerns overriding information service concerns and creating opportunities as well as risks.

 - Unproven new enterprises may fail, and vendors may be left without an opportunity to benefit from an ongoing relationship after an expensive sales and development process.



EXHIBIT V-1

ISDN DISTRIBUTION SERVICES



* PSTN = Public Switched Telephone Network



- Cautious approaches are particularly recommended for shared tenant services which have thus far failed to generate significant interest from tenants.
- Pay phone services are changing, with new credit card billing systems requiring software and processing services.
 - The sale of Western Union's airliner-based Airfone to GTE should lead to reduced charges and more volume; however, the processing components of this business and its Railphone equivalent are expected to be captive, with GTE Data Services as the provider.
 - Other opportunities for pay phone services may be found related to other forms of transportation--commuter buses, ferries, urban transit, ocean liners.
- Cellular systems are operated by either independent firms or subsidiaries of the LECs. Due to regulatory and business requirements, these subsidiaries will often use RCS firms or internal systems to handle their billing.
 - The cellular industry is characterized by volatile pricing driven by competitive influences, requiring the ability to change price schedules rapidly.
 - There are billing format inconsistencies between the regular telephone system, cellular billing, and "roamer" billing which need to be addressed.
 - In addition to billing services, cellular operators require value-added services such as traffic pattern analysis, channel use statistics, and equipment efficiency reports.



- Professional service opportunities are significant. Several have been reported above in the vendor profiles; professional services are addressed elsewhere in this volume.
- Fiber optic networks, for the most part, are being designed as bulk service providers to other carriers. As end-to-end, switched services (including the local loop) via fiber cables are introduced, information systems to implement and then manage them will be needed.
- Other emerging areas in telecommunications are mobile data applications (using cellular, paging, or other radio common carrier frequencies) for field personnel and other requirements, digital radio-based rural telephone systems, proposed mobile satellite communications services, and radio positioning/messaging systems.
- Proposed rural telephone systems may offer niche opportunities. An estimated one million homes are currently beyond telephone network services. Cellular-like systems are being proposed for new installations and as replacement systems.





VI RECOMMENDATIONS AND CONCLUSIONS

- For vendors considering product or service development in this market, INPUT recommends:
 - Recognition be made of the long lead times and planning cycles characteristic of many telephone operations, leading to long sales cycles, particularly in regulated segments. This sluggishness, a holdover from the regulated environment, also means prospective competition from BOC subsidiaries may be developmentally slowed.
 - Vendors be aware of the fact that needed systems are often massively complex and interrelated, a fact that can heavily influence service or software design.
 - Vendors recognize that the levels of automation can be significantly different among entities, related to specific segment, prospect size, location, culture, and requirements.
 - Vendors examine ways of adapting software, systems, and services to large telecommunications users who are operating and managing their own facilities and to international (particularly developing) markets where telecommunications infrastructures are being developed.





VII FORECAST RECONCILIATION

- Exhibit VII-1 shows the variances in both the long- and short-term projections for user expenditures for information services in the telecommunications market when comparing INPUT's 1985 and 1986 report findings.

A. PROCESSING SERVICES

- INPUT's 1985 market sizing for remote/batch services remains constant; however, the 1990 market size is estimated at \$766 million (compared to \$745 million) for a 3% increase over that projected in the 1985 report. The AAGR forecast through 1991 is 18%, one point higher than the 1985-1990 AAGR forecast of 17%.
- The 1985 market size for facilities management processing services varies from INPUT's 1985 estimate by a negative 6%, but this turns out to be a minor change. Instead of \$18 million, the 1985 market is sized at \$17 million due to a shift in classifying some revenues from FM to processing services, a result of a refined definition. Instead of a 17% AAGR as reported for 1985-1990 in our 1985 report, the AAGR from 1986 through 1991 is now forecast at 20% for facilities management.
- The result is a minor decrease of the estimated 1985 market for all processing services and an increase in the size of the 1990 market, with a total proces-



EXHIBIT VII-1

TELECOMMUNICATIONS SECTOR - DATA BASE RECONCILIATION
OF MARKET FORECAST BY DELIVERY MODE

DELIVERY MODE	1985 MARKET			1990 MARKET			1985-1990 AAGR Forecast in 1985 Report (Percent)	1986-1991 AAGR Forecast in 1986 Report (Percent)
	1985 Forecast (\$ Millions)	1985 Report (\$ Millions)	Variance as Percent of 1986 Report	1985 Forecast (\$ Millions)	1986 Forecast (\$ Millions)	Variance as Percent of 1986 Forecast		
Processing Services								
Remote Computing/ Batch Services	\$340	\$340	0%	\$745	\$766	-3%	17%	18%
Facility Management	18	17	6%	40	43	-7%	17%	20%
Total Processing Services	\$358	\$357	0%	\$785	\$809	-3%	17%	18%
Application Software	\$ 47	\$ 49	-4%	\$260	\$264	-2%	41%	40%
Turnkey Systems	\$199	\$199	0%	\$500	\$497	1%	20%	21%



sing services AAGR of 18% through 1991, compared to a 17% AAGR (through 1990) in the 1985 report.

B. APPLICATIONS SOFTWARE

- Instead of a \$47 million 1985 market, INPUT now sizes this market at \$49 million for a 4% increase. The 1990 market grows by \$4 million, but the comparable AAGR (for 1985-1990 versus 1986-1991) declines from 41% to 40%.

C. TURNKEY SYSTEMS

- The forecasts and projections for turnkey systems remain relatively constant, with only minor variances between the reports.
- As can be seen, the changes reported between the 1985 and current report are marginal.

