M-SVA-PM
Letter
Original

May 29, 1987

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Dear
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:

Enclosed are three reports from INPUT's Market Analysis and Planning Service (MAPS). They are:

- Wholesale Distribution Sector
- Process Manufacturing Sector
- Service Industry Sector

These reports are a part of a series entitled U.S. Information Services Industry-Specific and Cross-Industry Markets. The reports should be filed in the binder of that name in Section III, Industry-Specific, with the tabs provided. All tabs are filed alphabetically in each section. (Please note that Wholesale Distribution is filed under "D" for Distribution.)

Also enclosed are updated 1987 Title Pages to be filed behind the printed title page of each volume. A Table of Contents, which includes all the reports shipped to date for these volumes, is included for your reference and should be filed with the Title Page in Volume I.

You will note the new format for the reports. They have been bound for ease of use but can still be maintained in the binders provided.

If you have any questions or comments, please call me at (415) 960-3990. INPUT, as always, welcomes the opportunity to assist you in the effective use of its information, reports, and services.

Yours truly,

Michael Cohn
Program Manager
Market Analysis and Planning Service

MC:ml

Enclosures

Market
Analysis and
Planning
Services
(MAPS)

U.S. Information Services Industry-Specific Markets 1986-1991

Process Manufacturing Sector

INPUT®

1943 Landings Drive, Mountain View, CA 94043 (415) 960-3990

U.S. INFORMATION SERVICES
INDUSTRY-SPECIFIC MARKETS, 1986-1991
PROCESS MANUFACTURING SECTOR

APRIL 1987

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Market Analysis and Planning Services (MAPS)

U.S. Information Services Industry-Specific Markets, 1986-1991
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U.S. INFORMATION SERVICES
INDUSTRY-SPECIFIC MARKETS, 1986-1991
PROCESS MANUFACTURING SECTOR

EXHIBITS

I ISSUES, TRENDS, AND EVENTS

A. OVERVIEW

- Process manufacturing is the sixth largest market for industry-specific information services.
- It contains a diverse group of subindustries including oil and gas exploration and processing, food processing, chemicals, primary metals production, printing, and forest and wood products.
- All these industries have similar characteristics:
  - They manufacture a product in bulk processes where, during the process, it is difficult to discriminate one end unit of the process from another.
  - They use continuous flow processes that involve several tightly integrated technical steps in the conversion of raw materials to finished goods.
  - They manufacture using very high volume, highly automated production runs.

- Several other important features characterize process manufacturing in general:

  - Once started, throughput tends to be high but predictable.

  - The pattern of the production process, including materials routing, is rigid.

  - There is a high degree of vertical integration between successive stages of the manufacturing process.

  - Equipment tends to be very specialized, sometimes capable of performing only a single or at most a few processes and nothing else.

  - The industries are capital intensive relative to other industries, frequently employing hundreds of millions of dollars in capital at a single plant site. The ratio of capital to labor in the process manufacturing sector is the highest for any major SIC industry.

- Exhibit I-I shows the relationship between process specialization and volume production. It also displays the differing challenges that confront information systems management as their manufacturing processes grow larger and more rigid.

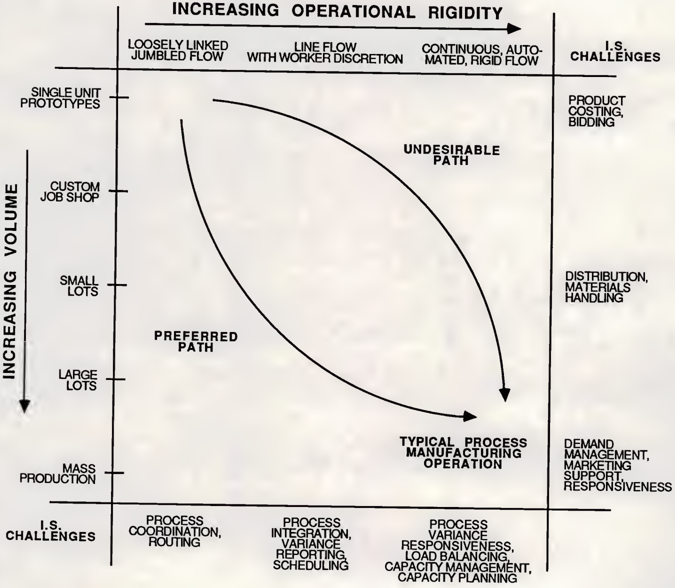
  - Most process manufacturing operations reside at or near the lower left corner of the diagram. Note that volume is high, but flexibility is low.

- The above characteristics have important implications for operating and strategic management:

  - The size of the capital commitment necessary to participate in these industries is huge. Steel plants, refineries, and mines can cost hundreds of millions of dollars to bring on-line. Return on investment (reflected as returns on assets) is among the most important driving forces.

EXHIBIT I-1

VOLUME OPERATIONS MATRIX FOR PROCESS MANUFACTURING WITH I.S. CHALLENGES



  - The industry is very sensitive to in-place capacity and capacity utilization.

  - High fixed costs associated with large capital investments mean that breakeven volume is frequently high relative to other industries.

  - Because of the highly specialized processes that characterize most process manufacturing operations, there is little flexibility or alternate uses of capital once committed. Barriers to industry exit are high.

  - Lead times for operational planning commitments such as scheduling production runs to change product mix or raw materials purchases and delivery typically are much longer than for other industries.

- Information technology has primarily been applied to the management of the manufacturing process itself and only secondarily to management reporting systems common in other industries such as those that address variable cost management or product marketing.

  - There has only recently been application of information technologies for still higher level "strategic" purposes such as is common in the banking, insurance, and medical industries. Such applications include processing and adding value to data captured in production or distribution and reselling that data or using it as the basis of entry into new product lines or markets.

  - Ignoring the cost of embedded process control systems, much of which is provided by process automation machinery and equipment manufacturers, spending for information processing technologies represents a smaller portion of total capital expenditures for this sector than for any other major SIC industry.

- As a result of these factors, opportunities for information technology management are unique.
    - Services that provide even slight increases in operating efficiency can have dramatic effects on overall profitability.
        - These may come through lowering operating costs by means of software to improve raw materials or finished goods inventory management, data collection and analysis to improve production variance reporting and responsiveness, or streamlining distribution logistics.
    - Services that increase capacity utilization are equally important.
        - Such services include better machine load balancing, improved production scheduling, and better maintenance scheduling.
    - The ability to reduce the risks associated with large and inflexible capital commitments is highly desirable.
        - A "newly" discovered application is tighter integration of marketing data collection with tactical and strategic planning to alert management of even slight changes in target markets.
        - The food processing subsector is a leading user of this application.
    - IS departments are looking at ways to quickly make available to top management relevant summaries of the huge amount of data collected in the manufacturing process, data that now takes days or sometimes weeks to be collected and filtered through floor and plant level personnel.

    - These typically include data on production variances, product status, lead times, machine operating parameters, capacity utilization, and equipment loading.

- Exhibit I-2 summarizes these top management concerns and some possible information systems department responses.

- Exhibit I-3 lists some of these information requirements by the different levels of the manufacturing organization at which they arise and are addressed.

- In terms of sales, the three most important sectors within the process manufacturing industry are oil and gas, food processing, and chemicals. Specific analyses of these sectors are included below.

B. OIL AND GAS

- The oil and gas industry is composed of two distinct subsectors--exploration and refining--with each employing different types of production technologies and information services.

- The exploration and pumping subsector explores for oil and natural gas. This sector has been hit by a precipitous decline in the market price of petroleum products in the past year, with prices falling from the mid to high $20s in January 1986 to the low teens by summer. At the end of 1986, prices are hovering around the low to mid teens with little prospect of improvement.

- An ensuing "depression" has hit the drilling industry with a direct impact on seismic exploration companies, the largest supplier of information services to the oil and gas industry.

EXHIBIT I-2

TOP MANAGEMENT CONCERNS IN PROCESS MANUFACTURING AND POSSIBLE I.S. MANAGEMENT RESPONSES

MANAGEMENT OBJECTIVE	MANAGEMENT MEANS	I.S. TOOLS
INCREASE OPERATIONAL EFFICIENCY	LOWER OPERATING COSTS	PROCESS INTEGRATION, AUTOMATION
	INCREASE THROUGHPUT	VARIANCE REPORTING, RESPONSE
	INCREASE CAPACITY UTILIZATION	IMPROVED PRODUCTION PLANNING
		CAPACITY LOAD BALANCING
		MAINTENANCE SCHEDULING
DECREASE RISKS OF HIGH CAPITAL COMMITMENT	LOWER BREAKEVEN POINT	IMPROVED PROCESS EFFICIENCIES
	INCREASE FLEXIBILITY OF PROCESS OUTPUT	PROCESS RESEARCH TOOLS
	IMPROVED WARNING OF MARKET SHIFTS	MARKET INTELLIGENCE SYSTEM

EXHIBIT I-3

DIFFERING INFORMATION REQUIREMENTS IN PROCESS MANUFACTURING

PLANT FLOOR LEVEL

- PROCESS SPECIFICATIONS (TOLERANCES, FLOW RATES, ETC.)
- PROCESS CONFORMANCE, OUT-OF-TOLERANCE FLAGGING
- SCHEDULING

PLANT LEVEL

- INVENTORY LEVELS, USAGE RATES
- PRODUCTION DEFECT RATES, VARIANCES
- MAINTENANCE SCHEDULING, SHUTDOWN
- MATERIALS, MACHINING, LABOR COSTS

CORPORATE LEVEL

PRODUCTION RELATED	OTHER
PRODUCTION MIX, VOLUMES	MARKETS TARGETED/ABANDONED
CAPACITY UTILIZATION RATES	RETURN ON ASSETS, INVESTMENT
TECHNOLOGY SELECTION	PRODUCT MIX
	INDUSTRY CAPACITY
	ACQUISITION, DIVESTMENT

    - As recently as 1980, the domestic oil industry supported some 600 land-based seismic exploration crews. By early 1985 that number had fallen to 250. At the end of 1986 an estimated 90-100 crews were working in the continental U.S. This dramatic decline in new exploration has reduced the demand for seismic data acquisition services and systems. This includes demand for all information services delivery modes--software products, processing services, and turnkey systems.

    - Another consequence of falling oil prices on information service providers has come about through the withdrawal from operation of marginal pumping stations, wells producing at high cost or at so low a quantity as to be uneconomical to continue to operate. This has reduced the demand for turnkey wellhead management and production logging systems.

- Some major information service providers to the oil and gas industry have experienced declines in revenues of up to 90% over their operating levels only two years ago. All have laid off people and idled equipment, many have filed for bankruptcy, and several have resorted to merging or being acquired by other oil field service companies; for example, Seiscom Delta's absorption from Chapter 11 into Grant Norpack.

- Falling hardware prices and increasing capabilities of microcomputer-based systems have further compounded vendors' troubles. A VAX-based turnkey system costing $250,000 two years ago now can be sold on a MicroVax at a bundled price of $50,000.

- Revenue from software products is also under pressure as buyers have been conditioned to expect a rough proportionality between hardware and software system prices. A $250,000 VAX system is more able to support a $100,000 software product than is a $30,000 MicroVax system. Also, once developers have recovered sunk software development costs, pressures to cut prices in an attempt to gain very high margin sales have led to further price declines.

- Two trends have proven minor mitigation for seismic processing firms caught in the throes of this depression.
  - Some oil companies, such as Conoco, have discontinued in-house seismic exploration, preferring instead to rely on outside contractors and their considerable excess capacity and price-cutting tendencies.
  - Seismic data reprocessing has become more important as new techniques have emerged for combining old data or data from different sources to reinterpret oil field potential.
- Return to recent levels of prosperity for these geophysical processing companies is almost solely a function of worldwide oil prices with most information providers believing that a minimum price of around \$20 per barrel will be needed to resume exploration and hence demand for their services. Many players also note that they do not expect such sustained prices to prevail before the end of the decade.
- The oil refining business has sustained profits during this depression by means of such steps as closing down refineries, writing down assets, or suspending building, research, and development projects.
  - Despite major expenditures for capital improvements in recent years (spending for capital improvements grew tenfold from 1973-1983), actual U.S. refining capacity was less in 1986 than it was in 1975.
    - Chevron cut capital spending by 30% in 1986 while ARCO cut \$40 million from its original spending plans.
  - Imports, relying on cheaper feedstocks, have continued to take an increasing share of U.S. markets for finished products.

  - The withdrawal of capacity and retrenchment on building and research efforts has resulted in declining demand for software products, on-line data bases, and professional services.

- Future demand for information services products in this sector will remain weak for several years as producers absorb recent capital additions and wait for market prices to stabilize before adding more capacity.

  - Also, recent cutbacks in research and development programs suggest that new processes and technologies will not be as plentiful in future years as they have been in the past.

  - Exceptions are areas of hazardous waste management and environmental monitoring and management.

C. FOOD PROCESSING

- Like the larger process manufacturing industry itself, the food processing subsector is made up of many smaller industries including those processing meats, canned goods, frozen goods, beverages, or bakery products.

- The total value of all shipments from this SIC sector (SIC number 20) will exceed $320 billion in 1986.

- The industry is dominated by leviathan food processors such as RJR Nabisco, Beatrice, Dart and Kraft, and Phillip Morris (which in 1986 purchased General Foods). This is due to several factors:

  - A history of mergers which accelerated in 1986.

  - Economies of scale achieved in purchasing, processing, marketing, and distribution.

  - Competitive advantages gained by research into new food production processes or preferential access to shelf space in retail sales channels.

  - Recent changes in consumer preferences such as poultry over red meat and rising demand for convenience foods have been met successfully by the larger food processors.

- Exhibit I-4 lists the top 20 food processing companies and their 1985 and 1986 total sales. In contrast to the oil and gas industry where industry companies almost all suffered reduced revenues, only two of the top 20 firms in the food processing industry suffered year-to-year revenue declines. This buoyancy and the resultant increase in demand for information services helped sustain total demand for information services in the process manufacturing industry as a whole.

- The industry showed a resurgence in profits in 1986 over 1985 owing to declining prices for raw food stuffs and fuels, stable wages, and an ability to resist passing these cost advantages along to the retail level.

- This pattern of large firms experiencing stable, profitable growth has made the food processing subsector one of the largest spenders on information processing in the process manufacturing industry, with IS budgets approaching 2% of total sales.

  - This level of spending also makes it one of the most information-intensive spenders in all of industry.

EXHIBIT I-4

TOP 20 U.S. FOOD PROCESSING COMPANIES BY 1986 FOOD SALES

1986 RANK	COMPANY NAME	1986 SALES ($ Millions)	1985 SALES ($ Millions)
1	Phillip Morris Companies, Inc.	12,621*	3,662
2	Beatrice Companies, Inc.	8,959	8,141
3	RJR Nabisco, Inc.	7,387	4,698
4	Dart & Kraft, Inc.	7,065	6,800
5	The Coca-Cola Company	6,832	6,479
6	Anhauser-Busch Companies, Inc.	6,829	6,744
7	IBP, Inc.	6,821	6,756
8	PepsiCo, Inc.	5,976	5,717
9	Nestle Holdings, Inc.	5,496	2,502
10	Ralston Purina Company	5,156	4,117
11	Archer Daniels Midland	5,112	4,540
12	Campbell Soup Company	4,314	3,880
13	H.J. Heinz Company	4,190	3,908
14	Sara Lee Corporation	4,132	4,068
15	ConAgra, Inc.	4,100	4,400
16	CPC International, Inc.	4,039	4,215
17	Borden, Inc.	3,185	3,121
18	General Mills, Inc.	3,061	2,771
19	The Pillsbury Company	3,030	2,400
20	The Quaker Oats Company	2,955	2,756

* Includes General Foods

Source: Food Processing Magazine, December 1986

- There are several reasons for this:

  - Some of these manufacturers produce thousands of product lines. Coordination requirements for raw materials purchases, inventory management, and production scheduling are enormous.

  - A raft of products means dozens of different manufacturing processes.

  - Many manufacturers market their products through hundreds of different channels, further compounding coordination and management information requirements.

- The industry is experiencing considerable changes in data collection associated with the use of scanners in retail stores.

  - Some 12,000 stores now use scanners, accounting for an estimated 50% of total food purchases.

- Large food processors such as Pillsbury, Beatrice, and Frito-Lay (PepsiCo) are attempting to capture this data directly at the store level through outbound sales forces. Until recently, such data were only available on a summary basis months after actual collection.

- Having such data available on an almost daily basis has enormous implications for product planning and competitive product positioning.

  - Timely data on brand movement in different settings can prove extremely valuable for planning geographic market expansions, product pricing or promotion campaigns, or product line terminations.

  - The data can also be used to persuade retailers to reallocate shelf space or shelf positioning to brands which are proven movers in similar settings.

  - The strategic value of early recognition of new trends or shifts in purchasing patterns is also significant.

- Retailers, realizing the value of such data to food processors, have begun to capture the data themselves and resell it to the manufacturers.

  - Used in conjunction with a Direct Product Profit (DPP) software standard which is emerging from the retail food industry, this trend could have major implications for food manufacturers and their information processing directions.

D. CHEMICALS

- The chemical and related hydrocarbon processing industries have experienced steady growth in recent years, though the direction and composition of future growth is expected to change.

  - Competition for basic chemical products from foreign sources with new plants and access to cheap petroleum and natural gas feedstocks is leading U.S. producers to shift production to higher technology products.

  - Price pressures from these sources have caused manufacturers to step up research and development spending for ways to improve production efficiencies for existing products.

  - Environmental pressures are forcing major spending on pollution abatement and hazardous waste management facilities and technologies.

  - Capital spending for compliance with federally mandated pollution standards is estimated to have reached $3 billion in 1986.

- Continued increases in overall demand will hinge partly on increases in the demand for related products including plastics, rubbers, solvents, and fertilizers.

II SIZE AND GROWTH

- Exhibit II-1 shows the distribution of spending for industry-specific information services in the process manufacturing sector for 1986 and its growth through 1991.

- Industry-specific spending in this sector totaled $1.28 billion in 1986, approximately 6% of the total spent in the entire economy for such services.

- The growth rate in spending from 1985 to 1986 was 12%, trailing the more robust 18% growth rate in spending tallied for the economy as a whole.

- A more detailed breakdown year-by-year is shown in Appendix PM-A which shows the process manufacturing industry sector by delivery mode.

- Problems in the process manufacturing sector, discussed below, led to a lower level of growth for every type of information service when compared to growth in spending for services in the other combined sectors. In some cases the differences were dramatic.

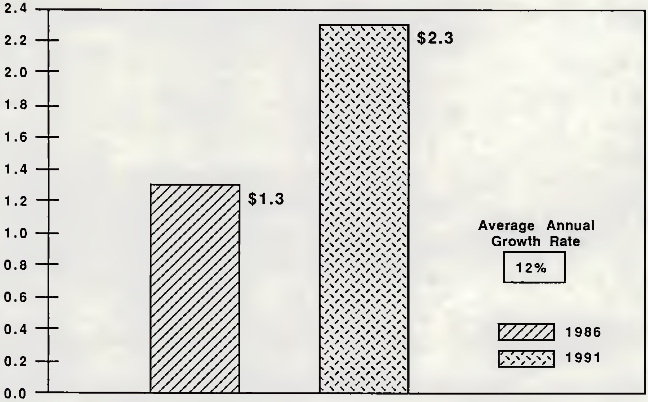
  - Spending for processing services grew 14% from 1985 to 1986, from $697 million to $793 million. This compares to a 15% growth rate for industry-specific spending as a whole.

  - Spending for turnkey systems was up only 10% over the same period, to $360 million, versus a 19% growth rate for all industries.

EXHIBIT II-1

INPUT®

PROCESS MANUFACTURING SECTOR INFORMATION SERVICES MARKETS, 1986-1991
($ Billions)



  - Software spending in the process manufacturing sector showed the greatest weakness relative to spending in the other combined sectors. A low 5% increase over the previous year resulted in a spending level of $130 million (by contrast, all sectors combined showed a healthy 26% increase in spending for industry-specific software products).

- Similarly, forecasts for the five-year growth rate of spending in this sector, from 1986 to 1991, show it to be trailing the growth rates for the other combined industry sectors.

  - Processing services are forecast to grow at an average annual rate of 14% over the five-year period versus a 15% growth rate overall. Total demand will reach $1.5 billion by 1991.

  - Spending for turnkey systems should grow by 10% a year to $580 million by 1991. This compares with 19% growth for all sectors over the same period.

  - Applications software spending shows the greatest weakness when compared with other sectors. This delivery mode is forecast to show only an 8% average annual growth rate through 1991 compared with a 26% annual rate for all other sectors. Total spending should reach $194 million by 1991.

- Exhibit II-2 provides a summary of important demographic data relating to the process manufacturing industry and forecasts of IS spending by employee through 1991.

EXHIBIT II-2

INPUT®

PROCESS MANUFACTURING INDUSTRY DEMOGRAPHICS AND INFORMATION SERVICES SPENDING

	1982	1986	1991
Number of Institutions (000)	140	138	135
Number of Employees (000)	7,738	7,251	7,600
Revenues ($ Billions)	$1,212	$1,386	$1,530
IS Department Spending ($ Millions)	$8,440	$11,696	$14,927
IS Spending Per Employee	$1,091	$1,613	$1,964
Industry-Specific IS Spending ($ Millions)	$930	$1,283	$2,278
Industry-Specific IS Spending Per Employee	$120	$176	$299

(1) Includes SIC numbers 10, 11, 12, 13, 14, 20, 21, 22, 24, 26, 28, 29, 30, 32, 33.

Sources: U.S. Industrial Outlook; Statistical Abstract of the United States; U.S. Department of Labor Employment and Earnings Report; INPUT Estimates.

III APPLICATION ANALYSIS

A. OVERVIEW

- Several applications which have been rated as highly important by industry IS executives are common to most process manufacturing processes and companies.

- Virtually all respondents to INPUT's surveys cited the requirement of improved data integration up and down the corporate organization as one of their key requirements.

    - These requirements include unifying or coordinating diverse data structures, processing systems, process control systems, and application development environments.

    - One of the most commonly sounded themes among process manufacturing IS management was the need to provide improved support for marketing and strategic management.

        - Process manufacturing is one of the laggards in this area, having concentrated technology resources more on operational problems than on tactical or strategic business management.

- Improved process automation and integration was another frequently noted requirement.

- Connectivity and communications requirements also received high ratings.

    - Several respondents noted that as people are removed from the factory floor by process automation, there is a greater need for centralized data collection, process monitoring, and adjustment.

    - An almost universal complaint was that no one vendor or service provider was able to provide a complete solution to company's process automation, communications, and data processing requirements.

- Many DP applications are now being written by process or manufacturing engineers.

    - These are especially common in applications which involve measurement, recording, and aggregation of variables in the production process such as pressure, pH, volume, temperature, or decibels.

    - There has been an avalanche of such in-house applications developed on PCs.

- An almost universally cited requirement is for software programs aimed at helping manufacturers meet environmental regulations.

- Most production applications are developed and supported by the vendors such as Honeywell, Foxboro, and Fisher which provide the process automation machinery and equipment. Considered embedded systems, these are not considered a part of the information services industry.

- Exhibit III-1 summarizes the top process manufacturing application requirements by subsector.

EXHIBIT III-1

TOP PROCESS MANUFACTURING APPLICATION REQUIREMENTS

OVERALL:	Improved Data Integration
	Process Automation
	Communications/Connectivity
OIL AND GAS:	Waste Separation
	Environmental Control
	Seismic Analysis
CHEMICALS:	Value-Added Customer Ordering
	Automated Product Batch Changeover
	Pollution Abatement and Control
MINING:	Environmental Analysis
	Mine Production Management
	Mine Economics Analysis
FOOD:	POS
	Forward Integration to Retailer

B. OIL AND GAS

- In the oil exploration area, seismic analysis remains the most pressing application. This application actually includes three subapplications--seismic data acquisition such as is done by field crews using geophones or recording instruments, processing to analyze the data collected in the acquisition phase, and reprocessing, where collected data from different surveys or with different techniques are combined to produce different or more refined analyses.

- In the refining area, top applications include programs to facilitate waste separation and management and aid in byproduct recovery and recycling.

- Environmental control and reporting applications were rated among the most pressing by respondents.

    - One respondent estimated that 20% of all capital spending in the refining industry is now going for compliance with environmental regulations.

C. FOOD PROCESSING

- Food processors cited only a few industry-specific applications that rated high on their requirements list.

    - Point-of-sale applications are important to most food processors who are looking to integrate data collection and processing all the way from the retail check-out counter back through the wholesaler to the manufacturer itself.

        - Reasons cited for this need include competitive requirements and the need to respond more quickly to fickle consumer tastes for new foods and diet trends.

    - On-line order processing both from suppliers and to customers was also cited.

D. CHEMICALS

- Users from the chemical sector reported several top applications priorities over the next two years. These include:

    - Value-added customer ordering including adding on-line chemical engineering and design support services as a competitive weapon in gaining and holding new markets.

    - Process control automation. This has been called the "robotics" of the process manufacturing industry.

        - Included here are turnkey systems providing enhanced data collection and more responsive process adjustment systems.

        - Especially important are tools to support automated blending and production changeovers.

    - As with the oil and gas subsector, pollution abatement control and monitoring was rated high on respondents' most pressing application requirements.

    - Lab research aimed at more exotic, higher valued, refined products should be supported with software development and modeling tools and on-line data bases.

E. MINING

- Research in the mining industry revealed an abundance of applications needing addressing.

- Mine operators have historically supported data processing requirements on mainframes or minicomputers at headquarters or regional offices but are now beginning to try out some of these applications on PCs located at the mine sites.

    - Pre-mining and feasibility analysis.

    - Environmental analysis including hydrology, sediment loading, toxic handling, and reclamation.

    - Mine production management, including geologic contouring for open-faced mines, manpower, and equipment scheduling and control.

    - Automated mine production systems.

    - Mine economics and financial analysis including equipment and labor operating costs, leases, and tax royalties.

    - Geological analysis including deposit modeling and reserve analysis.

- Many of the above applications need to be supported with data from on-line data bases and by means of remote data collection and transmission, similar to that employed in wellhead logging in the oil and gas subsector.

IV VENDORS AND PRODUCTS

A. OIL AND GAS

1. WESTERN GEOPHYSICAL

- Western Geophysical (Houston, TX) sells several types of software packages for acquisition and processing of seismic data. They are offered on a batch processing basis and are sold to major oil companies. Western Geophysical has maintained a presence in both land- and marine-based seismic exploration, though it has recently sold off some of its fleet of offshore seismic testing boats.

- The company's most important seismic processing offering is the Western Seismic Data Processing Package, a more than one million line program that runs on IBM mainframes under the MVS operating system. It accepts data from Western's LRS 16 Seismic Data Acquisition program which is used in field environments to collect data from seismic sampling tests.

- The company also offers an interactive seismic data interpretation program, Crystal, which operates on MVS mainframes but which is being ported to IBM's new 9370 machine to run under VM.

2. GEOSOURCE

- Geosource, headquartered in Houston, develops software and sells services in support of both oil and gas field exploration and production. Its software runs on Perkin-Elmer minicomputers. During the recent shutdown in seismic exploration, Geosource has turned to international markets to sustain sales.

3. SEISMOGRAPH

- Seismograph markets the Phoenix line of products and services to support seismic exploration. In addition to selling Phoenix as a software product to run on Raytheon Data Systems hardware, a more recent version has been developed for DEC VAX minicomputers. Seismograph also offers the product as a turnkey system and offers Phoenix-based processing services through its service centers in Tulsa, Denver, Houston, Midland (TX), Oklahoma City, and Sherman Oaks (CA).

4. PHILLIPS PETROLEUM

- The Applied Automation Division of Phillips Petroleum sells a package of products for managing petroleum manufacturing processes. The Optrol family of products includes distributed control systems with high-speed networking of instrumentation systems.

5. LANDMARK GRAPHICS

- Landmark Graphics Corporation in Houston sells turnkey systems that collect seismic data at the wellhead and transmits it to headquarters for interpretation and analysis. The Landmark II system sells for $220,000. Landmark III sells for $280,000.

B. FOOD PROCESSING

I. INFORMATION RESOURCES, INC.

- IRI (Chicago, IL) is a leading developer and vendor of software products and on-line processing services providing marketing management applications in the food processing industries.

  - IRI's Express software product provides decision support tools built around a relational data base management system for application development and ad hoc queries by brand managers for tracking and forecasting sales of products by product line, part number, type of distribution channel, and a variety of other criteria. Also available are graphics, modeling, and other financial and statistical applications. Express is available on a timesharing basis, and in 1986 IRI introduced a version for the IBM PC, pcExpress, for $1,495.

  - Promoter measures incremental sales and profits from past promotions and enables users to allocate resources to improve the effectiveness of future promotion investments. In addition to supporting analyses of sales, promotions, distribution, and ad expenditures, it permits such questions as "How do different market or geographic segments respond to different prices, shelf locations, and promotion campaigns?"

  - The company also offers on-line data bases for use by its customers in simulating marketing campaigns and strategies.

- IRI's customers are heavily concentrated in the food processing industry and include such firms as Nabisco, General Foods, Kellogg, Kraft, Quaker Oats, and Ralston Purina.

C. MINING

1. MINE SAFETY APPLIANCES

- MSA (Pittsburgh, PA) sells the Data Acquisition Network (DAN) for mine-wide monitoring and supervisory control. The system gathers and reports data from hundreds of remote mine locations on conveyor systems, ventilation machinery operation, fire and gas detection, and shearing equipment conditions.

2. MORRISON-KNUDSEN

- Morrison-Knudsen, a mining operator, has developed a DEC VAX-based package for its own operations. The company now sells and supports the program which assists in the management of such processes as:
  - Pre-mining feasibility analyses.
  - Environmental reviews.
  - Surface mine topology planning.
  - Mine economics.
  - Land and lease management.
  - Recently ported to PCs and DEC's MicroVAX supermicro, the new program, dubbed Eagles, provides many of the same functions, albeit with less depth in each area. It sells for $20,000 to $30,000.

3. RADIAN CORPORATION

- Radian (Austin, TX) sells the CPS-1 grid modeling and geologic contouring package for open face mine planning and operations. Based on the IBM PC, the program allows mine operators to design the most cost-effective open pit configurations and reclamation scenarios.

APPENDIX PM-A: FORECAST DATA BASE: PROCESS MANUFACTURING SECTOR

- This appendix contains the following forecast information, as shown in Exhibit PM-A-1:
  - Market size by delivery mode for each year, 1985-1991.
  - Market growth rates for 1985-1986.
  - Average annual growth rate (AAGR) for each delivery mode for the five-year period, 1986-1991.

EXHIBIT PM-A-1

PROCESS MANUFACTURING INDUSTRY SECTOR INDUSTRY-SPECIFIC SERVICES MARKET, 1986-1991

Segmentation by Delivery Mode	($M) 1985	1985-1986 Growth	($M) 1986	($M) 1987	($M) 1988	($M) 1989	($M) 1990	($M) 1991	AAGR 1986-1991
Processing Services									
Remote Comp/Batch	657	14%	749	854	974	1,110	1,265	1,442	14%
Facility Management	40	10%	44	48	53	56	59	62	7%
Total Processing Services	697	14%	793	902	1,027	1,166	1,324	1504	14%
Application Software									
Mainframe/Mini	96	4%	100	107	114	123	133	145	8%
Micro	28	7%	30	32	35	39	43	49	10%
Total Application Software	124	5%	130	139	149	162	176	194	8%
Turnkey Systems	327	10%	360	400	441	492	541	580	10%
Sector Total	1,148	12%	1,283	1,441	1,617	1,820	2,041	2,278	12%

About INPUT

INPUT provides planning information, analysis, and recommendations to managers and executives in the information processing industries. Through market research, technology forecasting, and competitive analysis, INPUT supports client management in making informed decisions. Continuing services are provided to users and vendors of computers, communications, and office products and services.

The company carries out continuous and in-depth research. Working closely with clients on important issues, INPUT's staff members analyze and interpret the research data, then develop recommendations and innovative ideas to meet clients' needs. Clients receive reports, presentations, access to data on which analyses are based, and continuous consulting.

Many of INPUT's professional staff members have nearly 20 years' experience in their areas of specialization. Most have held senior management positions in operations, marketing, or planning. This expertise enables INPUT to supply practical solutions to complex business problems.

Formed in 1974, INPUT has become a leading international planning services firm. Clients include over 100 of the world's largest and most technically advanced companies.

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