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Information Services
Opportunities & Trends, 1994-1999

# Discrete Manufacturing

U.S. Market Analysis Program

Information Services
Opportunities & Trends, 1994-1999

# Discrete Manufacturing

June 1994

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M&S 459/01 2/94

Published by
INPUT
1881 Landings Drive
Mountain View, CA 94043-0848
United States of America

**U.S. Information Services Market Analysis Program**

***Discrete Manufacturing***

***Information Services Opportunities and Trends, 1994-1999 Forecast Update***



MVDM • 658 • 1994

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# Exhibits

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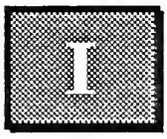

# Introduction

## A
## Purpose, Contents and Organization

This section identifies the purpose and scope of this report, notes key issues affecting information services expenditures in the *discrete manufacturing* market sector and explains how the document is organized.

### 1. Purpose

The purpose of this report is to identify key opportunities and challenges for users and providers of information services in the discrete sector of the manufacturing industry. The 1994 INPUT forecast for this sector is included.

### 2. Contents and Organization

In addition to this introductory chapter, the report contains analyses of the information services market and competitive environment as described below:

- Chapter II, *Trends, Events and Issues*, discusses changes, market issues and activities, along with competitive factors in the discrete manufacturing sector that can impact current and future use of information systems (IS).

- Chapter III, *Information Systems Environment*, presents an analysis of the information systems environment, noting the impact of applications trends, environmental forces, new technologies and budgets for the U.S. discrete manufacturing market.

- Chapter IV, *Market Forecast,* presents an analysis of expenditures for information services, by product/service sector, for the U.S. discrete manufacturing market.
- Chapter V, *Competitive Environment*, discusses key industry issues and considers the competitive positioning of major vendors. It also identifies significant vendors by size and application area, and offers profiles of a selection of leading vendors.
- Chapter VI, *User Buying Patterns,* presents near-term and long-range plans to implement new applications.
- Chapter VII, *Conclusions and Recommendations*, offers suggestions and recommendations for participants in the discrete manufacturing market.
- Appendix A contains the forecast database and presents a detailed forecast by product and service for the discrete manufacturing vertical market. A reconciliation to the previous forecast is also provided.
- Appendix B defines the structure of the discrete manufacturing industry, describes INPUT's research methodology and lists related INPUT reports.

## B
## Related INPUT Reports

The following INPUT reports may also be of interest:

- *U.S. Process Manufacturing Market, 1994-1999* (available in July 1994)
- *U.S. Applications Solutions Market, 1993-1998*
- *U.S. Network Services Market, 1994-1998* (available in August, 1994)
- *U.S. Software Product/Support Strategies Market, 1994*
- *U.S. Systems Integration/Professional Services Market, 1994-1999* (available in September 1994)

- *U.S. Business Process Re-engineering Market—Impact on Systems Integration* (available in July 1994)
- *Outsourcing Market Forecast, 1994-1999* (available in September 1994)
- *The U.S. EDI and Electronic Commerce Markets, 1993-1998*

## C
## Executive Overview

Total Quality Management (TQM) practices and global competitiveness cause the distinctions between discrete and process definitions to blur. The concepts of continuous flow, flexible manufacturing, process control, 100% quality, 100% service, reduced cycle times and increased customer responsiveness require that managers blend the best of process- and discrete practices. Implementing these concepts indicates an increase in automation and information services in the market; it also predicts a redirection of the marketing, development and delivery practices for the vendors of such services. It is appropriate to note here that TQM measures ALL activities in a company in terms of a "process" environment.

### 1. Key Trends and Issues

Key trends and issues influencing information services are noted:

- Implementing TQM principles and computer-integrated manufacturing (CIM) elements brings about a new company structure, often referred to as business re-engineering. The portions of that change referred to in this report are:
  - Cellular structure and the team approach to continuous improvement
  - Separation of the planning, execution and control functions, as those activities apply to achieving TQM objectives

  - Outsourcing and building vendor relationships, in information services delivery and partnering for manufacturing operations as well as the purchase of services and materials

  - Computers and information services to promote the attainment of company goals, and the importance of new technologies as they apply to achieving the sought-after results

- The discrete manufacturing sector is influenced by conflicting forces:

  - Foreign competition and new markets

  - Global needs and concerns with easier communication

  - Spill-over from merger and acquisition activity of the 1980s

  - Dramatic decrease in product life cycles

  - Need to run lean, yet be more customer-responsive

  - Growth and its attendant investment versus profitability

- All but aerospace and defense-related industries are predicted to grow at a comfortable rate through the forecast period, and personnel growth is projected to grow at a slower rate than revenues.

- Profitability has returned for most companies, but there is still some uncertainty due to large company problems and restructuring costs.

- Inflation has definitely slowed and interest rates remain low, but taxes increased.

- The regulatory environment is relatively quiet, but there are emission control and worker protection issues to consider in selected industries. *De facto* self-regulation is appearing in the form of ISO-9000 certification as many U.S. manufacturers adopt European quality standards.

- The proven new business practices inherent in TQM and CIM offer significant opportunities to companies in marketplace. Two elements necessary to achieve continuous improvement tools and training are available, but are they fully understood, and will businesses invest fast enough to reap the benefits?

- There is a recognized need for immediate, accurate, integrated information availability. Networks, distributed computing, open systems and relational databases offer those qualities at a reasonable return-on-investment basis. Is the knowledge available to take advantage of these resources?

- Downsizing, particularly to client/server systems, is a particularly strong trend in this sector.

- Software vendors and systems integrators are scrambling to migrate their offerings to client/server and open systems technologies, a necessary attribute to compete in the current environment.

## 2. Market

The information services market in the discrete manufacturing sector is expected to have healthy growth through 1999. Total expenditures for information services is forecast at $16.5 billion in 1994 (a 13% growth over 1993), expanding to $32.6 billion in 1999, for a compound annual growth rate (CAGR) of 15%.

Business processes re-engineering is driving demand for information services in this sector. As companies restructure, the information services function within a manufacturing company must respond with new techniques for providing immediate and accurate decision-making information. The move to client/server environments is compatible with this new structure.

Strong competition among information services providers is aiding growth in the information services market. The market remains fragmented, with no single vendor dominating a category. At the same time, specialized vendors are entering the market and carving out their own niches.

Exhibit I-1 shows INPUT's forecast of expenditures and growth rates for each product and service category.

EXHIBIT I-1

## Discrete Manufacturing—1994-1999 Market Forecast

| Products and Services | 1994 ($M) | 1999 ($M) | CAGR 94-99 (%) |
|---|---|---|---|
| Sector Total | 16,528 | 32,597 | 15 |
| Professional Services | 5,580 | 7,869 | 7 |
| Turnkey Systems | 3,655 | 6,377 | 12 |
| Applications Software | 3,237 | 9,235 | 23 |
| Systems Integration | 1,948 | 4,977 | 21 |
| Outsourcing | 1,027 | 2,660 | 21 |
| Processing Services | 925 | 1,069 | 3 |
| Network Services | 156 | 410 | 21 |

*Professional Services* represents the largest category of IS expenditures. However, the strong growth expected in packaged software and systems integration in this sector will come at the expense of information services consulting, a major component of professional services. As such, INPUT has revised the growth rate during the forecast period down slightly from the 1993 report.

*Turnkey Systems* is the second-largest product and service category is turnkey systems, at $3.3 billion in 1993. This sector is a natural market for application/function-specific turnkey systems, and so should continue growth at 12% through 1999, to $6.4 billion.

*Applications Software* will be the fastest-growing product and service category, at a CAGR of 23% through 1999; expenditures should reach $9.2 billion, surpassing the current product and service category leader (professional services). The strong growth results from continued expenditures on traditional systems, such as MRP II, plus expenditures on newer technologies, such as manufacturing execution systems, object-oriented systems, etc.

*Systems Integration* is another fast-growing product and service category, showing a 20% CAGR through 1999 and reaching almost $5 billion in that year. Systems integrators enjoy the growth of a market that requires specific knowledge in multiple disciplines, a skill set which is seldom available in-house.

*Outsourcing* is divided into platform, applications, desktop services and network management submodes. Growth in this area is forecast at a 21% CAGR through 1999, from $851 million in 1993 to $2.7 billion in 1998.

*Processing Services* is the slowest-growing product and service category in the discrete manufacturing information services market—a result, in part, of the improving price performance of hardware and other service alternatives.

*Network Services* is the smallest of the product and service categories, and is made up of electronic information services and network applications. This is a fast-growing category where INPUT expects a 21% CAGR through 1999—tripling the market from $129 million in 1993 to $410 million by 1999.

### 3. Conclusions and Recommendations

Vendors who want to achieved significant revenues in the discrete manufacturing sector will:

- Target narrow market segments
- Develop industry expertise and invest in industry training
- Develop alliances with niche vendors and invest in improving their own products rather than re-inventing a successful solution
- Develop a sales approach that emphasizes the critical business needs of the customer, rather than the features of the product
- Train sales people to sell value, not price
- Understand the concepts of business re-engineering, total quality management and value-added integration
- Establish formal programs to ensure quality in product and customer service and support

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II

# Trends, Events and Issues

This chapter presents significant trends, events and issues affecting discrete manufacturers in the United States. The conditions explored include the economy, the competitive picture and the current business practices of restructuring and re-engineering and implementation of total quality management (TQM) principles.

As companies in the market continue to restructure, they are making greater use of available technology from information services vendors. Additionally, TQM implementation requires increases in automation, improved work flow and immediate information movement and availability. The latter part of the chapter discusses recent trends and improvements in information technology offerings.

## A
## General Business Trends and Events

In retrospect, 1993 was a very good year for the U.S. economy. The recession that was halted in 1992 generated a slow recovery in 1993, and the pace of recovery should now accelerate as the pent-up demand for consumer products is satisfied by new production. In addition, the U.S. auto industry continued its strong competitive performance against foreign manufacturers.

Industrial demand has also been on hold for the last few years, as fiscal caution forced conservative spending patterns for industrial goods and services, including information services. Now, with the country back on a slow but steady growth path, INPUT believes that spending by discrete manufacturers for IS will continue on the healthy path forecast in INPUT's 1993*Discrete Manufacturing* report.

According to the Department of Commerce's 1994 edition of The *U.S. Industrial Outlook*, American industry is healthy and growing at a moderate pace. Exhibit II-1 summarizes growth in revenues for discrete manufacturing industries. Key points to emphasize are:

- Machine tools are expected to grow at 12.1% and production machinery at 5.5% this year, paving the way for continued growth across the discrete manufacturing industry.
- The aerospace and defense industries continue to slow overall industrial growth. When these industries are included, overall growth in discrete manufacturing is expected to be a negative 0.5%; excluding aerospace, industrial growth should be a healthy 6.4%.

EXHIBIT II-1

**1994 Industrial Growth**

| Chapter | Industrial Grouping | 1993 Revenue ($B) | 1994 Revenue ($B) | 93-94 Growth (%) |
|---|---|---|---|---|
| 26 | Computer equipment | 62.5 | 66.2 | 6.0 |
| 21 | Shipbuilding | 9.8 | 9.5 | -3.0 |
| 18 | Electrical/energy equip. | 21.0 | 21.8 | 3.8 |
| 17 | Production machinery | 60.3 | 63.6 | 5.5 |
| 16 | Machine tools | 5.8 | 6.5 | 12.1 |
| 15 | Electronic components | 80.8 | 88.3 | 9.2 |
| 14 | General components | 22.5 | 23.5 | 4.4 |
| | Subtotal | 262.7 | 279.4 | 6.4 |
| 20 | Aerospace | 120.7 | 102.0 | -15.6 |
| | Growth for All Industries | 383.4 | 381.4 | -0.5 |

*Source: U.S. Industrial Outlook*

## B
## Specific Industry Trends, Events and Issues

The overriding trend in discrete manufacturing companies is toward delivering excellent products and/or services—on a timely basis, at a competitive price and assuring 100% customer

satisfaction. The approach mandates responsiveness to individual customers as well as to the market as a whole; while adoption of the principles has been highly beneficial, actual implementation has been slow. Those companies and/or industries that implemented new concepts early are now reaping the rewards.

- The semiconductor industry began restructuring in the mid-1980s, after suffering a major loss of market share. It has steadily increased worldwide market share, and regained the number-one market position from the Japanese.

- The domestic automotive industry, after years of declining market share, made a dramatic resurgence. By far the largest industry in the U.S., it is expected to grow by $14.3 billion in 1994 or 8.9% above 1993. This follows a strong 6.5% growth in 1993 over 1992.

Initially, companies in the discrete sector began to re-engineer their business practices to fight foreign competition. Ultimately, they achieved more—they found themselves in "market leader" positions. Now other companies are joining the march toward "excellence."

The new principles are proven: they are used and they are implemented. For buyers and sellers of IS, this is an extremely important trend. TQM has at its heart automation and totally integrated information that is available immediately. Because of the new concepts, computer-integrated manufacturing (CIM) has become a reality in many companies. As workers become empowered, they are not only allowed to make decisions, they *must* make decisions. Immediate, complete and accurate information is required at all levels for decision-making to be effective.

### 1. Re-engineering the Manufacturing Company

Restructuring is continuing on a large scale throughout discrete manufacturing companies. Although it has many elements, the major factors are listed in Exhibit II-2.

EXHIBIT II-2

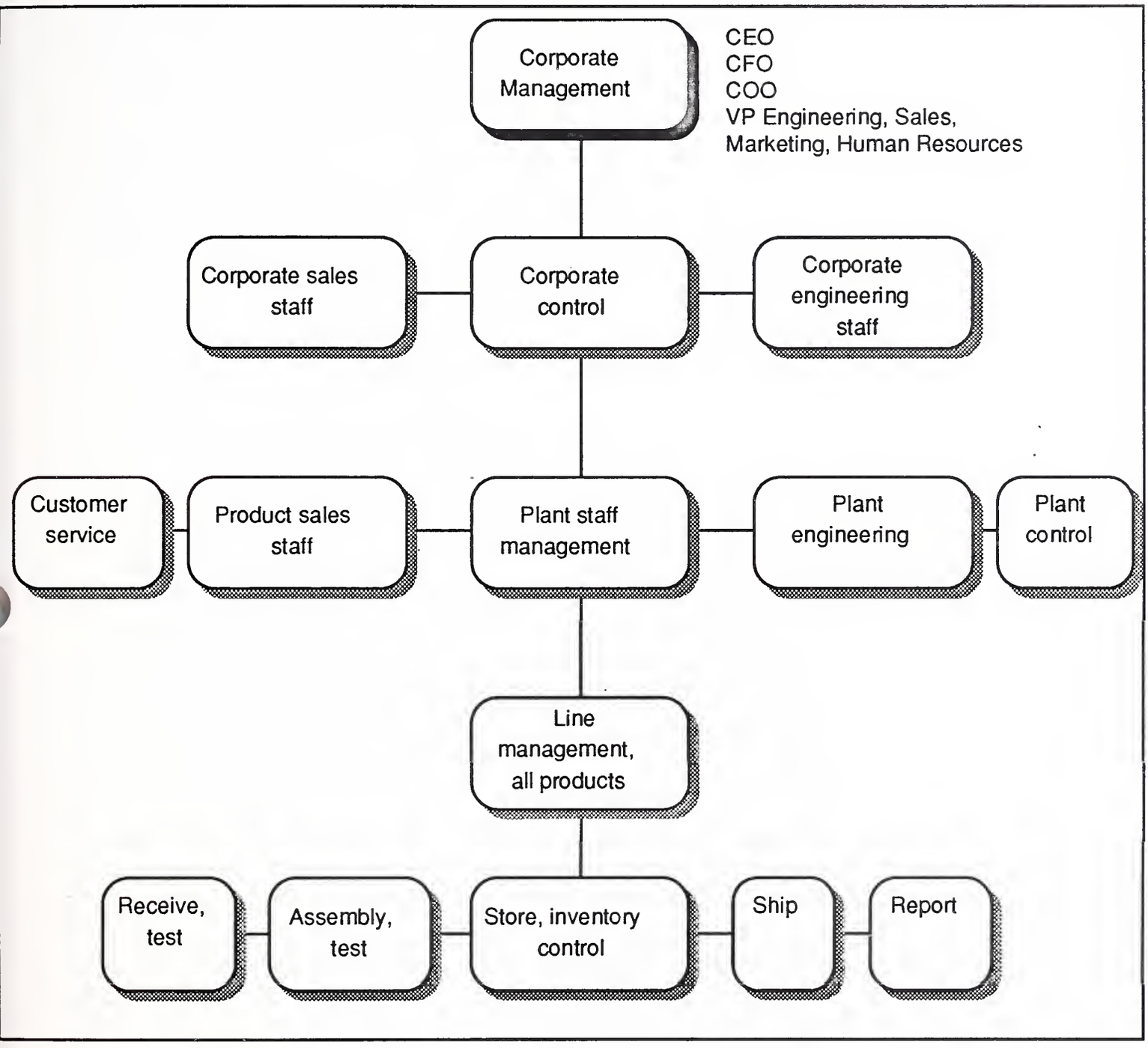
## Elements of Re-Engineering

- Team assignments to perform complete operations, typically called "focused cells."
- Worker empowerment, moving decisions to the lowest level possible.
- Continuous improvement in terms of:
  - Shortening all cycles in business operations
  - Work toward achieving 100%-acceptable quality
  - 100% customer satisfaction
- Responsiveness to total market and individual customer needs
- Streamlining to perform only in a company's area of expertise

As shown in the 1993 report, cellular concepts in manufacturing brought positive changes to the work environment. The old hierarchical structure is noted in Exhibit II-3.

EXHIBIT II-3

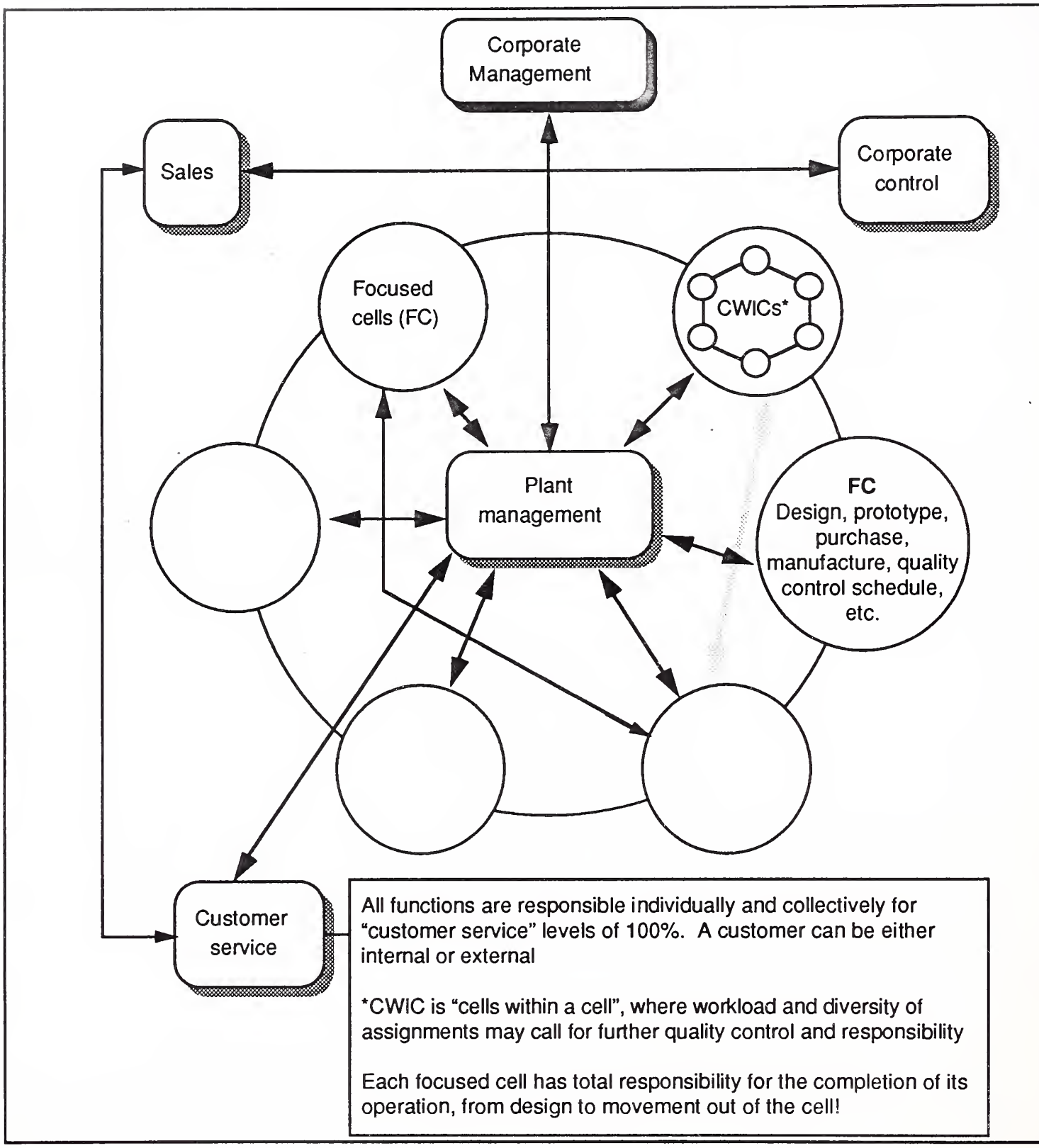
## Old Hierarchical Structure




However, the old structure has given way to a new way of conducting business activity, as shown in Exhibit II-4.

EXHIBIT II-4

## Re-Engineered Structure




The new cellular structure leads to worker empowerment and accountability. With quality and service as the key watchwords,

the ability to react must reside at the point of opportunity or problem.

As worker involvement and the team approach succeed, real benefits to companies are becoming evident in terms of continuous improvement. For instance:

- Product life cycles are shortening dramatically and "time to market" for new products is keeping pace with the change. For example, Chrysler brought the Dodge Viper to market in only three years, a 25% reduction in the typical four-year cycle to introduce a new car. Much of the reduction is due to concurrent/simultaneous engineering methods. Products are also designed for easier manufacturing.

- Order-receipt-to-shipping cycles have contracted. Motorola pagers went from three weeks' lead time to two hours. A General Electric controls plant dropped from six months' lead time to three weeks. Aside from better customer service, these improvements also offer financial benefits in terms of lower inventories and fewer returns.

- Quality improvement reports are staggering. Scrap is reduced from the 3% to 5% range to less than 0.5%. "Rework" in companies like Hewlett-Packard has been reduced to almost insignificant numbers.

- Cycle reductions and improved quality lead to customer satisfaction. In addition, computers and automation that tracks production lots and serial numbers provides the manufacturer with the means to continue satisfaction through better and quicker service *after the sale*.

The improvements automatically lead toward satisfying total market and individual customer needs. Automation aids this pursuit through the electronic interchange of data and through advanced network services, giving businesses a quick reaction capability.

As restructuring begin, a new phenomenon occurs. Businesses have streamlined (or downsized) with a positive effect on overall performance. Operations that don't fit a company's normal practices are often outsourced. Product lines are sold to implement redefined corporate strategies. Professional services

are contracted out rather than adding internal personnel. Middle management jobs are eliminated. There are numerous reasons for all this:

- In the past, heavy taxes (50%) and high profitability made an employee's cost appear to be lower. With lower profits, extremely high benefits costs and lower tax rates, the picture has changed.

- Acquisition activities of the 1980s left many companies with too many diverse businesses, too much duplicated overhead and heavy debt burdens (often causing losses simply due to interest charges). Streamlining and downsizing became necessary for survival.

- The Japanese proved that high quality, fair prices and customer satisfaction are achievable on a profitable basis.

These re-engineering projects are leading to a re-emergence of the importance of computer-integrated-manufacturing (CIM). The original attempts at implementing CIM were restricted to making computers talk to one another. Today's information needs to support the re-engineered business call for true "Information" — Integrated Manufacturing and Service. Current technology for networking (local area networks and client/server approaches), operating systems standards and relational databases are bringing true CIM closer to reality.

### 2. Regulatory Issues/Events

The trend toward self-regulation is continuing in discrete manufacturing. The entire European Community will require conformance to ISO-9000, and that standard is rapidly emerging in the United States as well. In order for IS vendors to sell to many larger manufacturing companies, they must demonstrate a willingness to implement the new TQM practices. Companies like Ford and Motorola require such programs, and they often require (by contract) that a vendor apply for a quality certification.

Several leading IS providers in this sector have ISO-9000 certification underway for their customer support and product development organizations. One such software vendor was told by a major manufacturing company in late 1993, "We have a policy that all of our vendors must be certified in terms of quality

standards, yet we had no way of evaluating software firms. ISO-9000 certification satisfies that requirement easily."

As more IS vendors implement ISO-9000, those without it will be at a competitive disadvantage.

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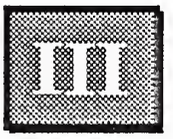


# Information Systems Environment

## A
## Global IS Issues

The re-engineering of the manufacturing business away from the hierarchical model to focused cells (see chapter 2) is causing a restructuring of manufacturing information service operations away from centralized mainframes toward work group-oriented systems and client/server architectures.

## B
## IS Applications Environment

Exhibit III-1 shows responses to key discrete manufacturing industry survey questions, regarding planned applications, by application category.

An explanation of the column headings follows:

- "Number of Applications" is the total number of applications for each application category.
- "Strategy" contains two subheadings, "Client/Server" and "Downsizing." The "Client/Server" count by category indicates the number of applications within the category that will use a C/S architecture. The count under the heading "Downsizing" represents the number of client/server applications (of the total that are implemented) that are part of a general downsizing strategy.

- "Platform" indicates the number of times one of three major platform classes was mentioned as the key implementation platform. More than one response per application was permitted.
- "Resources" covers six potential sources that will be employed as part of the implementation process. As was the case with the question regarding platform, more than one response per application was permitted.
- Finally, for each application, respondents indicated whether the application would use EDI or be outsourced. The last two columns give a tabulation.

EXHIBIT III-1

## Planned Applications in Discrete Manufacturing

| Application Category | No. of Apps. | Strategy | | Platform | | | Resources | | | | | | EDI | Out-sour-ced |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Client Srvr | Down size | CS/ LAN | Mini-comp-uter | Main-frame | Corp. IS | Dept. IS | User Staff | Sys. Integ-rators | Other Out-side Svcs. | Pack-aged Soft-ware | | |
| Financial | 54 | 34 | 21 | 28 | 13 | 22 | 25 | 15 | 18 | 4 | 6 | 29 | 16 | 0 |
| Mfg. Operations | 44 | 20 | 12 | 16 | 16 | 14 | 16 | 16 | 14 | 6 | 10 | 16 | 19 | 0 |
| Infrastructure | 35 | 29 | 10 | 25 | 9 | 8 | 10 | 19 | 11 | 3 | 4 | 11 | 14 | 3 |
| Engineering | 25 | 15 | 7 | 13 | 7 | 4 | 5 | 12 | 8 | 1 | 5 | 4 | 12 | 5 |
| Sales/Marketing | 22 | 10 | 5 | 10 | 6 | 7 | 10 | 10 | 8 | 3 | 4 | 9 | 13 | 5 |
| Database | 10 | 6 | 1 | 6 | 4 | 4 | 0 | 3 | 2 | 0 | 1 | 4 | 5 | 3 |
| Personnel | 6 | 2 | 2 | 2 | 1 | 3 | 2 | 1 | 4 | 0 | 1 | 1 | 2 | 7 |
| Inventory | 5 | 1 | 1 | 1 | 4 | 0 | 3 | 3 | 1 | 0 | 1 | 1 | 1 | 1 |
| Purchasing | 4 | 0 | 0 | 0 | 1 | 3 | 3 | 1 | 0 | 0 | 0 | 0 | 2 | 0 |
| Logistics | 2 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 2 | 0 |
| Total | 207 | 118 | 59 | 102 | 62 | 65 | 75 | 81 | 66 | 17 | 32 | 75 | 86 | 24 |
| Percent | 100 | 57 | 29 | 49 | 30 | 31 | 36 | 39 | 32 | 8 | 15 | 36 | 42 | 12 |

There are a number of observations that can be drawn from analyzing the summary data:

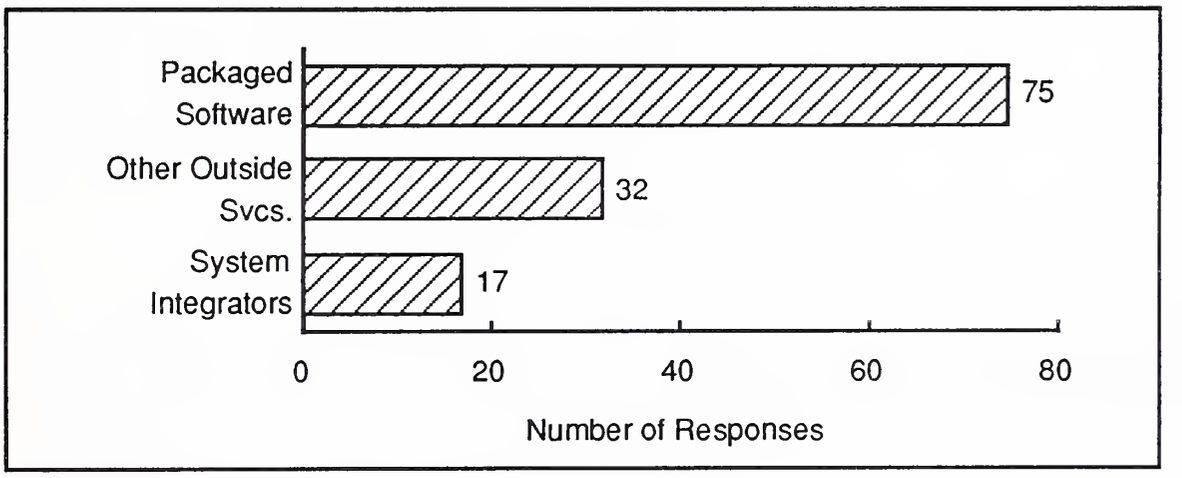
- The information systems function, either corporate IS or departmental IS, will provide resources for three out of every four planned applications.
- More than half (57%) of the 207 applications identified in the survey plan to use some sort of client/server architecture.
- Forty-two percent (42%) of the applications will use EDI (electronic data interchange) in some form.
- Packaged software is planned for 36% of the applications.

## C
## IS Response to Environmental Forces

Sixty percent (60%) of all discrete manufacturing firms in INPUT's survey plan to use outside resources to implement new applications. As shown in Exhibit III-2, packaged software is the most frequently used outside resource in this sector, and is planned for 75 out of the 207 applications in the survey.

EXHIBIT III-2

**Use of Outside Products and Services**




*Total Mentions: 124*

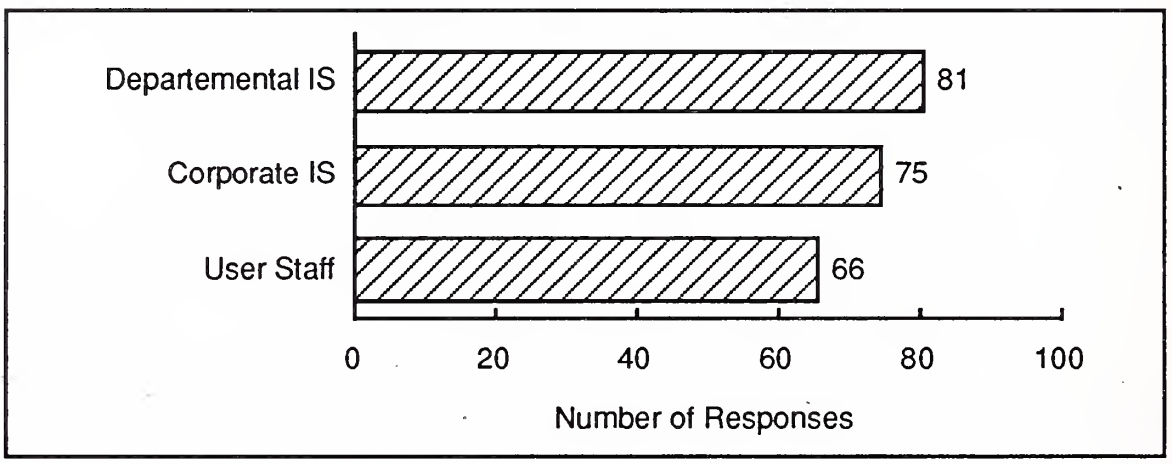
Other outside resources, mostly professional services, are planned for 32 applications, while systems integrators will be used on 17 projects. This low number should not discourage systems integration firms, however, as projects involving systems integrators in this sector tend to be much larger than those which do not.

The average project that planned to use systems integration exclusively was budgeted in the $500,000 to $1 million range, while those using packaged software or professional services exclusively were in the $100,000 to $500,000 range.

Exhibit III-3 shows that the information services function, whether at a corporate or departmental level, will provide resources on 15% of the 207 planned applications, or 75%.

EXHIBIT III-3

**Internal Development Resources**




There is a strong move toward client/server architectures in this sector, with 57% of new applications planned using this approach. In INPUT's view, the move to client/server computing is a long-term trend in discrete manufacturing, driven by the continuous restructuring discussed in Chapter II.

## D
## Impact of New Technologies

The increasing demand to integrate manufacturing processes and systems has resulted in some vendors offering integration tools to address user needs. Fastech's *Cellworks*, US Data's *Factory-Link*, Savior's *Flexis* and Lotus' *@ Factory* are examples of products designed primarily to tie equipment together. They use standard "drivers/servers" to bypass differences in protocols.

The concept is expanding to include application products, with tools (called application enablers) provided by the same vendors. As open systems begin to appear, the length of integration projects will shorten and the requirement for cross-discipline expertise

should diminish. When systems are designed with openness in mind, using object-oriented techniques, each discipline can define its own integrated information needs.

Changes to company infrastructures will become a continuing process, causing the IS function to constantly play catch-up. As such, object-oriented programming (OOP) could become a standard for program development for manufacturers as well as IS providers in this sector. The knowledge and experience to use and implement OOP is slowly appearing, and should cause major redevelopment activities and systems changes within the next five years. The long-term advantages of OOP, primarily lower maintenance costs and easier systems changes for open/integrated environments, will far outweigh the costs of implementation.

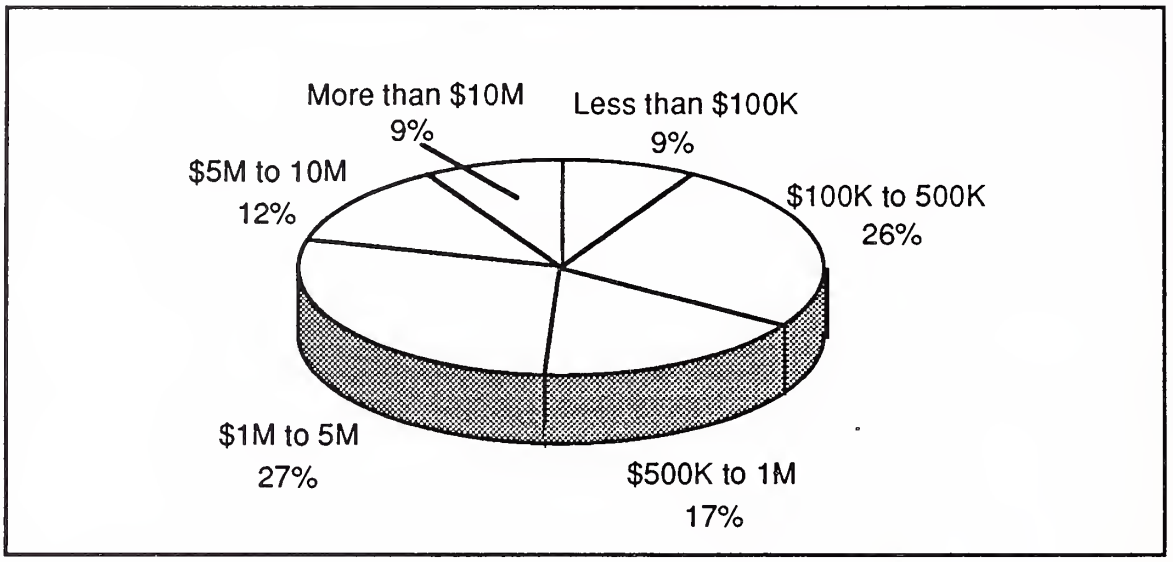
## E
## Organization and Budget

INPUT asked those surveyed to indicate how much they intended to invest in applications, excluding hardware. As shown in Exhibit III-4, almost half of the projects planned in discrete manufacturing are have an applications budget more than $1 million.

*Note: The number of applications referenced (352) is larger than the number shown in Exhibit III-1, because the response base for that exhibit includes those who answered all applications characteristics questions, while those respondents used for Exhibit III-4 may have only answered the applications budget questions.*

EXHIBIT III-4

**Planned Investment in Applications**

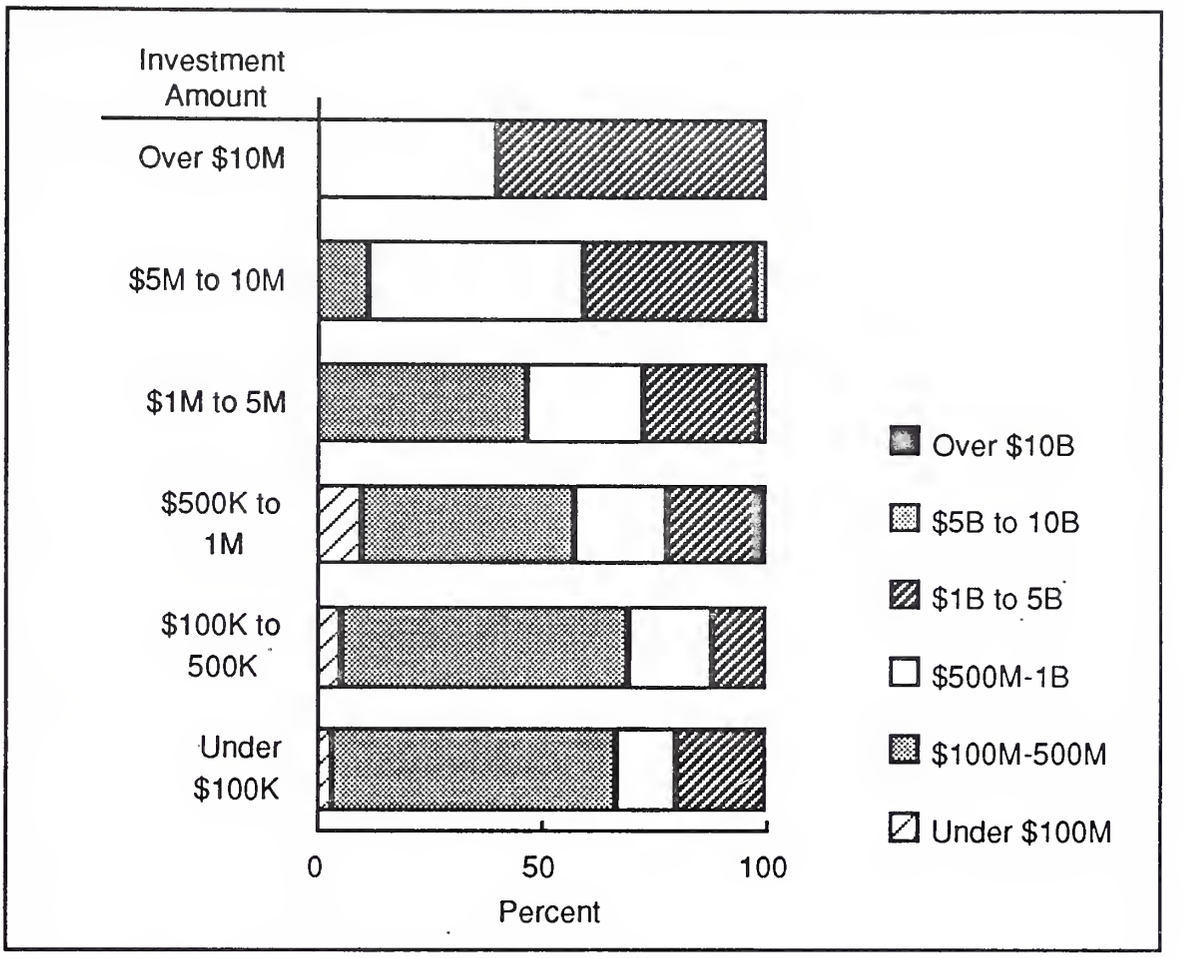



*352 Applications*

As one might expect, the big projects tend to be in big companies. Only 17% of the projects budgeted at more than $500,000, are in companies with less than $1 billion in sales. Exhibit III-5 shows planned investment in applications by company size.

EXHIBIT III-5

**Planned Investment by Company Size**



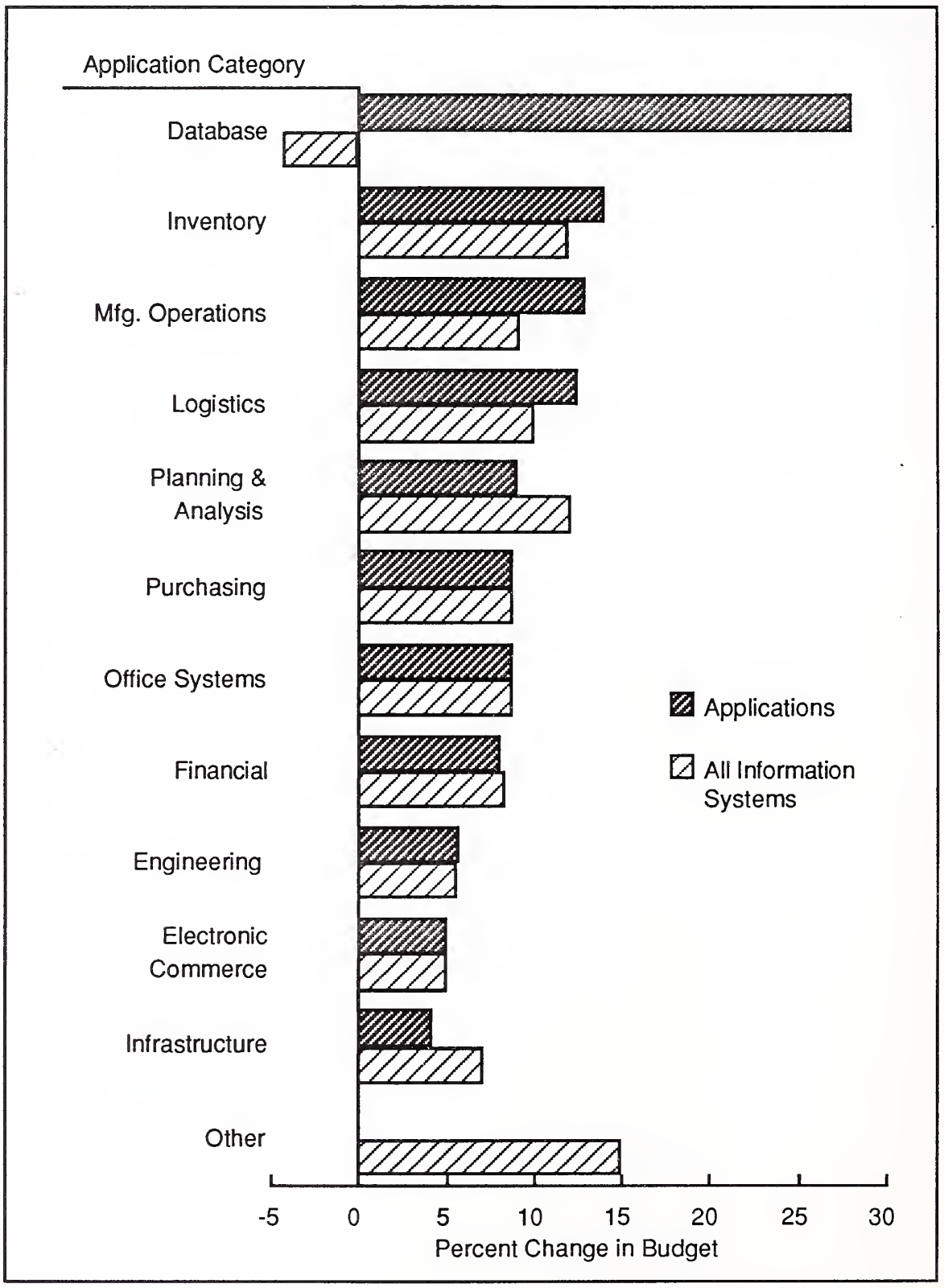

On average, respondents indicated that spending on applications would increase by 8.9% in the next year. As shown in Exhibit III-6, spending on database applications will grow the fastest at 28%. It is notable that total IS spending for database (which includes hardware expenditures) will decrease, indicating a shift of investment away from hardware and toward software and services for this application category.

On the other hand, spending on planning and analysis will grow at a healthy 13%, though the growth will be for hardware.

In all other categories, there are no significant differences in spending patterns on applications versus total IS spending.

EXHIBIT III-6

## Percent Change in Budgets

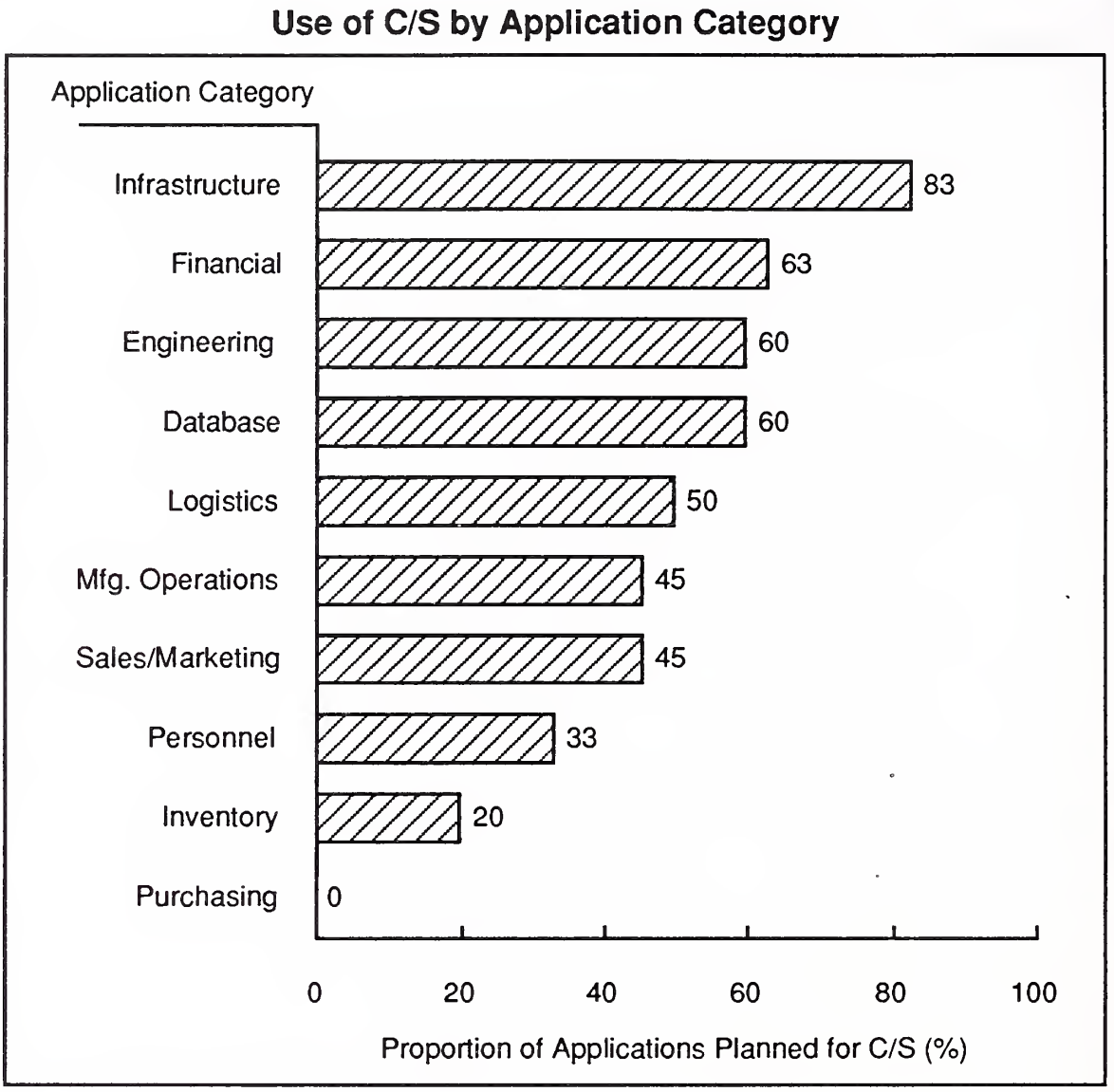


## F
## IS Department Objectives

In the most recent survey of discrete manufacturing firms, INPUT focused questions regarding information systems objectives on three areas: downsizing of applications, migration to client/server architectures and increasing/decreasing emphasis on standardization.

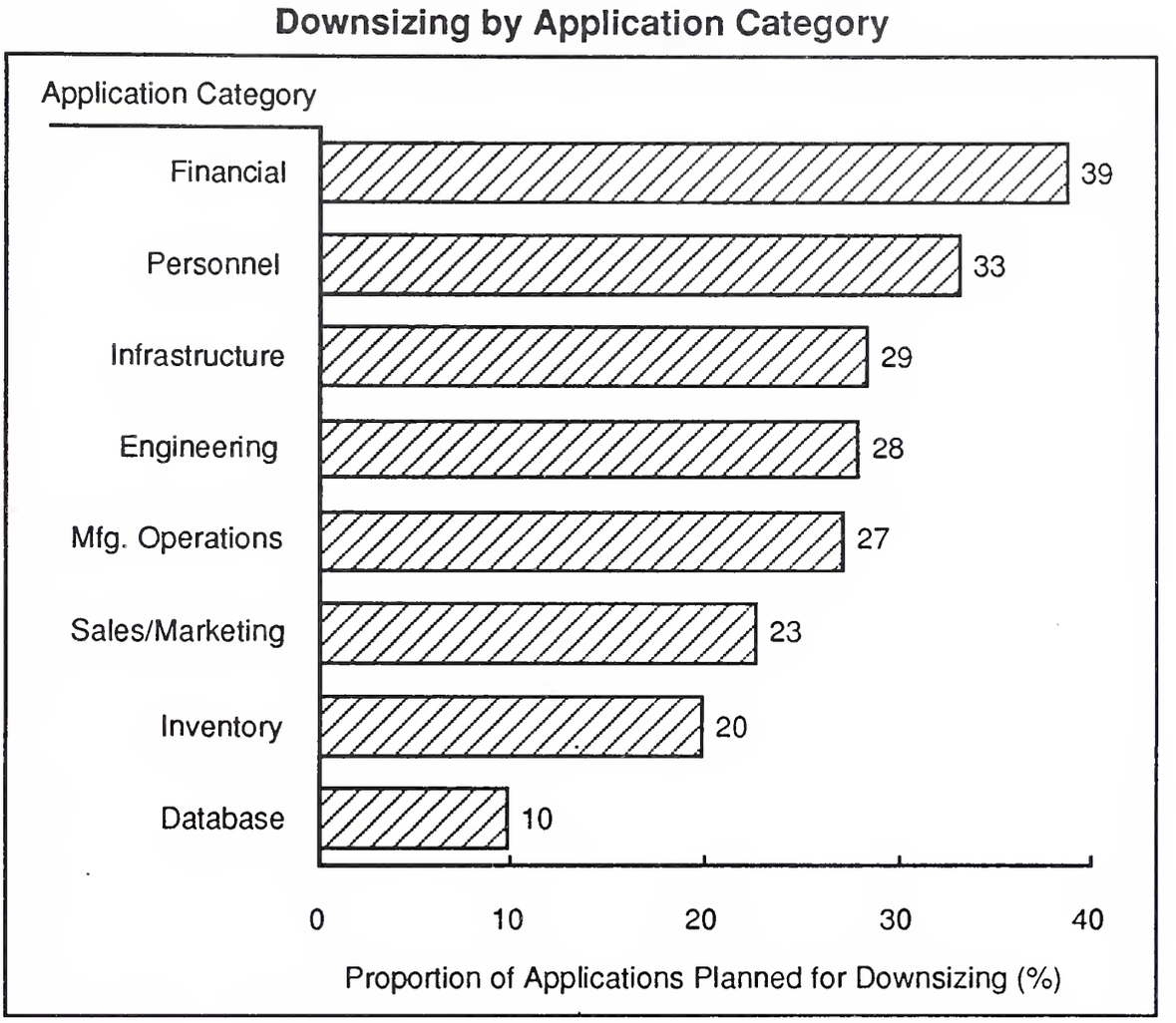
The most pronounced trend evident from the survey is the migration to client/server. Respondents indicated that they planned to use C/S for 57% of planned applications overall. A very high proportion (83%) planning to move infrastructure toward client/server indicates the strength of this trend. Exhibit III-7 summarizes the use of client/server by application category.

EXHIBIT III-7




Twenty-nine percent (29%) of all respondents said they planned to downsize applications, though 39% of financial applications are downsized. Downsizing plans by application category are shown in Exhibit III-8.

EXHIBIT III-8




The vast majority of people interviewed were silent on the subject of standardizing platforms and operating systems. Only 16% respondents indicated that they planned to increase standardization, and 2% anticipated a decrease in standardization.

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IV

# Market Forecast

## A
## Market Overview

The market for information services in the discrete manufacturing sector is expected to continue healthy growth through 1999. The analysis in this chapter is presented for seven product and service groups. They are:

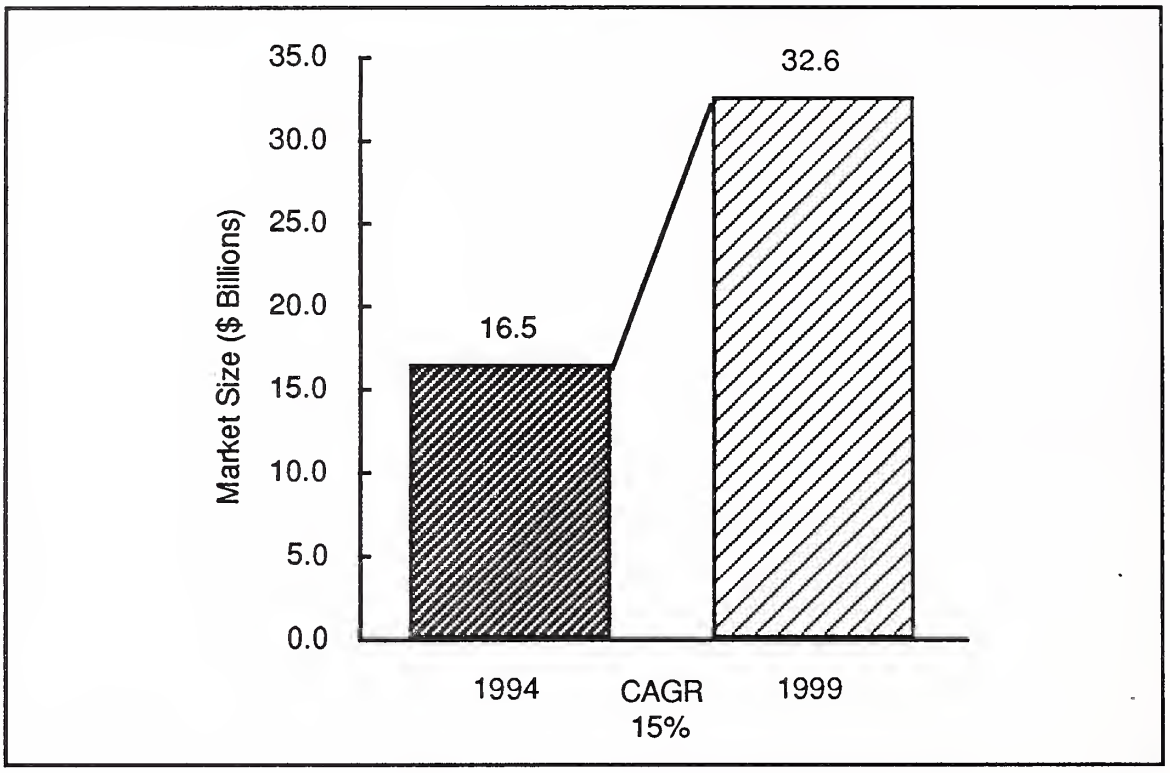
- Applications software products
- Network/electronic information systems
- Processing services
- Professional services
- Systems integration
- Outsourcing
- Turnkey systems

As shown in Exhibit IV-1, the total market for these services is forecast at $16.5 billion in 1994 (a 13% growth over 1993), expanding to $32.6 billion in 1999, for a compound annual growth rate (CAGR) of 15%.

INPUT anticipates increased growth rates during the latter part of the forecast period as IS functions keep pace with changes to company infrastructures. As manufacturers continue to re-engineer their businesses in the drive to TQM, information systems must change.

EXHIBIT IV-1

**Information Services Market, 1994-1999**




## 1. Driving Forces

*Business Process Re-engineering*—The re-engineering of business processes is driving demand for information services in this sector. As companies restructure, the information systems function within a manufacturing company must respond with new techniques for providing immediate and accurate decision-making information. As traditional hierarchies are flattened and the focused-cell teams become cross-functionally self-sufficient, many support functions are migrating to line roles. The move to client/server environments is compatible with this new structure.

*Competition*—Strong competition among vendors aids growth in the information services market. In each product and service category there are several strong competing vendors, and, in general, no single vendor has gained dominance. In addition, highly specialized vendors are entering the market and carving out their own niches. Future Three Software in Livonia, Michigan, for example, specializes in automotive release systems, which help integrate existing MRP and EDI systems for production automotive suppliers.

*User knowledge*—The strong trend to client/server systems means that more users will deal with new systems. Users are trained continuously in new methods of using information systems, and are looking to the vendors to provide expertise. Training providers, including professional services firms, systems integrators and suppliers of turnkey systems, will all benefit.

### 2. Growth Inhibitors

*Customization*—Because open systems are not available across all applications, significant customization is still required to integrate new applications with existing ones. This slows the systems implementation and realization of benefits. While professional services vendors and systems integrators will benefit from such customization, total market expansion would occur more rapidly if there were less need for product modification. The allocation of dollars, by category, should change over the forecast period toward more product sales as open systems become available.

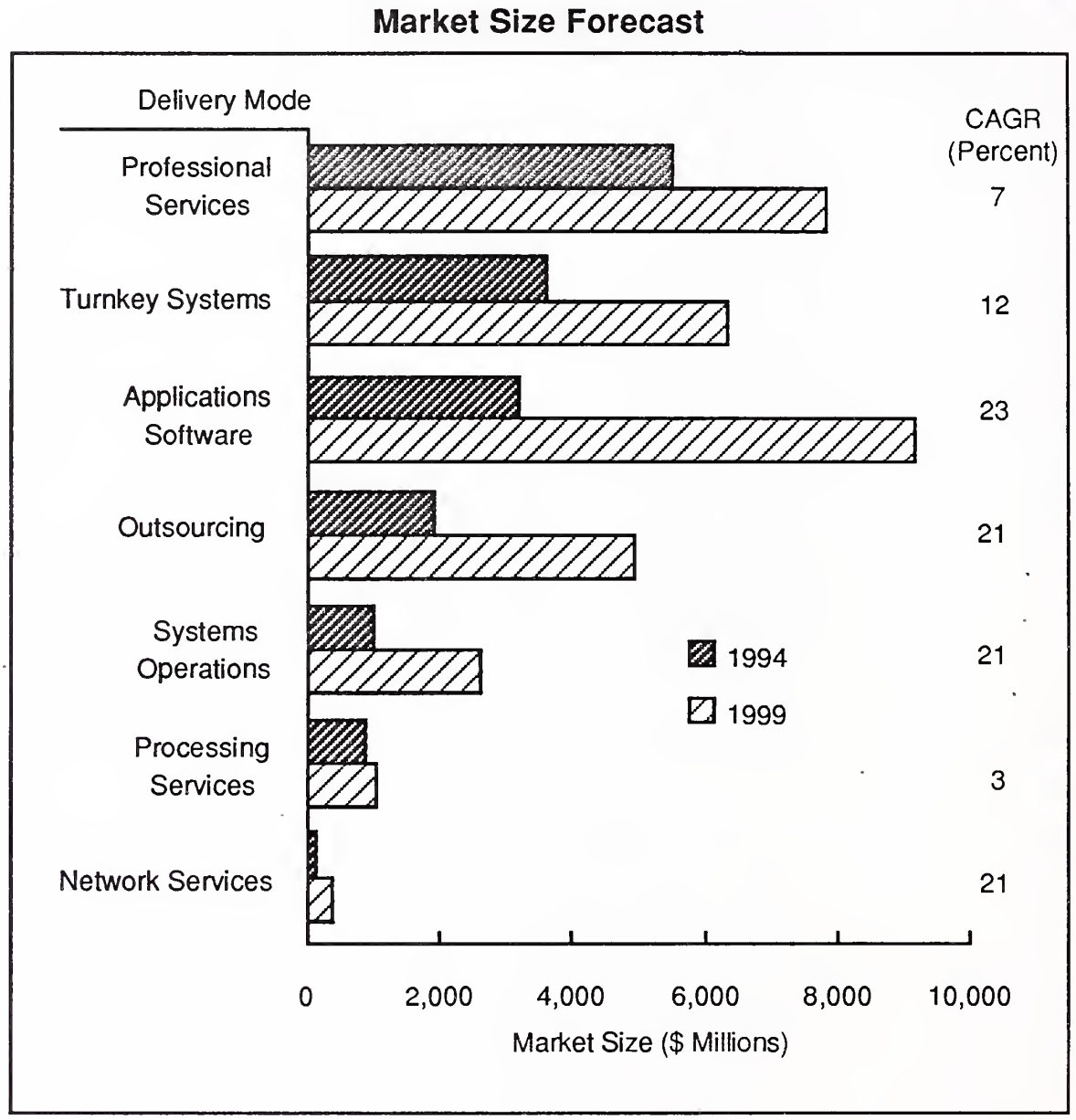
*Vendor Sales Personnel*—Product vendors often fail to provide in-depth training in manufacturing applications for their own personnel, concentrating instead on product training. Consequently, sales people tend to focus on features of their products rather than the problems of the customer. A fundamental communications gap develops, with vendors talking about product features and buyers trying to understand how all this helps them do their job. Third-party consultants are often hired to assist in the evaluations, adding another element to the decision process.

Furthermore, with increasing focus on manufacturing systems integration, buying and implementation decisions are made by committees. As manufacturing software continues to evolve and become more complex, it is increasingly difficult for buyers to differentiate between alternatives, with the net result that the buying process is lengthened.

## B
## Forecast by Product and Service

Exhibit IV-2 displays market size and growth rates by product and service category.

EXHIBIT IV-2




## C Analysis

### 1. Professional Services

The largest category of information systems expenditures is professional services. At $5.2 billion in 1993, and growing at 7% throughout the forecast period to $7.9 billion, it represents a substantial market. INPUT has revised the growth rate during the forecast period, down slightly to 7% from the 8% figure in the 1993 report. The strong growth expected in packaged software and systems integration in this sector will come at the expense of professional services.

### 2. Turnkey Systems

The second-largest product and service category is turnkey systems, at $3.3 billion in 1993. With shop floor and other dedicated systems still a part of the American manufacturing scene, this sector is a natural market for turnkey systems. This mode should continue to grow at 12% through 1999, to $6.4 billion.

### 3. Applications Software

Applications software will be the fastest-growing product and service category, at a CAGR of 23% through 1999, although 1993-94 growth is expected to be at 20%. Standing at $2.7 billion in 1993, expenditures should reach $9.2 billion by 1999, surpassing the current product and service category leader (professional services). The strong growth results from continued expenditures on traditional systems, such as MRP II, plus expenditures on newer technologies, such as manufacturing execution systems or object-oriented systems.

### 4. Systems Integration

The systems integration market is another fast-growing product and service category, showing a 21% CAGR through 1999 and reaching almost $5 billion in that year. The importance of systems integration at present cannot be overstated. The "legacy" build-up of islands of automation and information is a deterrent to the success of a re-engineered business. Systems integrators enjoy growth in a market that requires specific knowledge in multiple disciplines, a knowledge which is seldom available in-house.

### 5. Outsourcing

Outsourcing is divided into platform, applications, desktop services and network management submodes. Growth in this area is forecast at a 21% CAGR through 1999, from more than $850 million in 1993 to almost $2.7 billion in 1998.

INPUT's view is that client/server implementations and downsizing will create needs that cannot be served in-house. Growth in outsourcing will come from two specialized submodes: desktop services and network management. Desktop services now includes document imaging and publishing. Network management includes WANs and LANs; it is a rapidly changing

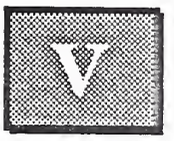
area, considering the complex client/server and distributed database resources now available.

### 6. Processing Services

Processing services is the slowest-growing product and service category in the discrete manufacturing information services market. Some growth will occur as a by-product of the growth of those companies already using "outsourced" production resources. There will also be some growth as a result of the gradual move away from mainframes, because certain applications will need access to high-powered transaction and/or database capabilities. As hardware prices drop and parallel processor products mature, pressures will be brought to bear on this market.

### 7. Network Services

The smallest product and service category, network services, is made up of electronic information services and network applications. This is a fast-growing submode, and INPUT forecasts a 21% CAGR through 1999—tripling the market from almost $130 million in 1993 to $410 million by 1999. The largest revenue contribution will come from the expansion of EDI services/applications. There will continue to be intracompany needs for those large, multiplant enterprises that are creating focused manufacturing plants which rely on information from other focused plants. There will also be increased vendor/customer communications assets to manage, as users build partnerships and share more information.



# Competitive Environment

This chapter presents an analysis of information services vendors serving the discrete manufacturing sector. The chapter is divided into the following sections:

- Competitive Climate
- Vendor Ratings
- Competitive Positioning
- Leading Vendor Profiles

In the conduct of its research, INPUT performs extensive analyses of vendor revenues. To present useful and accurate information for the discrete manufacturing market, U.S. revenues are separated from worldwide revenues, and revenue is split between discrete and process manufacturing sectors in instances where an information services vendor serves both sectors.

## A
## Competitive Climate

Every vendor in this market sector has struggled over the past two years to deliver products that run in a UNIX environment with a relational database and a graphical user interface. While most can now point to customer installations of these new systems, few have completed the process. The time needed to develop new products is lengthening and product life cycles are shrinking.

At the same time, vendors known primarily for turnkey systems are rapidly shifting to become software companies which support multiple platforms.

The strategic focus for information systems projects continues to be integration, integration, integration. Systems vendors must offer systems that tie the whole enterprise together, moving from manufacturing resource planning (MRP) to Enterprise-wide Resource Planning (ERP). Information systems and services vendors participating in this marketplace must understand that systems decisions are made in the context of business process re-engineering.

## B
## Competitive Positioning

A weak economy in the United States and abroad over the past few years occurred at a time when vendors had to make significant investments in migrating their products to an open architecture. This combination hurt profits, especially in companies such as The ASK Group, which were late to update their product offerings. To participating vendors, the market is characterized by increased competition and pricing pressure.

There is also increased alliance and acquisition activity as companies try to gain product development expertise, market share and experience in vertical market segments. The acquisition of Elke Corp. by System Software Associates (SSA) and the alliances between SSA and most of the major systems integrators serving this sector are examples.

Discrete manufacturing vendors can be considered in the following segments:

**1. Traditional MRP**

- American Software
- Andersen Consulting
- The ASK Group
- Cincom Systems
- Computer Associates
- qad.inc.

- SAP America
- Symix Systems, Inc.
- System Software Associates

**2. Cell Controllers**

- Fastech
- Savior
- US Data

**3. Manufacturing Execution Systems (MES)**

- Consilium
- Effective Management Systems
- Promis

## C
## Selected Vendor Profiles

### 1. SAP America

International Court One
100 Stevens Drive, Suite 350
Lester, PA 19113
(215) 521-4500
President: Klaus Besier
Wholly Owned Subsidiary of SAP AG
Total Employees: 420
Total Revenue: $129,000,000
FYE: 12/31/93

#### a. Company Background

SAP America, Inc. markets and supports the client/sever-based R/3 System and the mainframe-based R/2 System, fully integrated applications software systems designed to integrate the information needs of Fortune 500 companies. SAP America was

established in January 1988, and operates as a wholly owned subsidiary of SAP AG, developer of the R/2 System.

- SAP AG was founded in 1972 in Walldorf (Germany) by four former IBM engineers.
- In 1985 SAP International was formed in Biel (Switzerland) to support the marketing and sales activities of SAP AG's international subsidiaries. SAP International's operations were consolidated into SAP AG's headquarters in Walldorf in April 1992.
- SAP AG reported sales of $665 million (U.S.) for 1993, an increase of 32% over 1992 sales. SAP AG currently has 3,500 employees, 28 international subsidiaries and more than 3,000 customers in 36 countries.

### b. Strategy

SAP's challenges are to expand its international coverage and customer base; exploit opportunities in eastern Europe; while at the same time extending market coverage to small and medium-sized organizations in the North America and Western Europe.

To address the needs of large and midsize corporations that require integrated applications systems using an open systems client/server strategy, SAP introduced the R/3 System, with first deliveries to North American customers in September 1992.

Like the R/2 System, the R/3 System provides a range of on-line, real-time, integrated business applications. Also like R/2, R/3 customers can address specific applications needs while laying the foundation for a single, enterprise-wide strategy.

The delivery of R/3 to North America, was ahead of SAP's announced schedule and well ahead of major competitors such as System Software Associates and The ASK Group.

### c. Products and Services

The R/3 System is an integrated set of 10 business applications modules that manage a range of strategic business applications for data-intensive corporations with numerous locations and operations.

- The core of the R/3 System is the Basis System, which contains development tools for the system and provides interface capabilities that allow users to access database information in any module from anywhere in the company.
- R/3 System modules include:
  - RF: Financial Accounting
  - FA: Fixed Assets
  - RK: Cost Accounting
  - RK-P: Project Planning and Control
  - RV: Sales-RM-PPS: Production Planning and Control
  - RM-MAT: Material Management
  - RM-QSS: Quality Assurance
  - RM-INST: Plant Maintenance
  - RP: Personnel Management
- Modules are available and priced separately. Pricing on the Basis System starts at $100,000, depending on configuration.

### d. Key Issues

Key issues concerning the company are:

- SAP America has strategic alliances and relationships with professional services firms and systems integrators that augment its sales and support efforts in the United States. SAP Alliance partners include Andersen Consulting, CAP Gemini America, Computer Task group, Coopers & Lybrand, Deloitte & Touche, Ernst & Young, KPMG, Price Waterhouse and SHL Systemhouse.
- Despite its relatively recent introduction, the R/3 System accounted for more than 80% of the company's 1993 North American revenues.

## 2. System Software Associates

500 West Madison Street 32nd Floor
Chicago, IL 60661
Phone: (312) 641-2900
Fax: (312) 641-3737
Chairman, President and CEO: Larry J. Ford
Status: Public
Total Employees: 1,500
Total Revenue: $263,400,000
Fiscal Year End: 10/31/93

### a. Company Background

System Software Associates, Inc. (SSA), founded in 1981, develops, markets and supports BPCS (Business and Planning Control System), an integrated line of business software for manufacturing, financial and distribution management applications designed to run on IBM's AS/400, as well as the IBM RS/6000 and the HP-9000. SSA's revenue is derived primarily from the discrete manufacturing, process manufacturing and distribution industries. SSA sells and supports its products through its affiliate network, a major accounts organization and branch offices.

### b. Strategy

SSA defines its market as the industrial sector and aims its products at international companies. In June, 1993, SSA announced an open systems strategy, marking a departure from its focus on the IBM AS/400 and S/3x platforms. Delivery of the first open systems version of the products in the announcement was scheduled for "early 1994."

The company also changed its organization from a regional to a country focus, establishing entrepreneurial, self-sufficient teams in each country where it is represented.

### c. Products and Services

Seventy-one percent (71%) of SSA's fiscal 1993 revenue was derived from license fees, 29% from client support services and other sources. SSA's primary software product line known as the Business Planning and Control System (BPCS/AS) consists of integrated products designed for manufacturing, distribution and

financial applications. This set of applications is augmented by EDI/SET to support electronic data interchange for the BPCS/AS applications and AS/SET of CASE tools that facilitate customization of the applications.

During 1993, the company acquired Elke Corp., a provider of software for tracking and managing the maintenance of equipment, facilities and vehicles. The product line, called Main/Tracker, has 2,500 installations and, as is the case with the other SSA products, is migrating to an open system, client/server approach in 1994.

**d. Key Issues**

Key issues concerning the company are:

- The rate of revenue growth from fiscal 1991 to 1993 declined, primarily as a result of weakened economies in SSA's major overseas markets, and diminished foreign revenues due to a strengthening of the U.S. dollar. Competition from other vendors whose open systems offerings were available for shipment in 1993, notably SAP, was probably a factor as well.

- Revenue growth was also reduced by the planned reduction in hardware reseller sales associated with SSA's withdrawal from the IBM U.S. Industry Remarketer program.

- Sales increased by existing affiliates and continued expansion of the company's global affiliate network.

- Direct entry into key markets, usually by acquiring the affiliate in the market.

- Expansion of SSA's client services groups which increased revenues by 50% in fiscal 1993.

- Introduction of new BPCS/AS and AS/SET products.

- SSA's HelpLine, a telephone support service for SSA's software clients, is in the process of certification according to ISO-9000 standards.

- SSA's primary competitors for its BPCS product line include American Software, Andersen Consulting, ASK Computer Systems and Marcam. CASE competitors include Synon.

### 3. The ASK Group

2880 Scott Blvd.
Santa Clara, CA 95052
Phone: (408) 562-8800
President and CEO: Eric Carlson
Status: Public
Total Employees: 2,300
Total Revenue: $426,213,000
FYE: 6/30/93

#### a. Company Background

The ASK Group develops, markets and supports manufacturing and financial management applications for HP, DEC, IBM midrange and UNIX-based computers, which are available as software products or turnkey systems and via processing services. As a result of the acquisition of Ingres Corporation, The ASK Group also provides relational database management systems (RDBMSs) and application development tools for open systems.

#### b. Strategy

The ASK Group pursued a strategy of diversification by developing and acquiring core software technologies intelligent relational databases, fourth-generation language (4GL) development environments, application development tools and open application products, in addition to its traditional manufacturing and financial management applications products for Hewlett-Packard (HP), DEC and IBM midrange systems.

The company's development plans include moving its applications to an open systems environment with software operating on all the major hardware platforms.

The company also concentrates on selling software and services and the continued de-emphasis of low-margin third-party hardware sales. Marketing focuses on expanding direct and indirect channels of distribution. The company's strategy is to sell direct only when it adds value; in all other cases, it leverages sales through VARs, system integrators and distributors.

### c. Products and Services

*Database and Connectivity*—These products include the ASK INGRES Intelligent Database, Knowledge Management, Replicator, Enhanced Security, Net, Star and Gateway products for Intel-based, DEC, HP, Sun Microsystems and IBM computers, minicomputers, workstations and PCs running proprietary and UNIX operating systems. In addition, Ingres products have been ported to operate with a range of computers from other computer system companies.

*Applications*—The ASK MANMAN Information System is an on-line, interactive system that consists of integrated products for manufacturing, finance, marketing, customer service, decision support and computer-integrated manufacturing functions. There are more than 2,000 MANMAN clients worldwide. The products run on HP, DEC and UNIX systems.

ASK SIM/400—supports manufacturing, accounting, bar code, distributed requirements planning (DRP), sales order management, multiple CPU distributed requirements planning and EDI functions.

*Tools*—Tools products allow customers and systems integrators to adapt manufacturing products to specific needs. They include ASK Windows4GL, ASK Vision, as well as query and reporting tools and imbedded languages.

### d. Key Issues

Key issues concerning the company are:

- The ASK Group continues to de-emphasize its hardware reselling activities, and focus on its software and services business. Prior to the 1990 acquisition of Ingres, about 80% of revenue was from the U.S. and hardware resales accounted for more than 50% of total business. Now 51% of revenue comes from international markets and more than 88% is from software licenses and services.

- The company expanded its client base to include not only manufacturing customers, but also customers in international banking, government, transportation, telecommunications, advanced research and retail.

- Sales in 1993 declined 1.4% over 1992 to $426 million. The company posted a nominal profit of $149,000 in 1993, compared to a loss of $47.7 million the previous year.

- The ASK Group attributes its problems to being slow to move its flagship manufacturing products away from proprietary operating systems for DEC/VAX, HP-3000 and IBM AS/400 computers. The company shipped 100 licenses of UNIX-based ASK MANMAN/X in 1993.

- In March, 1994, Eric Carlson was appointed president and chief executive officer of The ASK Group, replacing Pier Carlo Falotti, who resigned.

### 4. qad.inc

qad.inc
6450 Via Real
Carpinteria, CA 93013
Phone: (805) 684-6614
President and CEO: Pamlea Lopker
Status: Private
Total Employees: 400
Total Revenue: $65,000,000
FYE: 12/31/93

#### a. Company Background

qad.inc, founded in 1979, develops, markets and supports integrated manufacturing, distribution and financial applications software. The company's flagship product, MFG/PRO™, is targeted to discrete, assemble-to-order, make-to-stock, repetitive and process manufacturing environments.

In addition to its headquarters near Santa Barbara, CA, qad has direct sales/support offices in Atlanta, GA; Boston, MA; Chicago, IL; Dallas and Houston, TX; Grand Rapids, MI; Los Angeles and San Jose, CA; Mt. Laurel, NJ; Phoenix, AZ; Portland, OR; and Toronto, Ontario, Canada.

In Europe, the company has direct sales/support offices in Amsterdam, Berlin, London and Paris, with distributors in 14 countries.

In the Asia/Pacific region, the company has direct sales/support offices in Hong Kong, Sydney and Melbourne, with distributors in 10 countries.

One hundred percent (100%) of qad's revenues are from manufacturing, discrete and process, with 80% coming from applications software licenses and the remainder from associated professional services. Approximately 55% of the company's business is in North America, 30% in Europe and 15% in the Asia/Pacific region.

### b. Strategy

qad's principal strategic focus is to penetrate international markets using a product set designed with an open systems architecture. This open design gives qad a lead over competitors who still invest heavily in re-engineering their products.

qad differentiates itself from its larger competitors by emphasizing the strength of its manufacturing modules, as well as its open system design. The company emphasizes its capability to manage the entire "supply chain," from customer demand through shipping, manufacturing, receipt of materials and purchasing.

Because its products run on such a wide variety of hardware platforms, it can offer the customer the lowest total price by tailoring the network to fit the situation exactly.

The company concentrates on three industry groups: automotive; electrical and industrial products; and consumer packaged goods, more specifically: food and beverage, health and beauty aids and pharmaceuticals.

### c. Products and Services

MFG/PRO is an integrated manufacturing, distribution and financial software product that addresses the entire discrete manufacturing spectrum from repetitive to configure-to-order. Key features of the product are:

- MFG/PRO is written using the PROGRESS fourth-generation language and relational database system, and has a built-in report writer to facilitate customization. It runs on all operating systems and platforms supported by PROGRESS, which include UNIX, HP-UX, UTLRIX, VMS and MS-DOS, on more than 400 hardware platforms.

- The product has multisite, multinational, multicurrency and multilanguage capabilities, and supports repetitive, make-to-stock and configure-to-order manufacturing environments, as well as process, batch-process environments.

**d. Key Issues**

During 1993, the company released version 7 of MFG/PRO, which features distributed database and a release management system.

Though lacking the resources of publicly held competitors such as SAP, SSA and ASK, qad.inc continues to grow at more than 80% per year. Sales for the year ending Dec. 31, 1993 are estimated at $65 million, compared with $35 million for 1992 and $19 million in 1991.

The company is increasing its emphasis on strategic relationships with CAP/Gemini, Origin, as well as numerous national/regional firms around the world.

VI

# User Buying Patterns

## A
## Application Plans

In INPUT's survey of discrete manufacturers, respondents were asked to specify which, if any, outside resources they planned to use in developing new applications. Questions specifically focused on:

- Packaged application software
- Systems integrators
- Other outside resources, e.g., professional services firms

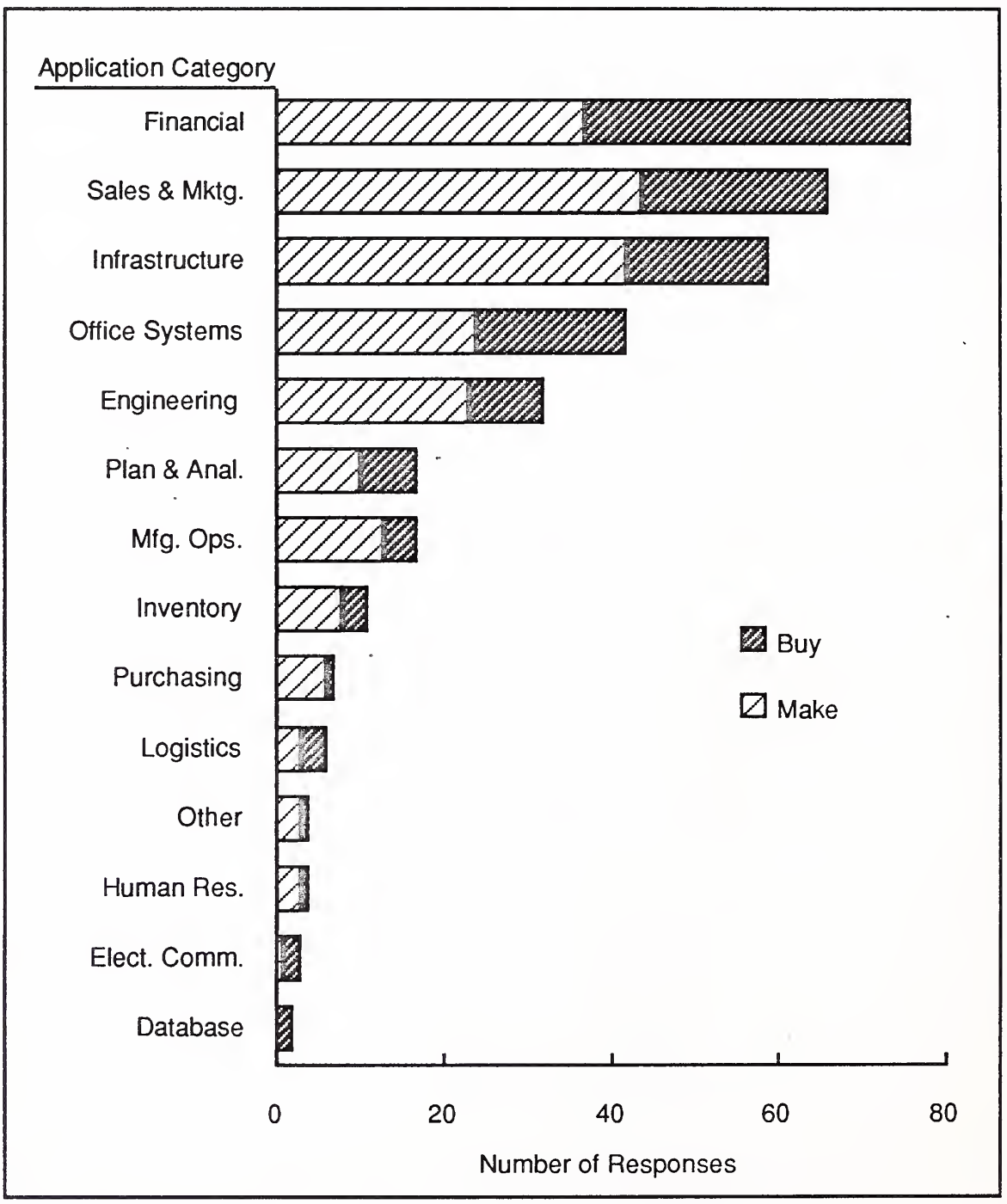
Exhibit VI-1 summarizes responses by application category. The term "buy" indicates that a respondent intended to use one or more of the above outside resources, while the term "make" reflects a response that no outside resources were planned for implementation of the application. Key observations are:

- Overall, respondents plan to buy 37% of new applications. Financial systems represent the largest opportunity for IS providers, with just more than half of the 76 new applications targeted for outside assistance. This reflects the maturity of products in this category, as well as the high degree of standardization of these applications.
- Outside resources will be used in 33% of the 66 sales and marketing applications. This category contains systems such as sales order entry and customer service, which are often unique to a company.

- Engineering, inventory and manufacturing operations will rely heavily on inside resources, involving outside information services providers in only 24% to 28% of new projects.

EXHIBIT VI-1

**New Applications—Make versus Buy**

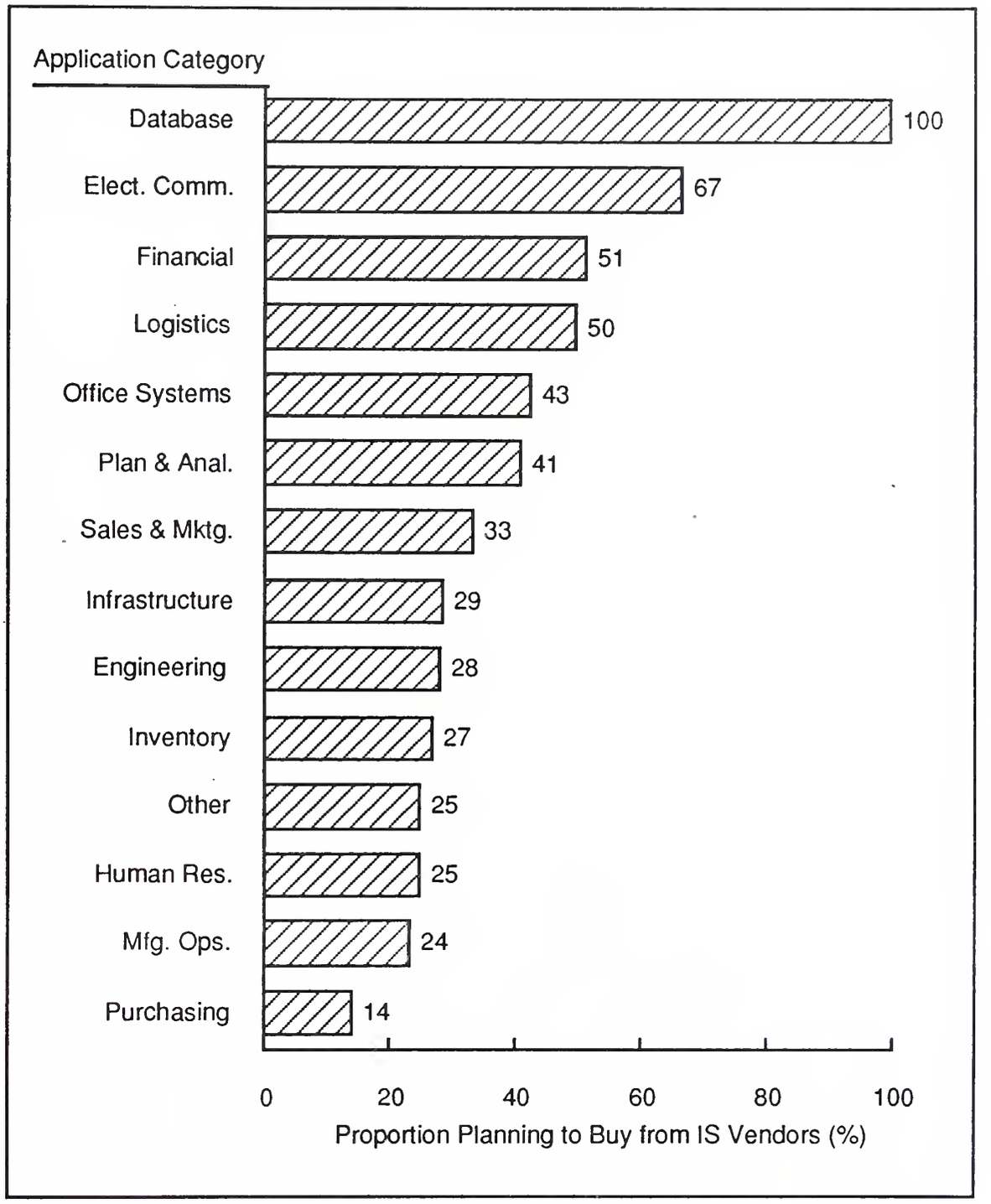



*Total Responses: 346*

Exhibit IV-2 shows the proportion of respondents for each application category who will use outside resources.

EXHIBIT VI-2

## Opportunities for IS Providers




Outside resources are used to the greatest extent in database and electronic commerce applications, though relatively few of these applications are planned.

## B
## Timing of New Applications

Respondents were asked when they intended to begin each planned application. As shown in Exhibit VI-3, the planning horizon for new applications in this sector extends to 36 months, but 77% of all new projects are planned to begin in seven to 12 months.

EXHIBIT VI-3

**Timing of New Applications**

| Category | 1-3 mo. | 4-6 mo. | 7-12 mo. | 13-24 mo. | 25-36 mo. | Total |
|---|---|---|---|---|---|---|
| Database | 0 | 0 | 2 | 0 | 0 | 2 |
| Electronic Commerce | 0 | 0 | 2 | 0 | 1 | 3 |
| Engineering | 0 | 0 | 25 | 4 | 3 | 32 |
| Financial | 1 | 4 | 51 | 2 | 18 | 76 |
| Human Resources | 0 | 0 | 4 | 0 | 0 | 4 |
| Infrastructure | 0 | 1 | 48 | 1 | 9 | 59 |
| Inventory | 1 | 0 | 9 | 0 | 1 | 11 |
| Logistics | 0 | 0 | 4 | 0 | 2 | 6 |
| Manufacturing Operations | 0 | 1 | 10 | 1 | 5 | 17 |
| Office Systems | 0 | 3 | 29 | 0 | 10 | 42 |
| Planning & Analysis | 0 | 0 | 13 | 0 | 4 | 17 |
| Purchasing | 0 | 1 | 5 | 0 | 1 | 7 |
| Sales & Marketing | 0 | 1 | 59 | 1 | 5 | 66 |
| Other | 0 | 0 | 4 | 0 | 0 | 4 |
| Total All Applications | 2 | 11 | 265 | 9 | 59 | 346 |

VII

# Conclusions and Recommendations

## A
## Industry and Information Services Market Conclusions

With the exception of aerospace, discrete manufacturing industries have recovered from the recession and are continuing to re-engineer their business to achieve high levels of customer service and quality. They continue to move decision-making closer to opportunities and problems (usually opposite sides of the same coin). As manufacturers strive to reduce cycle times, such decision-making requires integration of information at various locations inside and outside the company. These needs present excellent opportunities for information services vendors.

Discrete manufacturers have seen systems evolve since the 1970s, when they began to automate manual functions and use computers to manage large volumes of data. MRP was usually successful for companies large enough to install a mainframe.

In the 1980s, mini-computers and PCs allowed even the smallest manufacturers to implement these systems. At the same time, large manufacturers began to refine systems to more precisely meet user needs and to automate individual processes on the shop floor. As more processes were automated, islands of automation/information resulted.

Today, the focus is on integration. The trend is toward totally open, totally integrated systems that are database-independent, platform-independent and vendor-independent. INPUT expects object-oriented systems to appear by 1995 or 1996, allowing users to choose the best parts of various products and incorporate them into their operations. Users will modify and reconfigure applications as dictated by continuously changing business needs.

As usual, the adoption of technology lags its availability, and it will be the end of the decade before the extent and importance of these developments to the discrete manufacturing process becomes evident.

## B
## User Issues and Recommendations

Discrete manufacturers can receive significant benefits by taking advantage of products and services available from information services providers, rather than developing new applications internally. Manufacturers who obtained the highest return on their information services investment—and highest satisfaction, as well—applied the following principles:

- Define objectives and needs carefully, using outside expertise, if necessary.
- Identify three vendors or service providers who are successful in your industry. Insist on industry experience and expertise. Check customer references.
- Examine the vendor's financial viability. Hopefully, you will share a long and mutually beneficial relationship.
- Insist on an open systems approach from the vendor. The vendor should have a credible record in an open-systems environment.
- Keep customized development to a minimum, as custom systems could prove to be very difficult or expensive to adapt to changing conditions.
- Carefully define the network environment: Avoid building islands of information.
- Establish benchmarks, based upon current conditions, prior to implementation of a new system.
- When making a change, make it quickly. Make the decision quickly. Implement rapidly. Recognize benefits quickly. The more rapidly a significant move is made, the higher the return.

These user recommendations are summarized in Exhibit VII-1.

Exhibit VII-1

**User Recommendations**

- Define requirements carefully
- Select proven vendors
- Require truly open systems
- Minimize customization
- Avoid building islands
- Move quickly when making changes

## C
## Information Services Vendor Issues and Recommendations

The discrete manufacturing market is huge and fragmented, with no dominant vendor in any segment. However, the sheer size of this market can be inviting and intimidating at the same time. Information services vendors who built significant businesses in this market have followed the principles below:

- Target narrow market segments and strive for segment leadership to assure involvement in a large number of opportunities.

- Develop industry expertise and invest in industry training of sales and support staff. Training is easier in a narrow segment.

- Develop alliances with niche vendors. A large number of specialized applications are available (customer response systems, for example). Vendors with an open systems approach can take advantage of these applications and invest in improving their own products, rather than reinventing old products.

- Develop a sales approach that emphasizes the critical business needs of the customer, rather than the features of the product.

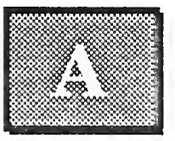
- Train sales people to sell value, not price. Too many vendors with too little money, desperate for sales, are causing price erosion. Some products are becoming commodities.
- Understand the concepts of business re-engineering, total quality management and value-added integration.
- Consider ISO-9000 certification for groups that develop the products and service the customers. Manufacturers expect all their suppliers, with the possible exception of information services providers (because there has, in the past, been no formal certification process), to have formal quality programs in place.

Vendor recommendations are summarized in Exhibit VII-2.

Exhibit VII-2

**Vendor Recommendations**

- Target narrow market segments
- Develop industry expertise
- Develop alliances with niche vendors
- Focus on customer's critical business needs
- Train sales people to sell value, not price
- Understand BPR, TQM and value-added integration
- Consider ISO-9000 certification



# Forecast and Reconciliation

## A
## Forecast Database

Exhibit A-1 offers the 1994-1999 forecast for the discrete manufacturing sector.

Differences between the 1993 and 1994 INPUT forecasts are:

- Estimates of 1993 expenditures for information services in this sector were slightly higher (0.4%) than forecast in the 1993 report—at $14.7 billion, reflecting a strong year-end finish in all categories except processing services.
- Variances for product/service market segments for the 1993 market were less than 10%, and for the 1998 market range from a 20% 1993 overstatement of professional services expenditures, to a 4% understatement of the spending for systems integration. The five-year CAGR for professional services has been adjusted downward slightly (10%) to allow for the erosion of software development spending.

EXHIBIT A-1

## Discrete Manufacturing User Expenditures Forecast by Product and Service Sector—1994-1999

| Products and Services | 1993 ($M) | Growth 93-94 (%) | 1994 ($M) | 1995 ($M) | 1996 ($M) | 1997 ($M) | 1998 ($M) | 1999 ($M) | CAGR 94-99 (%) |
|---|---|---|---|---|---|---|---|---|---|
| Sector Total | 14,687 | 13 | 16,528 | 18,639 | 21,176 | 24267 | 28,024 | 32,597 | 15 |
| *Professional Services* | 5,194 | 7 | 5,580 | 5,961 | 6,377 | 6831 | 7,327 | 7,869 | 7 |
| - IS Consulting | 1,342 | 13 | 1,510 | 1,687 | 1,884 | 2104 | 2,350 | 2,625 | 12 |
| - Education & Training | 827 | 10 | 906 | 1,000 | 1,104 | 1219 | 1,346 | 1,486 | 10 |
| - Software Development | 3,025 | 5 | 3,164 | 3,274 | 3,389 | 3508 | 3,631 | 3,758 | 4 |
| *Systems Integration* | 1,631 | 19 | 1,948 | 2,325 | 2,800 | 3396 | 4,124 | 4,977 | 21 |
| - Equipment | 957 | 20 | 1,149 | 1,370 | 1,655 | 2028 | 2,485 | 3,017 | 21 |
| - Software Products | 116 | 16 | 135 | 158 | 187 | 219 | 258 | 303 | 18 |
| - Professional Services | 505 | 19 | 601 | 723 | 870 | 1046 | 1,259 | 1,515 | 20 |
| - Other | 53 | 19 | 63 | 74 | 88 | 103 | 122 | 142 | 18 |
| *Outsourcing* | 851 | 21 | 1,027 | 1,239 | 1,493 | 1810 | 2,190 | 2,660 | 21 |
| - Platform Operations | 299 | 16 | 348 | 404 | 470 | 549 | 631 | 732 | 16 |
| - Applications Ops. | 338 | 19 | 403 | 478 | 565 | 670 | 795 | 942 | 19 |
| - Desktop Services | 115 | 26 | 145 | 183 | 228 | 286 | 360 | 451 | 25 |
| - Network Management | 99 | 32 | 131 | 174 | 230 | 305 | 404 | 535 | 33 |
| *Processing Services* | 894 | 3 | 925 | 952 | 980 | 1009 | 1,039 | 1,069 | 3 |
| - Transaction Proc. | 894 | 3 | 925 | 952 | 980 | 1009 | 1,039 | 1,069 | 3 |
| *Network Services* | 129 | 21 | 156 | 189 | 229 | 278 | 338 | 410 | 21 |
| - Electronic Inf. Svcs | 62 | 19 | 74 | 88 | 104 | 123 | 146 | 173 | 19 |
| - Network Applications | 67 | 22 | 82 | 101 | 125 | 155 | 192 | 237 | 24 |
| *Applications Software* | 2,706 | 20 | 3,237 | 3,905 | 4,760 | 5873 | 7,325 | 9,235 | 23 |
| - Mainframe | 405 | 5 | 427 | 450 | 472 | 497 | 523 | 550 | 5 |
| - Minicomputer | 1,284 | 11 | 1,430 | 1,585 | 1,756 | 1946 | 2,155 | 2,390 | 11 |
| - Workstation/PC | 1,017 | 36 | 1,380 | 1,870 | 2,532 | 3430 | 4,647 | 6,295 | 35 |
| *Turnkey Systems* | 3,282 | 11 | 3,655 | 4,068 | 4,537 | 5070 | 5,681 | 6,377 | 12 |
| - Equipment | 1,378 | 6 | 1,465 | 1,552 | 1,643 | 1740 | 1,843 | 1,952 | 6 |
| - Software Products | 1,297 | 13 | 1,460 | 1,642 | 1,848 | 2078 | 2,338 | 2,630 | 12 |
| - Professional Services | 607 | 20 | 730 | 874 | 1,046 | 1252 | 1,500 | 1,795 | 20 |

## B
## Forecast Reconciliation

Exhibit A-2 represents the forecast reconciliation for the discrete manufacturing sector.

Significant differences between the 1993 and 1994 INPUT forecasts are that:

- Estimates of 1993 expenditures for information services in this sector were slightly higher (0.4%) than forecast in the 1993 report, at $14.7 billion, reflecting a strong year-end finish in all categories except processing services.
- The growth rate for software development (the largest component of professional services) has been revised down slightly to 12% from the 13% figure in the 1993 report. As providers of application software and systems integration services move to open systems, their growth will accelerate at the expense of software development.

EXHIBIT A-2

**Discrete Manufacturing 1994 MAP Database Reconciliation**

| Products and Services | 1993 Market | | | | 1998 Market | | | | 93-98 CAGR per '93 Rpt. | 93-98 CAGR per '94 Rpt. |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1993 Market (F'cst) ($M) | 1994 Report (Actual) ($M) | Variance from 1993 Forecast ($M) | Variance from 1993 Forecast (%) | 1993 Market (F'cst) ($M) | 1994 Report (Actual) ($M) | Variance from 1993 Forecast ($M) | Variance from 1993 Forecast (%) | (%) | (%) |
| Total | 14,632 | 14,687 | 55 | 0 | 27,950 | 28,024 | 74 | 0 | 14 | 14 |
| Professional Services | 5,178 | 5,194 | 16 | 0 | 7,508 | 7,327 | -181 | -2 | 8 | 7 |
| Systems Integration | 1,620 | 1,631 | 11 | 1 | 3,972 | 4,124 | 152 | 4 | 20 | 20 |
| Outsourcing | 846 | 851 | 5 | 1 | 2,168 | 2,190 | 22 | 1 | 21 | 21 |
| Processing Services | 896 | 894 | -2 | 0 | 1,039 | 1,039 | 0 | 0 | 3 | 3 |
| Network Services | 128 | 129 | 1 | 1 | 334 | 338 | 4 | 1 | 21 | 21 |
| Applications Software | 2,695 | 2,706 | 11 | 0 | 7,201 | 7,325 | 124 | 2 | 22 | 22 |
| Turnkey Systems | 3,269 | 3,282 | 13 | 0 | 5,728 | 5,681 | -47 | -1 | 12 | 12 |

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B

# Industry Structure and Methodology

This appendix explains INPUT's research methodology and the techniques used in the preparation of forecast data.

## A
## Industry Structure

*Sector Definition*—The *discrete manufacturing* sector, as defined by INPUT, includes:

- Companies that fall within the Standard Industrial Classification (SIC) Codes of 23xx, 25xx, 27xx, 31xx and 34xx-39xx, shown in Exhibit B-1, are defined by INPUT to be in the discrete manufacturing sector. INPUT's definition also includes some hybrid companies, i.e., those companies that incorporate discrete and process operations to produce their products.

- A discrete operation is most easily defined by following the form of the material used at the beginning of the manufacturing process and noting if its form has changed after use. Typically, a purely discrete operation is one of assembly. If the material changes form during production and cannot be uniquely identified in the end product, then a process operation has probably occurred. Additionally, if the input material cannot be brought back to its original form, then a process has occurred to change it.

EXHIBIT B-1

**Discrete Manufacturing Sector**

| SIC Code | Description |
|---|---|
| 23xx | Apparel and other finished products |
| 25xx | Furniture and fixtures |
| 27xx | Printing, publishing and allied industries |
| 31xx | Leather and leather products |
| 34xx | Fabricated metal products except machinery and transportation equipment |
| 35xx | Industrial and commercial machinery and computer equipment |
| 36xx | Electronic and other electrical equipment and components, except computer equipment |
| 37xx | Transportation equipment |
| 38xx | Instruments; photo, medical optical goods; watches/clocks |
| 39xx | Miscellaneous manufacturing industry |

# B
# Research Methodology

*Research*—Much of the data on which this report is based was gathered during 1993 as part of INPUT's ongoing market analysis program. Trends, market sizes and growth rates are based upon INPUT research and in-depth interviews with users in the discrete manufacturing industry and the information services vendors serving the industry. INPUT maintains ongoing relationships with and a database of all users and vendors interviewed. Interviewees for the research portion of this report were selected from this database of contacts.

*INPUT Library*—In addition, extensive use was made of INPUT's corporate library in Mountain View, California. The resources in this library include on-line periodical databases, subscriptions to a broad range of computer and general business periodicals, continually updated files on more than 3,000 information services vendors and the most up-to-date U.S. Department of Commerce publications on industry statistics.

*Financial Data*—It must be noted that vendors may be unwilling to provide detailed revenue breakouts by product and service or

industry. Also, vendors often use different categories of industries and industry segments or view their services as falling into different product and service categories than those used by INPUT. Thus, INPUT must estimate revenues for these categories on a best-effort basis. For this reason, the product and service individual segment forecasts should be viewed as indicators of general patterns and trends rather than specific, detailed estimates for specific years.

*Rounding*—When displaying market forecast values in bar and column charts, INPUT rounds these amounts for ease of visual reference. Markets of $1 billion or more are rounded to the nearest $50 million; $100 million to $999 million to the nearest $10 million; and $50 to $99 million to the nearest $5 million. Actual values are shown in charts for markets of $49 million or less, in Appendix A tables and in chapter text.

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