EUROPEAN SOFTWARE AND SERVICES MARKET

1990-1995

DISCRETE MANUFACTURING

INPUT

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DECEMBER 1990

EUROPEAN SOFTWARE AND SERVICES MARKET

1990-1995

DISCRETE MANUFACTURING SECTOR

INPUT®

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Market Analysis Programme—Europe
(MAPE)

*European Software and Services Market,
1990-1995—Discrete Manufacturing Sector*

Abstract

This report analyses the market for software and services in the Western European discrete manufacturing sector. It identifies the major issues and opportunities for vendors, and the driving forces influencing the use of software and services in the discrete manufacturing sector. Market forecasts are provided both for the major country markets—Germany, France, the United Kingdom and Italy—and by key delivery mode. The principal delivery modes are turnkey systems, industry-specific application software products, professional services, systems integration, network services, systems operations, and processing services. The leading vendors in each country market are identified.

This report has 105 pages and 66 exhibits.

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Exhibits (Continued)

Exhibits (Continued)

I

Introduction

Introduction

A

Objectives

The principal objectives of this report are:

- To forecast the size of the market for software and services in the discrete manufacturing sector for Western Europe and for each of the major country markets over the period 1990-1995

- To forecast the size of the market for software and services in the discrete manufacturing sector by delivery mode

- To identify the leading software and services vendors in the discrete manufacturing sector in each of the major country markets

- To identify the major issues facing software and services vendors that are targeting the discrete manufacturing sector

- To identify the forces influencing demand for software and services within the discrete manufacturing sector

- To identify the opportunities arising for software and services vendors in this sector over the period 1990-1995

B

Scope

This report analyses the market for software and services within the Western European discrete manufacturing sector over the period 1990-1995.

The discrete manufacturing sector is defined as:

- Manufacturing of metal articles

- Mechanical engineering

- Electrical and electronic engineering

- Instrument engineering

- Manufacture of motor vehicles and their parts, and of other means of transport

- Textile industry

- Leather and leather goods manufacturing

- Furniture manufacturing

- Printing and publishing

Geographically, the report divides Western Europe into:

- Germany
- France
- United Kingdom
- Italy
- Rest of Europe

Market forecasts are derived from corporate user expenditures on software and services. Forecasts are provided over the period 1990-1995 for each of the key delivery modes, namely:

- Industry-specific application software products
- Turnkey systems
- Professional services
- Systems integration
- Network services
- Processing services
- Systems operations

C

Methodology

The research that contributed to this study was derived from the following sources:

- Twenty-five in-depth interviews conducted either face-to-face or by telephone with the leading vendors and users active in the Western European discrete manufacturing sector.

- INPUT's ongoing research of the Western European software and services market which includes the collection of revenue and service product data from over 300 vendors annually.

- The use of INPUT's extensive library facilities, which include vendor literature and press releases as well as trade press, newspaper and magazine articles.

D
Report Structure

Chapter I provides details of the objectives and scope of the research, and the methodology used.

Chapter II is an Executive Overview of the entire report. It summarises the principal findings of the research, with an emphasis on the opportunities for software and services vendors in the discrete manufacturing sector.

Chapter III contains the body of the report. It provides detailed market forecasts for the software and services market within the Western European discrete manufacturing sector. These forecasts are broken down by country and by delivery mode. For key delivery modes, further breakdowns of market size are supplied—for example, by equipment type and by application. The key issues confronting vendors and their responses to these issues are also discussed in more depth, as are the opportunities arising for vendors.

Chapter IV provides an overview of the driving forces within the discrete manufacturing sector.

Chapter V summarises the conclusions and recommendations of the report, emphasising the opportunities available to software and services vendors.

II

Executive Overview

II
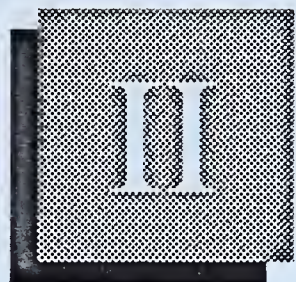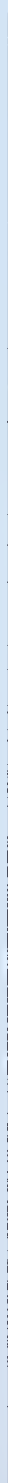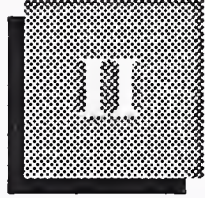
Executive Overview

A

Software and Services Partnerships Needed to Serve Discrete Manufacturing Sector

Partnerships between software and services vendors are becoming increasingly important to vendor success in serving the Western Europe discrete manufacturing sector. As users start to move towards computer-integrated manufacturing environments, no vendor can supply the full range of applications and services that is required. Accordingly, strategic partnerships are developing between vendors with complementary products or services. These relationships are no longer restricted to those between equipment vendors and application software product vendors. The equipment vendors also need partners with specialised systems integration skills, while groups of application software product vendors are forming to offer a wide range of complementary applications from a single source. Professional services vendors are left with the question of whether to continue to rely on their own products or to become project managers using third-party applications software products.

This situation presents opportunities for many vendors. In particular, it provides the smaller players who have a specialised product or skill with the opportunity to take advantage of the marketing strengths of the major vendors.

Major opportunities for software and services vendors are as follows:

Firstly, there is the opportunity to assist the user in integrating major applications such as CAD, production management and shopfloor data collection and control (SFDCC). In many instances, this will only entail providing the necessary data linkages between existing systems. In other cases, it will entail providing a complete business solution, moving towards a fully integrated ideal.

Secondly, the discrete manufacturing sector's need to forge closer relationships with both customers and suppliers will lead to considerable growth in the use of EDI. Increasing use of just-in-time procedures is driving the exchange of commercial documents such as orders and acknowledgements, and there remains considerable scope to extend the use of EDI in terms of both the number of companies involved and the range of documents exchanged. As component suppliers become more involved with manufacturers as design partners, the need to electronically exchange technical information such as design data is also increasing.

Within the application software products market, there remain opportunities for vendors who can supply and support manufacturers on a pan-European level. This is particularly true for products such as production management systems, where manufacturers are tending to standardise their European subsidiaries and facilities.

Growing opportunity areas within application software products also include shopfloor data collection and control and engineering data management; other specialisations such as computer-aided process planning and finite scheduling will assist manufacturers in moving towards a more integrated environment.

Pressures for cost reduction are now reaching the information systems department, as well as the factory floor. Consequently, there will be some reduction of personnel in information systems departments in the discrete manufacturing sector, and greater use of external agencies, which will boost professional services opportunities. In France and the United Kingdom, this trend will lead to significant growth in the use of systems operations, as the virtues of in-house information systems departments are seriously questioned.

B

Country Markets

INPUT forecasts that the market for software and services within the discrete manufacturing sector will be $18 billion in 1995. The compound annual growth rate (CAGR) will be 18% over the forecast period, as shown in Exhibit II-1.

This growth rate for the whole of the software and services market shows considerable variation from country to country, and between delivery modes. For example, because of the increasing need to integrate applications already implemented, such as CAD and production management, the growth in professional services and systems integration will be significantly greater than that in turnkey systems and software products over the next few years. Exhibit II-2 shows the 1990 Western European software and services market distribution by country.

EXHIBIT II-1

European Discrete Manufacturing Sector Software and Services Market Forecast 1990-1995

EXHIBIT II-2

European Discrete Manufacturing Sector Software and Services Market Forecast Percentage Distribution by Country, 1990

Totals market (1990) = $8.0 billion
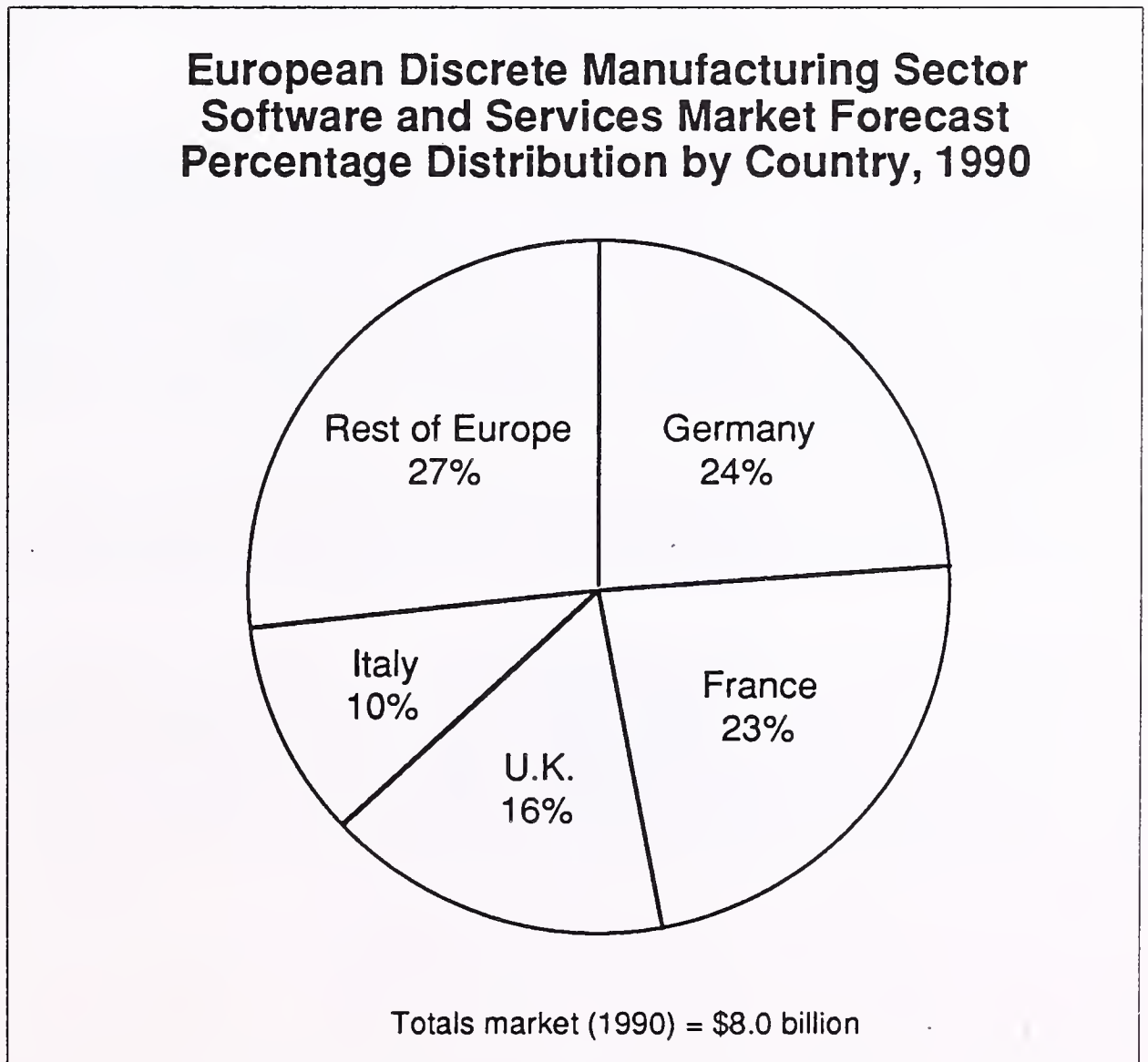
Among the four major Western European countries, Germany has the largest discrete manufacturing software and services market. Germany is also forecast to have the highest growth rate—21% over the period 1990-1995.

Germany has been recognised for some time as having the strongest manufacturing base in Western Europe, and additional investment within the discrete manufacturing sector is now being fuelled by the impact of reunification with East Germany.

In addition, the country's quality car manufacturers are for the first time being threatened by the Japanese. As the Japanese move their product ranges into the luxury car market, German manufacturers will have to change their production processes in order to bring their production costs into line. This presents opportunities for software and services vendors.

At the other end of the spectrum is the discrete manufacturing market in the U.K., with a forecast compound annual average growth rate of 14%. This sector in the U.K. is currently depressed by high interest rates, and many discrete manufacturing companies are delaying the implementation of information systems projects. This state of affairs is expected to continue for some time. However, these cost reduction pressures on the U.K. discrete manufacturing sector do provide some opportunities. For example, as companies look to reduce the cost of their in-house IS departments, the scope for professional services and systems operations vendors increases.

Growth rates for software and services within the discrete manufacturing sectors in France and Italy lie between those of Germany and the U.K., at 18% per annum. While vendor attitudes towards the strength of the markets in Germany and the U.K. showed a high level of consistency, their views of the future prospects for the software and services market in France and Italy were mixed. Some vendors in France were anticipating high levels of growth, while others were increasingly fearful of a slow-down in the second half of 1990.

Italy remains a difficult market for non-indigenous vendors, but one in which many vendors would like to increase their presence, as illustrated by the recent purchase of a 60% stake in Mesarteam by Sligos.

Part of the difficulty lies in the nature of Italian accounting practices. Another factor is that the market lacks sophistication, with many manu-facturers only requiring low levels of functionality in their production management systems.

The major subsectors within the Western European discrete manufacturing sector are:

- Automotive
- Electrical and electronic
- Mechanical engineering

The above subsectors, together with aerospace, tend to be the subsectors most heavily targeted by software and services vendors. Their growth levels are shown in Exhibit II-3.

EXHIBIT II-3

Subsector Growth Anticipated by Software and Services Vendors

Sector	Growth Rate
Automotive	High
Aerospace	Medium -High
Electrical and electronic	Medium
Mechanical engineering	Low

The automotive sector is the traditional leader in the use of process technology, to lower production costs. In recent years, lowering of production costs has frequently taken the form of increased technological modernisation of production facilities, leading to very high levels of factory automation and significant opportunities for software and services vendors. Little has changed, in that automotive manufacturers in Western Europe are again facing considerable pressures to improve their performance or face the prospects of acquisition and rationalisation. In addition, considerable capital expenditure is being made by vehicle manufacturers in Eastern Europe. Both these factors are likely to lead to increased expenditure for both product and process technology, with the implied spinoffs for software and services vendors.

The aerospace sector has been the traditional leader in product technology, and in the use of CAD and computer-aided engineering (CAE) for prototype design and evaluation. While product technology is still crucial in this sector, the use of sophisticated process technologies to help reduce production costs is becoming more important as competition increases.

The electronics sector is another industry with a tradition of innovation, and the automotive, aerospace, and electronics industries will remain at the forefront in the use of information technology.

C

Applications Software Products and Turnkey Systems

Turnkey systems was the largest single delivery mode in the Western European discrete manufacturing sector in 1990. However, this delivery mode is forecast to grow comparatively slowly over the period 1990-1995, moving into second place behind the professional services delivery mode by 1995. Growth for application software products and turnkey systems is shown in Exhibit II-4.

EXHIBIT II-4

European Discrete Manufacturing Sector Market Forecast, 1990-1995 Application Software Products and Turnkey Systems
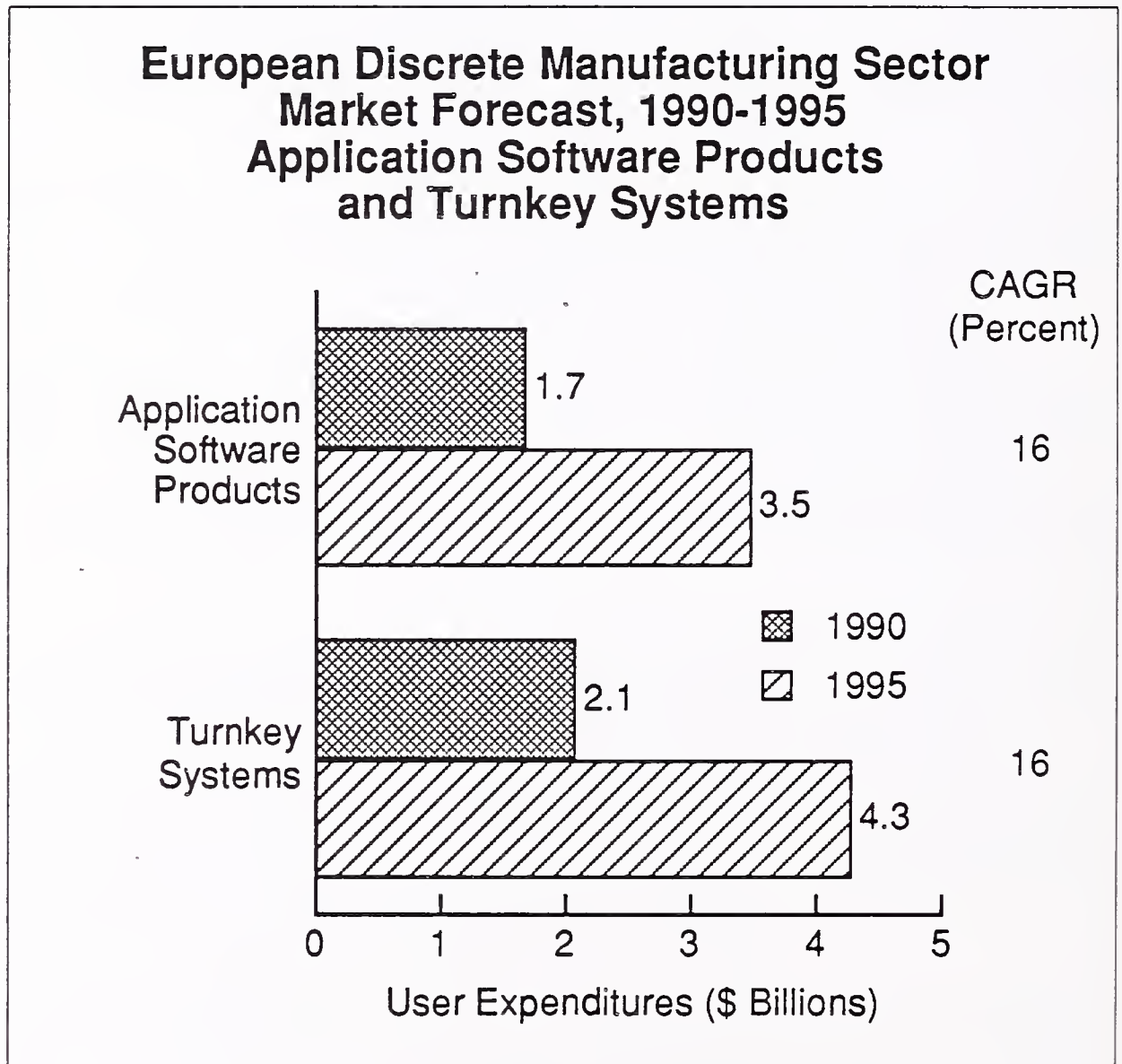
Historically, major turnkey markets in the discrete manufacturing sector have been for applications such as CAD and production management. However, growth in both of these areas is now slowing down.

CAD/CAM is still a growing market, but much of the growth is coming from the microcomputer-based systems end of the market. At the work-station level, the cost per seat will continue to fall. To counter these trends, the traditional CAD vendors such as IBM, Intergraph, and Prime/Computervision have introduced microcomputer-based products them-

selves, and are endeavouring to widen the use of CAD within discrete manufacturing organisations. In particular, they are keen to develop CAD from a drafting tool into a means of handling prototype evaluation and technical documentation. Adoption of concurrent engineering techniques is seen as a key driver of CAD workstation sales.

Both the turnkey systems and software product delivery modes are impacted by the slowdown in sales of production management systems. Production management is becoming largely a replacement market, and though the AS/400 segment appears healthy, there are apparent signs of a slowdown in the Digital sector.

The increasing acceptance of UNIX forms a watershed for many of the traditional vendors of production management systems. Both application software product vendors and the traditional European minicomputer turnkey vendors are having to redevelop their packages in order to run under UNIX. They are then faced with the task of persuading their existing customer base to remain loyal to them rather than choosing one of the many alternative UNIX-based competitors.

Exhibit II-5 shows users' purchasing intentions by application, and Exhibit II-6 provides a more detailed breakdown of vendors' expectations, by application and equipment platform.

EXHIBIT II-5

Discrete Manufacturing Sector
User Purchasing Intentions

Application	Level of Purchasing Intent
Shopfloor data collection and control	High
Production management	Medium
CAD/CAM	Medium
Engineering data management	Low

Summary of buying intentions stated by Western European discrete manufacturing users

EXHIBIT II-6

Vendors' Perception of Growth in Discrete Manufacturing Sector—Software Products by Application and Equipment Platform

Equipment Platform	Application			
	CAD/CAM	Engineering Database Management	Production	Shopfloor Data Collection and Control
Microcomputer and workstation	High	Low	Medium	High
Minicomputer	Low	High	Medium	High
Mainframe	Low	High	Low	Low

The market for production management systems is mature, but will continue to provide a steady flow of replacement business as companies rethink or adjust their information systems strategies. In some cases, replacement will come about as the result of a new overall computer-integrated manufacturing strategy. In other instances, users may be standardising systems across subsidiaries, countries, and/or factories. As part of these efforts, companies may also change the technology used. At the moment, there is a significant move to the AS/400. In the future, there will be an increased move towards UNIX and the use of distributed systems.

The principal drivers of growth in the CAD market over the forecast period will be the trend towards concurrent engineering, and the associated increase of subcontractors' involvement in the design process.

In 1990, engineering data management appears to be a product in search of a market. It is being actively promoted by the major equipment vendors, such as IBM, Digital and Unisys, and the specialist CAD vendors such as Intergraph. Though current levels of demand are low, the market for engineering data management systems is forecast to grow significantly over the next few years. Engineering database management is an important inter-application control mechanism, to ensure that the appropriate data and the correct version of it are available to all authorised users.

Shopfloor data collection and control (SFDCC) remains a high-growth application on both minicomputers and microcomputers. Once production management systems are in place, one of the next priorities is to

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obtain up-to-date information regarding actual events on the shopfloor. SFDCC is the means of achieving this. In its less sophisticated forms, SFDCC may involve solely manual input from shopfloor personnel. In its more advanced forms, it may involve direct control and monitoring of production cells. SFDCC is increasingly being used to monitor quality via techniques such as statistical process control, and to monitor the availability of machinery and its maintenance requirements.

D

Systems Integration and Professional Services

Professional services revenues from the discrete manufacturing sector are forecast to grow strongly between 1990 and 1995, making professional services the dominant delivery mode by 1995. Expenditures and growth for systems integration and professional services are shown in Exhibit II-7.

EXHIBIT II-7

.**European Discrete Manufacturing Sector Market Forecasts, 1990-1995 Systems Integration and Professional Services**
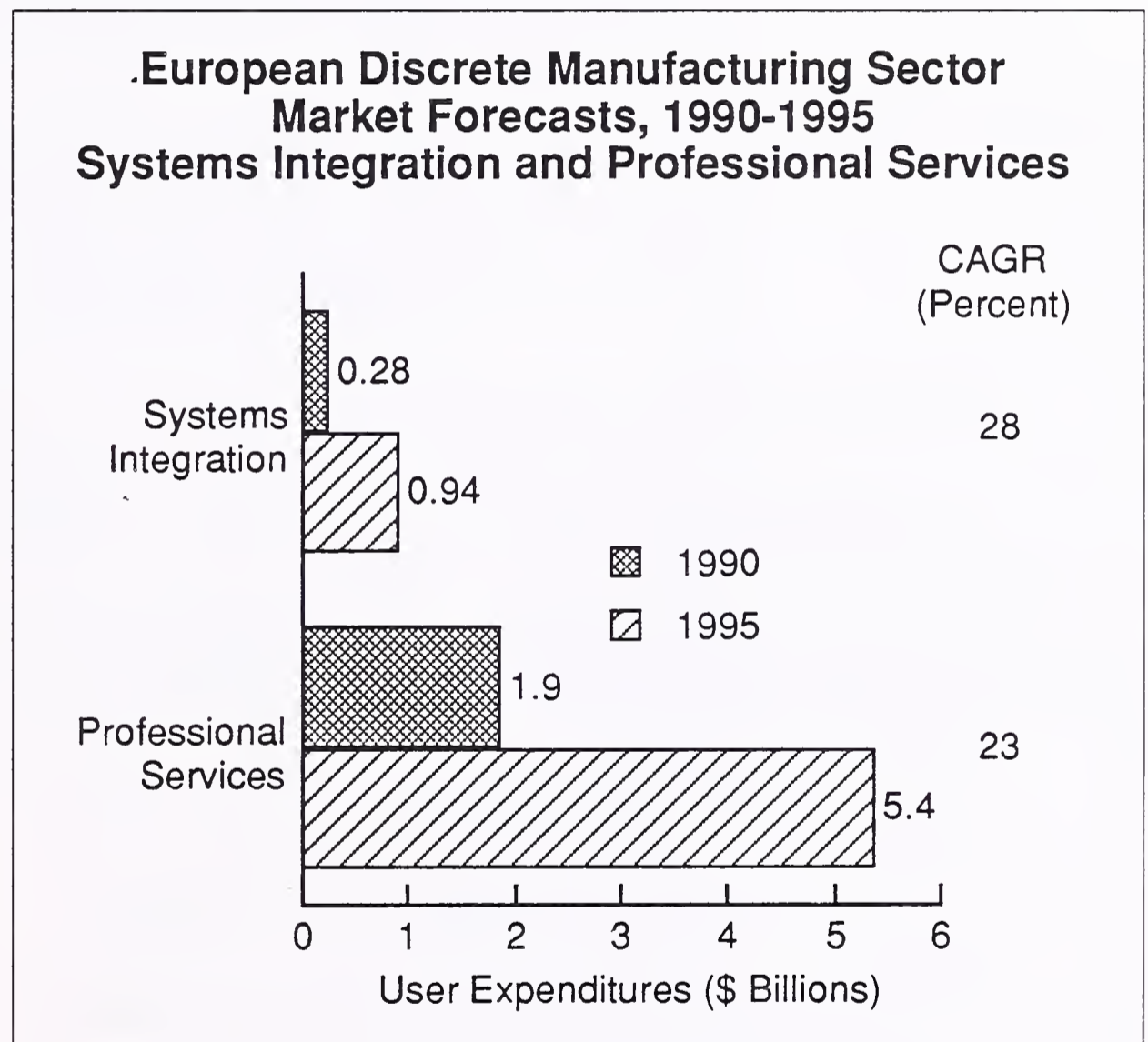
There are a number of driving forces behind the growth in professional services. Firstly, increasing cost pressure on the discrete manufacturing sector is now being felt by information systems departments, leading to some reduction of personnel. This is leading to increased use of professional services vendors at the expense of in-house development.

Secondly, the larger discrete manufacturing companies have now typically installed CAD, and probably several generations of a production management system, and are now turning their attention to better integrated systems covering the whole manufacturing process from CAD to factory automation.

In many areas, companies will retain their existing applications, but seek to pass data amongst them. This will typically involve a certain amount of professional services activity, though application enablers supplied by equipment vendors such as IBM and Unisys may be used to provide the framework for integration. For example, IBM Plant Floor Series Plantworks provides both systems and application enablers to support development of a customised distributed factory floor supervisory and control system. Similarly, ProductManager is an application enabler, assisting in the management of engineering data and links to the production management system.

This evolutionary approach is not always being adopted. In some instances, users are reviewing their complete systems strategy, and are replacing all their existing applications in a drive towards a complete business solution. One example of this approach is Thorn EMI, which is in the process of standardising its systems across nine operating divisions.

Another example of a company taking the computer-integrated manufacturing route is Kennametal Erickson, a cutting tool manufacturer currently spending $10 million on CIM across Europe.

Ideally in a CIM environment, all applications would present a common interface to users. This has been achieved by Gebr Heller Maschinenfabrik, working in conjunction with Nixdorf.

INPUT's user survey revealed a very high level of interest amongst respondents in integrating:

• CAD and production management
• Production management and the shopfloor

User integration plans are shown in Exhibit II-8.

EXHIBIT II-8

User Integration Plans

Area of Integration	Level of Requirement
CAD and production management	Very high
Production management and shopfloor	Very high

One example of a user in the process of linking CAD and production management is Rolls-Royce. Rolls-Royce has separately installed the Intergraph CAD system and the production management system of Computer Associates. The company has now linked production management to the Supercapes computer-aided production planning system, and is planning to link Supercapes to the CAD system.

Exhibit II-9 shows the current targeting of areas of integration by the major vendor categories.

EXHIBIT II-9

Targeting of Integration Areas by Vendors

Vendor Category	Area of Integration	
	Shopfloor to Production Management	CAD/CAM Production Management
Major equipment vendors	Medium	High
CAD vendors	None	High
Professional services vendors	High	Low
Application software product vendors	Low	None

Level of interest in area of integration shown by vendors

The major equipment vendors such as IBM, DEC, Unisys and Siemens are providing frameworks to enable their users to achieve complete computer-integrated manufacturing. Hence, they are interested in all aspects of integration, and are strongly targeting the systems integration market. Nonetheless, much of the attention at present is being directed

towards the provision of engineering data management systems and the integration of CAD and production management.

The CAD vendors are also trying to extend use of CAD systems away from the drafting function, and so are keen to develop links to production management systems.

The professional services vendors tend to lack expertise in CAD (this is not universally true; AT&T Istel has offered a CAD bureau for many years) and tend to focus on linking factory automation systems with production management systems.

Application software product vendors are generally not concerned with integration on a grand scale. However, they do tend to steadily increase the scope of their offerings. For example, production management software product vendors are evolving their offerings to cover more of the distribution management function, and to extend into basic shopfloor data collection and control.

Application software product vendors are also increasingly forming consortia amongst themselves to offer users a wide range of complementary applications. As these relationships become more formal, it is likely that groups of integrated applications will begin to emerge. This type of development might also be initiated by professional services vendors, who see themselves taking overall project management responsibility.

E

Network Services and Systems Operations

Use of both network services and systems operations is forecast to grow rapidly over the period 1990-1995, as shown in Exhibit II-10.

Use of EDI is widespread amongst major discrete manufacturing organisations, but so far both the scope and extent of this use has been quite limited. Hence there is considerable potential for EDI usage for commercial purposes to expand significantly within the discrete manufacturing sector as the number of trading partners interconnected increases, and as EDI is used for a wider range of transaction types.

The growth in systems operations will be fuelled by the increasing pressures on information systems departments to reduce their costs, and concern about the value for money being achieved from in-house information systems departments. Hence discrete manufacturing companies will increasingly bring in third parties to run information systems on their behalf. One recent example in the United Kingdom is Ferguson, the consumer electronics company. It has now reversed its earlier decision to bring information systems in-house, and awarded a systems operations contract to Thorn-EMI Datasolve instead. Systems operations are already important in the United Kingdom for vendors such as Thorn and Hoskyns, while a large part of AT&T Istel's revenues come from its systems operations activities on behalf of the Rover Group.

EXHIBIT II-10

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European Discrete Manufacturing Sector Market Forecasts, 1990-1995 Network Services and Systems Operations

CAGR (Percent)

Network Services — 0.64 / 1.9 — 24

Systems Operations — 0.18 / 0.66 — 30

▨ 1990
▧ 1995

User Expenditures ($ Billions)
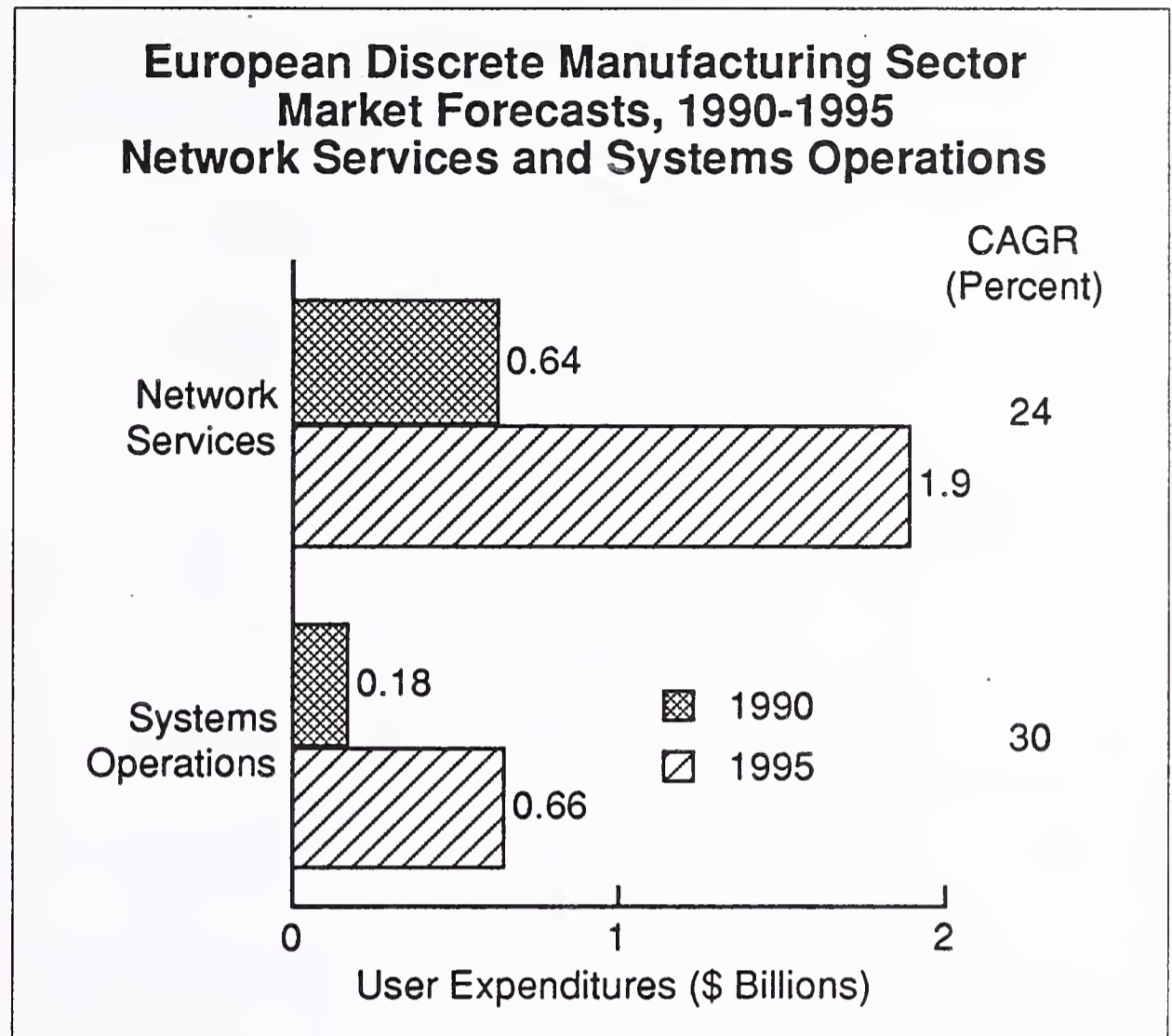
Systems operations will also become important within the discrete manufacturing sector in France. However, it is possible that initially there will be a faster take-up of systems operations by multinationals operating in France than by French discrete manufacturing companies.

As Exhibit II-11 shows, the discrete manufacturing industry is the leading sector in the use of EDI. While much of this demand is driven by increasing use of just-in-time manufacturing techniques, there is also considerable interest in the exchange of CAD data in the Western European discrete manufacturing sector. This is currently being fuelled by the closer links being forged between manufacturers and suppliers. For example, in the automotive sector, component manufacturers are becoming involved with the manufacturers as partners in vehicle design. Accordingly, there is a strong need to exchange up-to-date CAD data. To date, this has been largely achieved by the use of the same brand of CAD software and the exchange of magnetic tapes. However, networked exchange of data would enable much better communication between the relevant parties. This is also true for the exchange of data between the various sites and departments of individual manufacturing companies.

In the automotive sector, work is being undertaken to establish standards for the exchange of design data.

EXHIBIT II-11

Western European EDI Markets by Vertical Sector, 1989

- Others: 6%
- Transport: 10%
- Process Manufacturing: 10%
- Services: 12%
- Distribution/Retail: 13%
- Discrete Manufacturing: 49%

Total Market = $30 Million
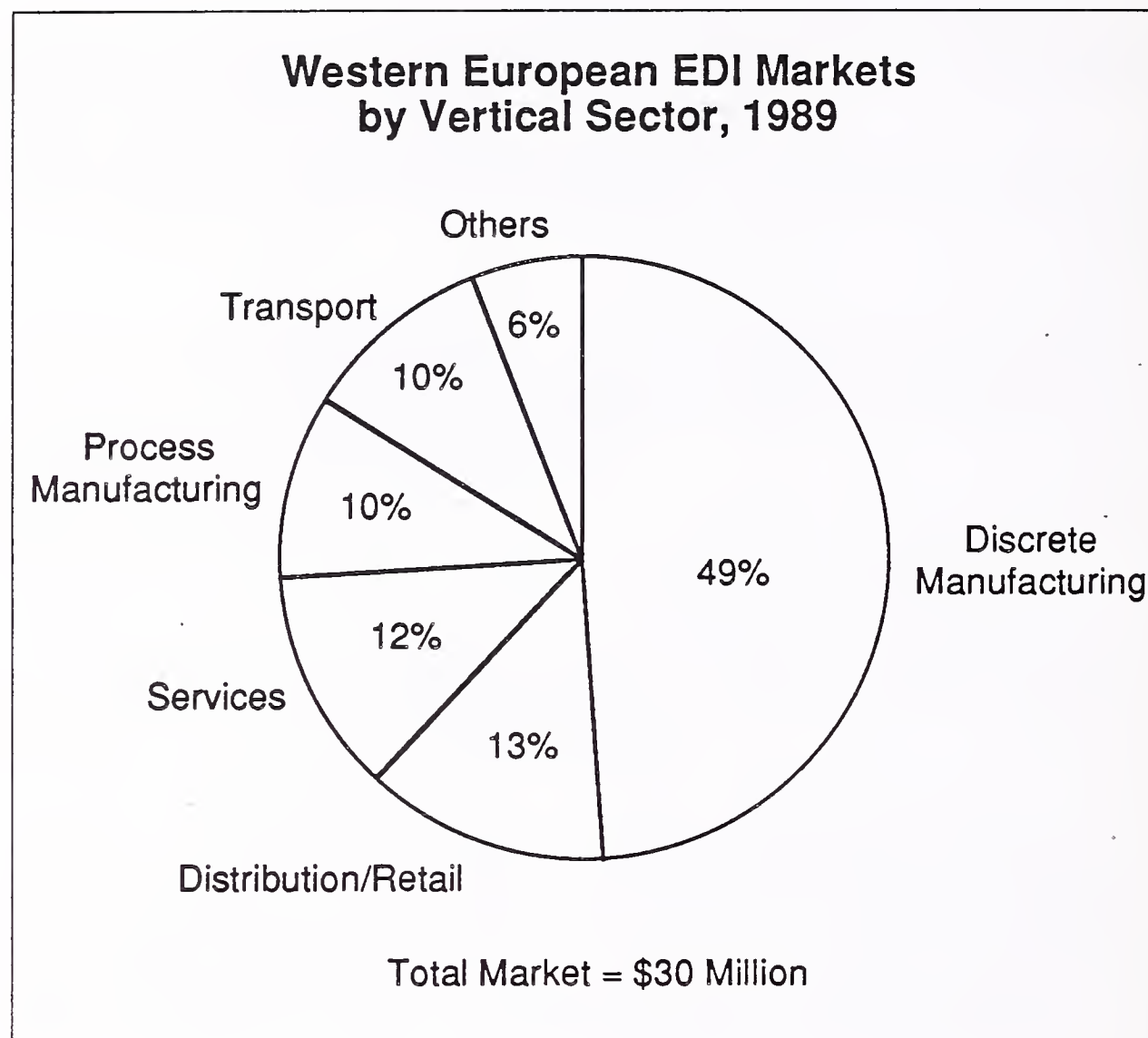
F

User Pressures

Many of the larger discrete manufacturing organisations are endeavouring to establish dominant positions within their chosen sectors of the discrete manufacturing industry. In many cases, this has involved acquisitions to build up European market share and to establish credibility at a European level. Rationalisation of facilities may follow. This has its own implications for software and services vendors as standardisation across countries occurs and buying decisions are no longer made at the individual subsidiary level.

Having built their European framework, discrete manufacturers are still facing cost pressures that pose a significant threat to their long-term competitiveness. For example, a recent study concluded that it took European manufacturers double the labour input to assemble a car, compared to their Japanese competitors.

The same broad conclusions are true at the design stage, where European manufacturers require double the engineering effort to develop a car. As well as the cost implications, the rate of new product introduction is increasing all the time, and manufacturers should be trying to significantly reduce the time it takes to bring a product to market.

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In addition to all these issues, customers are expecting greater product variability and reduced delivery times. A summary of these user pressures is given in Exhibit II-12.

User Pressures

Cost pressures   Concurrent engineering   Just-In-Time

Increased responsiveness

Users

Systems operations   Application integration   EDI
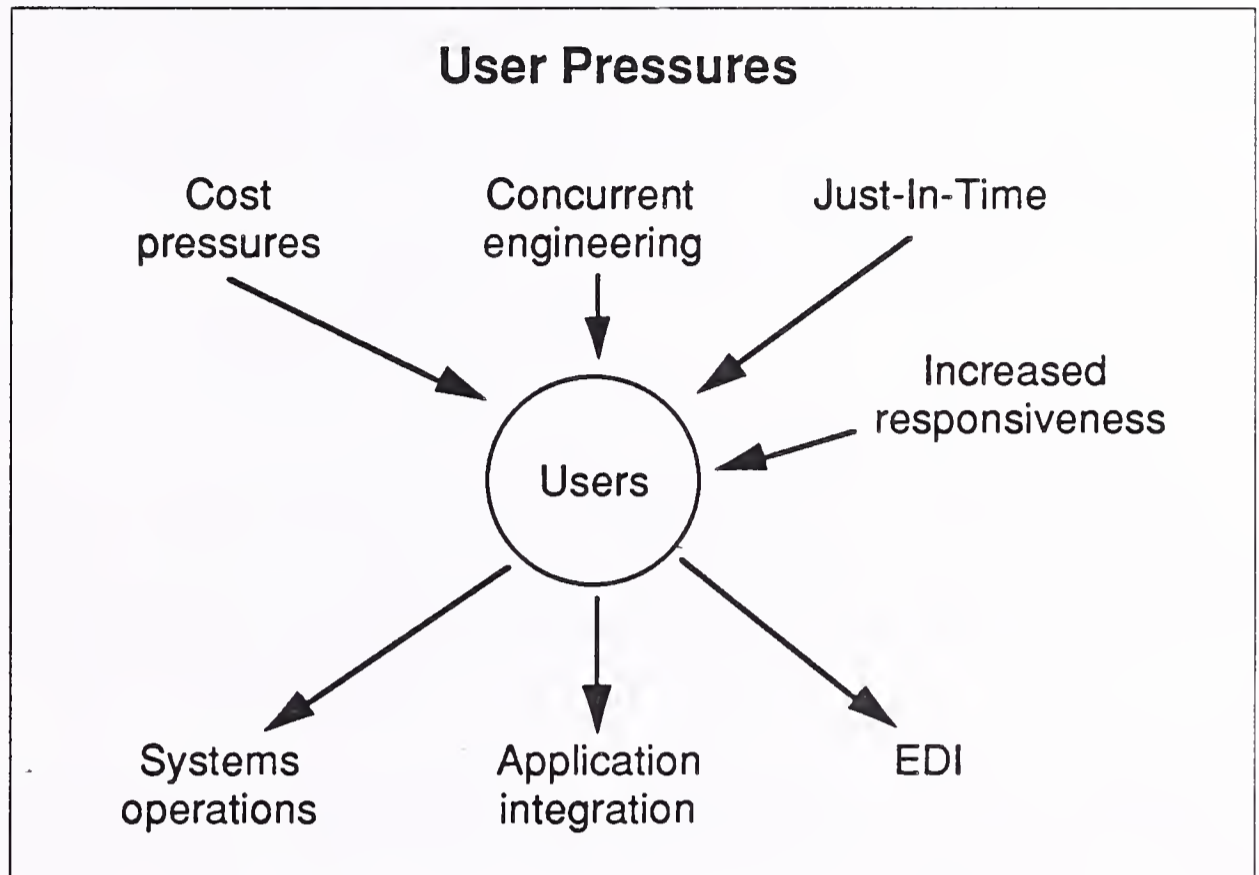
Each of these issues presents an opportunity for software and services vendors. Concurrent engineering necessitates more widespread use of CAD, and greater levels of integration with production engineering (via computer-aided process planning and computer-aided engineering) and production management systems.

Similarly, increased levels of integration between shopfloors, production management systems, and design systems leads to tighter control of manufacturing facilities, with resulting increased responsiveness to customers. Both cost reduction and improved delivery times can be achieved using just-in-time techniques, which are themselves greatly facilitated by use of EDI.

G

The Need for Collaboration

The major issue facing software and services vendors targeting the discrete manufacturing sector is the need for collaboration. Some examples of vendor collaboration are given in Exhibit II-13.

One aspect of this is the need for software and services vendors to achieve European coverage, given the increasing European focus of their clients. This has been readily achieved by the major CAD vendors, such as Intergraph and Prime/Computervision, but is proving more difficult for vendors to achieve in commercial areas such as production management systems. At present, there are no pan-European MRPII suppliers, although SAP is starting to develop a significant base outside Germany.

EXHIBIT II-13

Vendor Issues: Collaboration

- IBM Approved Industrial Systems Integrators
- Cincom "CIM Alliance" Programme
- Siemens and Lucas E&S
- ASK and EDS
- Sligos and Mesarteam

The other aspect of the collaboration issue is the need to provide complete business solutions for clients. Discrete manufacturing companies are increasingly looking to move towards a computer-integrated manufacturing environment. This places considerable stress on vendors to provide a wide range of software and services.

At present, it is impossible for any single vendor to provide such a wide range of offerings, and so extensive collaboration programmes are being built up by vendors.

Partnership needs of the various categories of vendors are shown in Exhibit II-14.

EXHIBIT II-14

Vendor Requirements from Partners

Vendor Requirements	Vendor Category		
	Application Software Product Vendors	Professional Services and Systems Integration Vendors	Major Equipment Vendors
Complementary application packages	High	High	High
Specialised professional services	High	Low	Medium
Systems integration	Medium	None	Low

Summary of level of vendor requirement by vendor category

The major equipment vendors, such as IBM, DEC and Siemens, are endeavouring to provide complete computer-integrated manufacturing environments for their clients, and are also endeavouring to become major systems integrators in their own right. As always, they have a strong need for application software products which can be marketed on their equipment. They have not yet assembled teams with adequate depth and breadth of experience to handle all aspects of systems integration. As a result, the major manufacturers remain dependent on professional services vendors to carry out specialised work on their behalf. IBM's Approved Systems Integrator programme is an example of this need, as is Siemens's relationship with Lucas.

Professional services vendors are faced with the question of whether to become owners of application software products or to depend almost exclusively on partnerships with application software product vendors. Opinion is divided on this subject, but either way, professional services vendors will always have some need for complementary application software products to fill the gaps in their own product range.

Rather than let professional services vendors pre-empt the situation, application software product vendors are forming their own consortia. For example, Cincom's CIM Alliance programme enables the company to offer users a wide range of complementary products alongside its own production management system.

H

Vendor Approaches to the Discrete Manufacturing Sector

Exhibit II-15 lists the leading vendors of software and services to the discrete manufacturing sector.

EXHIBIT II-15

European Discrete Manufacturing Sector Software and Services Leading Vendors 1989

Company	Estimated Revenues ($ Millions)	Market Share (Percent)
IBM	342	5.1
Nixdorf	223	3.3
Prime	182	2.7
Intergraph	170	2.5
CGS*	168	2.5

* Excludes Hoskyns' $63 million. Industry-specific revenues only.

IBM has been particularly active in terms of product announcements for the discrete manufacturing sector over the last twelve months, accompanying the announcement in October 1989 of the IBM CIM Architecture (ICA). IBM says ICA provides a framework for integrating CIM information from multiple application and information systems supplied by multiple vendors. It is clearly an attempt by IBM to persuade users to move towards computer-integrated manufacturing within an IBM framework, whilst reassuring them that non-IBM solutions can be included in part.

The architecture defines a set of hardware and software interfaces, together with a method for defining, managing and controlling CIM data. To address the two key areas of integration, IBM offers two enablers: ProductManager and the Plant Floor Series. ProductManager helps manage engineering data and its release to production management. The Plant Floor Series supports the development and integration of distributed factory floor supervisory and control systems.

The overall emphasis of these IBM offerings is to encourage users to retain their existing IBM products, and to move towards a more complete CIM environment. However, at the same time IBM is turning considerable attention towards its intermediate CIM offerings, based around the AS/400 and RS/6000.

A summary of vendor strategies is given in Exhibit II-16.

EXHIBIT II-16

Vendor Strategies

- Major equipment vendors and professional services vendors battle for systems integration market

- Application software products vendors move to UNIX

- IBM seeks to impose CIM architecture

- Partnerships versus product ownership
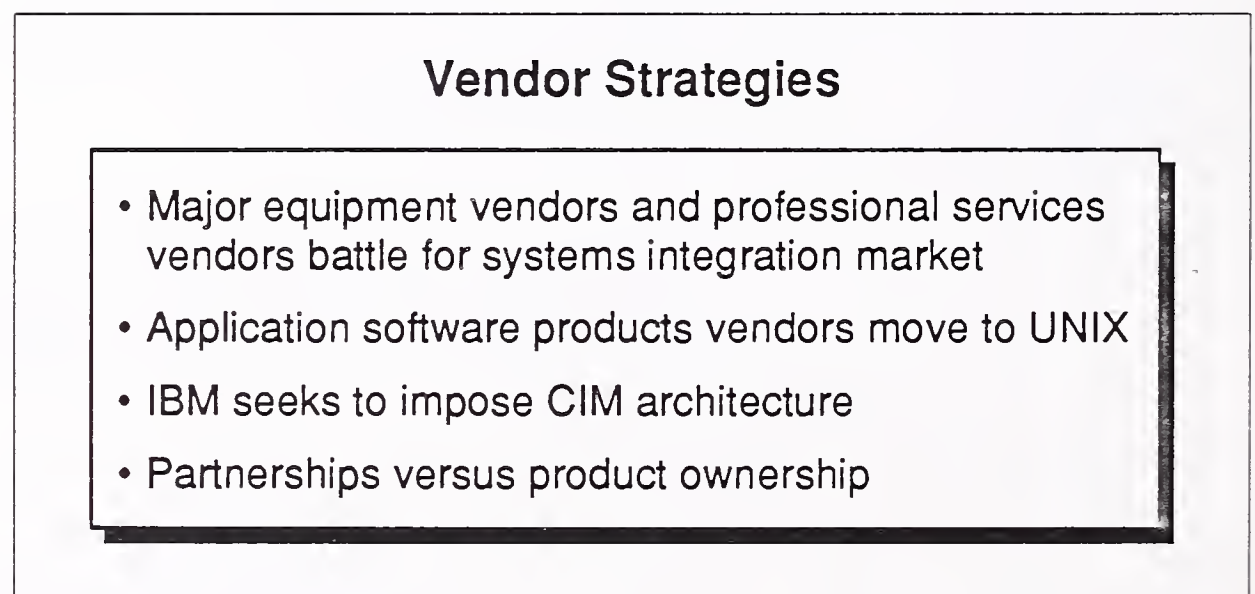
Siemens, aided by Siemens Automation (the company's factory automation business), is also aggressively targeting fully computer-integrated manufacturing solutions.

CGS is undoubtedly the most successful professional services vendor in the Western European discrete manufacturing sector, and its leadership position has been further emphasised by the acquisition of Hoskyns. CGS has now established itself in each of the four major country markets ahead of its rivals, such as Sligos and Sema Group.

The key strategic question for professional services vendors is the issue of partnerships versus product ownership. There are two points of view on this question. One is that application software products are an essential entry point into the professional services and systems integration markets. The opposing view is that products are expensive to develop, and it is better to build up a range of partnerships, giving access to the leading application software products. At the moment, the trend seems to be towards polarisation of application software product vendors and professional services vendors, with the latter becoming project managers and integrators. This approach obviously increases the flexibility of professional services vendors, at a time when considerable R&D is being spent on software products to implement them in a UNIX environment. This trend may reverse when the leading software products under UNIX become clear, thus leading to increased merger activity.

Considerable sums are being spent by application software product vendors, who have traditionally based their products on IBM mainframe or Digital hardware in moving their products to AS/400 and UNIX environments. For example, Dun & Bradstreet and Xerox have both moved their production management systems onto the AS/400, while CINCOM and ASK are introducing UNIX versions.

I

Key Opportunities

The major trend in the discrete manufacturing sector is users' need to integrate the major applications already installed, such as CAD and production management, and to provide better control of, and feedback from, activities on the shopfloor. In addition to providing better control of factory activities, and hence higher levels of customer responsiveness, the sharing of common up-to-date information between departments leads to considerable improvements in interorganisational communication and concurrent work. For example, improved sharing of data is forecast to lead to considerably reduced lead times in product design, and to more reliable products. This need for integration presents opportunities for both professional services and systems integration vendors.

As well as interorganisational integration, closer links are being established between manufacturers and their suppliers. As collaboration between manufacturers and their suppliers grows, and as just-in-time procedures become more commonplace, the use of EDI can be expected to expand significantly. At present, use of EDI is being delayed by a lack of global standards.

Information systems departments within the discrete manufacturing sector are also coming under cost pressures, with some lay-offs taking place as a result. This is leading to increased opportunities for both professional services vendors and systems operations vendors.

As yet, no single software and services vendor can provide the wide range of products and services required by the discrete manufacturing industry. This is leading to widespread partnerships involving consortia of leading vendors, and presents opportunities for vendors with a unique product or skill to take advantage of the marketing muscle of the principal vendors in the marketplace. Key opportunities are shown in Exhibit II-17.

EXHIBIT II-17

Conclusions
Key Opportunities

- Integration of major application areas

- EDI in support of JIT

- Cost reduction through professional services and systems operations

- Software products facilitating integration of "Islands of Automation"

- Partnerships are essential

The specific application software product opportunities in the Western European discrete manufacturing sector are shown in Exhibit II-18.

EXHIBIT II-18

Conclusions
Application Software Product Opportunities

- MRPII replacement on Pan-European basis

- Shopfloor data capture and control

- Engineering data management

- Completion of "CIM Wheel"

Although the production management software product market has now largely become a replacement market, it still accounts for a sizeable proportion of total revenues from the discrete manufacturing sector, and a number of major changes are taking place in the market. Firstly, users are looking to adopt common MRPII systems for use throughout their European facilities. As there are no truly pan-European vendors in this

area, this represents an open opportunity. The company closest to being a pan-European vendor is probably SAP. ASK and Cincom have been successful in the United Kingdom and France, but have had difficulty penetrating the German and Italian markets.

High growth rates are also forecast for shopfloor data collection and control, and engineering data management, both key areas in establishing a CIM environment. Similarly, there are opportunities for products such as finite scheduling and computer-aided process planning, which assist in moving the user closer to a CIM environment.

III

The Markets

III
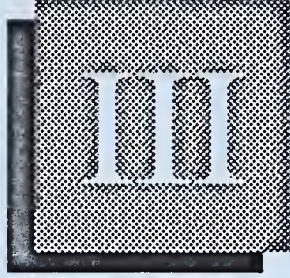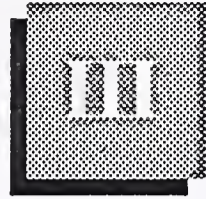
The Markets

A

European Software and Services Overview

The overall market for software and services within the Western European discrete manufacturing sector is forecast to grow from $8 billion in 1990 to $18 billion in 1995, at a compound annual growth rate of 18%, as shown in Exhibit III-1.

EXHIBIT III-1

European Discrete Manufacturing Sector Software and Services Market Forecast 1990-1995

These figures include only end-user industry-specific revenues. This means that revenues for systems software and cross-industry applications, such as accounting, are excluded. Examples of applications for which revenues are included are production management (including manufacturing resource planning or MRPII), and computer-aided design (CAD).

Exhibit III-2 shows the leading vendors in the discrete manufacturing sector, their estimated industry-specific revenues, and their market share.

The list is dominated by the major equipment vendors, such as IBM, Nixdorf, Siemens, Olivetti, Digital and Bull; the specialist CAD/CAM vendors, such as Prime and Intergraph; and the major professional services vendors, such as CGS, Sligos, EDS and Sema.

This list illustrates the point that it is comparatively easy to market technical applications software, such as CAD/CAM, on a pan-European basis, but difficult to achieve pan-European coverage with commercial applications software. The only commercial application software product vendor to appear in the European top twenty is SAP, a German vendor of production management systems. Even in this case, the company's position in the list of leading European vendors owes more to the company's dominance of the German market than its overall penetration of Europe. However, this may change as the company increases its drive into new markets. The company is already a significant player in France, and is becoming known in the U.K. SAP may be helped in achieving greater penetration in other national markets by Siemens's increasingly aggressive stance in targeting computer-integrated manufacturing.

With the exception of the major U.S. equipment and CAD vendors, the discrete manufacturing sector in each country market has until recently been dominated by indigenous vendors. However, there are clear indications that this is now starting to change. As companies in the discrete manufacturing sector increase their European focus, software and services vendors are doing likewise. Some recent examples of acquisitions having a major impact on the discrete manufacturing sector are CGS's acquistion of Hoskyns in the U.K., and SCS in Germany, together with Sligos's purchase of Mesarteam in Italy. If Istel's involvement with the Rover Group in the U.K. is discounted, then the acquisition of Hoskyns makes CGS the largest professional services supplier to the discrete manufacturing sector in both France and the United Kingdom. CGS already had a significant presence in Italy, and now has a major capability in the discrete manufacturing sector in each of the four major European country markets.

EXHIBIT III-2

Discrete Manufacturing Sector
Leading Vendors
Western Europe, 1989

Rank	Company	Target Share (Percent)	Estimated Revenues ($ Millions)
1	IBM	5.1	342
2	Nixdorf	3.3	223
3	Prime	2.7	182
4	Intergraph	2.5	170
5	CGS*	2.5	168
6	Siemens	2.3	155
7	Olivetti	1.4	91
8	Sligos	1.2	83
9	Istel	1.2	82
10	Mannesmann IS	1.2	81
11	Digital	1.2	80
12	EDS	1.1	74
13	McDonnell Douglas	1.1	74
14	Bull	1.0	66
15	Unisys	1.0	64
16	Hoskyns	0.9	63
17	SAP	0.9	62
18	Andersen	0.9	59
19	GEIS	0.8	53
20	Sema	0.8	52
	Other	66.9	4,476
	Total	100.0	6,700

Software and services revenues in the discrete manufacturing sector with Western Europe

* Does not include Hoskyns revenues

Provided CGS can successfully integrate these acquisitions, the company has a major lead over its main European rivals, such as Sligos, Istel, and Sema Group, in providing full European coverage. However, these three companies are also looking to improve their coverage of the discrete manufacturing sector throughout Europe, and more merger activity is likely over the next few years.

B

Key Subsectors

Exhibit III-3 shows the major subsectors within the Western European discrete manufacturing industry.

EXHIBIT III-3

Production in the Western European Discrete Manufacturing Industry by Subsector, 1989

- Automotive 18%
- Electrical Engineering 18%
- Mechancial Engineering 17%
- Manufacture of Metal Articles 13%
- Textiles 8%
- Footwear and Clothing 6%
- Other Transport 5%
- Printing 5%
- Office Machines 4%
- Furniture 3%
- Other 3%

Total production = ECU 1,400 billion ($1,700 billion)

Source: INPUT estimate, EEC

This corresponds to a considerable degree with the targeting of sub-sectors by software and services vendors. In order of priority, the top subsectors targeted by vendors are:

- Automotive
- Electronics
- Aerospace
- Mechanical engineering
- Electrical engineering

The automotive sector in Europe is expected to be one of the major battlegrounds of the 1990s. It has been suggested that the number of vehicle manufacturers in Europe will halve by the year 2000. There has already been a spate of mergers involving European companies.

For example:

- Ford has acquired Jaguar

- General Motors has taken a 50% shareholding and management control of Saab

- Fiat now controls Maserati, Innocenti and Alfa Romeo, and Renault and Volvo are believed to be close to forming a strategic alliance.

Alongside this merger activity, major refocusing is taking place in Eastern Europe, leading to considerable capital investment in the automotive sector. For example, Fiat is embarking upon a $7 billion project in the USSR, while Volkswagen, amongst others, is looking to significantly increase production within the former East Germany.

All this activity presents opportunities for software and services vendors.

In addition, the automotive sector is coming under greater pressure, as both the Japanese vehicle manufacturers and their component suppliers establish their first European plants. Hence, it is now even more imperative for European producers to increase the speed with which new models are brought to market, and to reduce their manufacturing costs significantly.

As the Japanese move to the luxury end of the car market, these pressures will increasingly apply to the German luxury car manufacturers such as BMW and Daimler-Benz, as well as the mass market producers.

Although the car industry has traditionally been the leader in terms of process technology, the aerospace industry is one of the leaders in the evolution of product and design technologies. Again, an increasing emphasis is being placed on alliances, and a major restructuring of the industry has recently taken place in Germany around Daimler-Benz. The Deutsche Aerospace Group now includes MTU, MBB, and Telefunken Systemtechnik, and is playing an increasingly important role in the European Airbus project, in which it has a 38% shareholding.

The automotive and aerospace sectors are those that software and services vendors expect to grow fastest over the next few years, as shown in Exhibit III-4.

EXHIBIT III-4

Subsectors in which Above-Average Growth Is Expected by Software and Services Vendors

Sector	Number of Mentions
Automotive	6
Aerospace	3
Electronics	1

Sample of 18 European software and services vendors.

Multiple responses allowed.

This is hardly surprising. CAD and computer-aided engineering play a major role in assisting both sectors to reduce the time taken to introduce new models. If concurrent engineering can be successfully implemented by users, leading to true sharing of consistent and up-to-date information amongst internal departments and component suppliers, then it could make a major impact on both new model lead times and unit production costs.

At the factory level, the use of JIT procedures—which necessitates the use of EDI for any but the most local of suppliers—can have a significant influence on both product quality and production costs. Even the aerospace sector is now having to pay more and more attention to its process technology and cost reduction.

Finally, since many of the larger players in the automotive sector have a considerable investment in factory automation, the ability to integrate this with their production management systems and design systems will lead to much improved management of their facilities and greater production flexibility.

C

Country Forecasts

1. Overview

Exhibit III-5 shows INPUT's forecast for the industry-specific software and services market in the discrete manufacturing sector for each of the major countries.

EXHIBIT III-5

Western European Discrete Manufacturing Sector Software and Services Market Forecast by Country 1990-1995

CAGR (Percent)

Country	1990	1995	CAGR (Percent)
Germany	1.9	4.9	21
France	1.8	4.2	18
United Kingdom	1.3	2.4	14
Italy	0.82	1.9	18
Rest of Europe	2.1	4.7	17

☒ 1990
☑ 1995
Overall CAGR = 18%

User Expenditures ($ Billions)
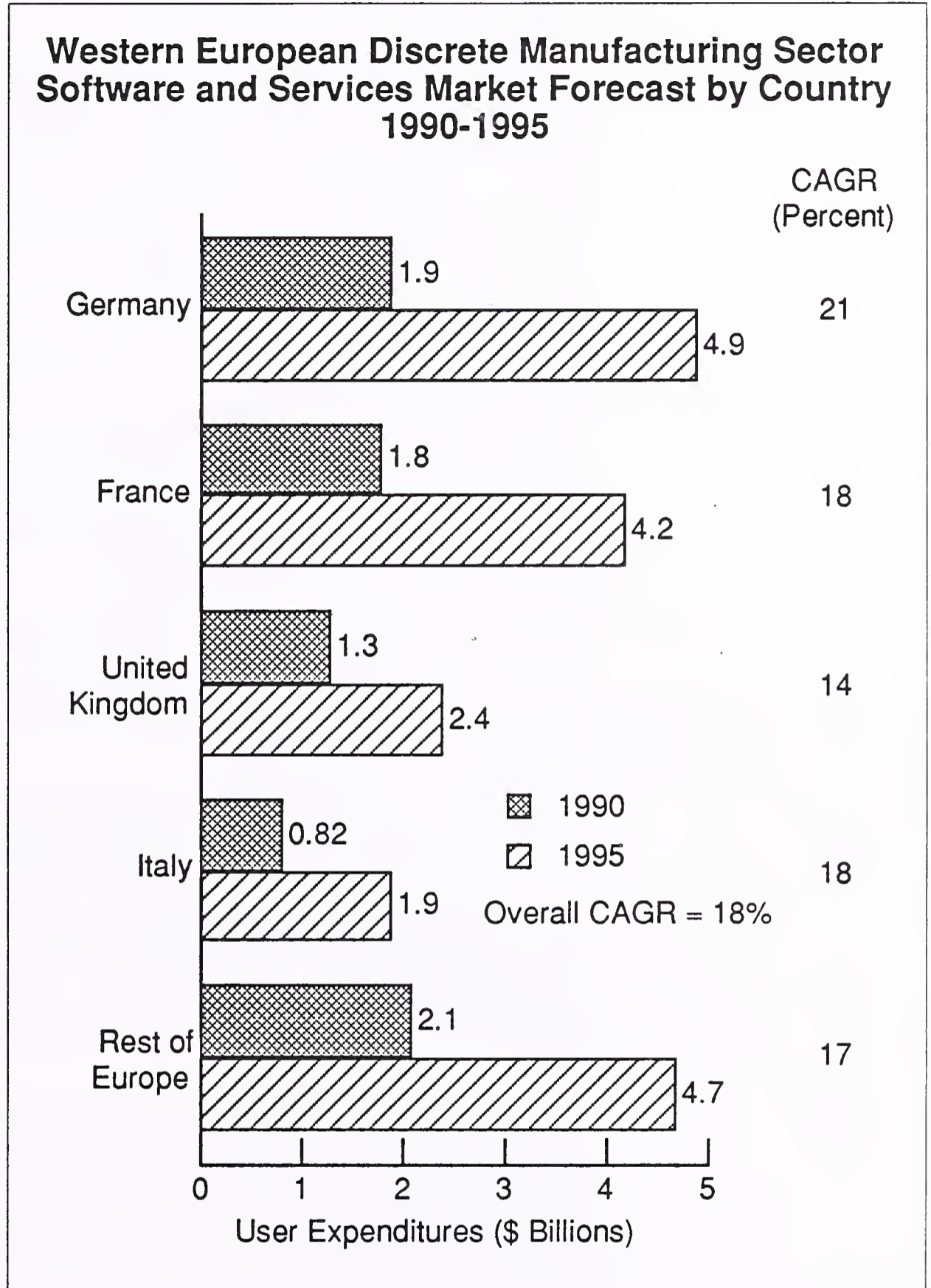
The major trends within each of these countries are discussed in the following sections of the report. In terms of broad comparisons, the fastest growing market over the period 1990-1995 is expected to be Germany, while growth in the United Kingdom, at 14% per annum, will be appreciably lower than the average for Western Europe.

2. Germany

Germany is widely recognised as having the largest and strongest discrete manufacturing sector in Europe. Indeed, the significance of the German discrete manufacturing sector within Europe can only be expected to increase as a result of the recent re-unification with East Germany. As capital investment either in East Germany or to serve the East German market grows, corresponding opportunities will arise for software and services vendors.

However, it would be a mistake to imagine that the German engineering sector does not suffer from the same pressures felt elsewhere in Western Europe. Indeed, it is frequently argued that the high cost of labour in Germany puts an increased onus on the discrete manufacturing sector to reduce its production costs by means of highly automated process technology. The discrete manufacturing sector software and services market forecast by delivery mode is given in Exhibit III-6.

The German equipment vendors—Nixdorf, Siemens, Mannesmann Kienzle, and Taylorix—have a considerable share (20%) of the software and services revenues from the discrete manufacturing sector. A list of leading vendors in Germany is given in Exhibit III-7.

Siemens is now starting to aggressively target the computer-integrated manufacturing (CIM) market. The company believes that it is well positioned to do so, since it is a major electrical conglomerate, and manufactures all the hardware required for CIM, from programmable logic controllers (PLCs) to mainframes. Siemens Automation is a complementary business to Siemens Data Systems, and has extensive experience in factory automation projects. Typical projects include the installation of flexible manufacturing systems and CNC/DNC implementations.

The remaining German equipment vendors were all traditionally suppliers of turnkey systems on proprietary hardware. Typically, their main target within the discrete manufacturing sector was production management systems. However, these companies have been adversely impacted by the increased acceptance of UNIX. This has resulted in the purchase of Nixdorf by Siemens. Mannesmann Kienzle is also available for purchase from the parent Mannesmann group.

Although Sigraph puts Siemens in the top five CAD vendors in Germany, the German CAD market is largely dominated by U.S. vendors. For example, Germany is Intergraph's main country market in Western Europe. On the other hand, the U.S.-based production management software products vendors find Germany a difficult market to penetrate. The market leader in this segment is the local supplier, SAP.

EXHIBIT III-6

Discrete Manufacturing Sector
Software and Services Market Forecast, 1990-1995
Germany

CAGR
(Percent)

Category	1990	1995	CAGR (Percent)
Processing Services	260	290	2
Network Services	130	510	32
Software Products	400	960	19
Professional Services	410	1,320	26
Systems Integration	120	460	31
Turnkey Systems	580	1,300	18
Systems Operations	20	70	30

▨ 1990
▨ 1995

Overall CAGR = 21%

User Expenditures ($ Millions)

0   500   1000   1500

EXHIBIT III-7

Discrete Manufacturing Sector
Leading Vendors
Germany, 1989

Rank	Company	Target Share (Percent)	Estimated Revenues ($ Millions)
1	Nixdorf	8.1	124
2	Siemens	7.9	121
3	IBM	5.0	77
4	Intergraph	4.4	68
5	Prime	4.0	61
6	SAP	2.9	44
7	Mannesmann Kienzle	2.7	41
8	Taylorix	1.5	23
9	Ploenzke	1.0	15
10	IKOSS	0.8	13
	Others	61.7	913
	Total	100.0	1,500

Software and services revenues from the discrete manufacturing sector within the Federal Republic of Germany

Other independent vendors with a leading position in the German discrete manufacturing software and services market include:

- Ploenzke
- IKOSS

More recently, the acquisition of SCS by CGS moves CGS into the leading names of independent vendors in Germany.

Siemens has recently acquired Calay Systems' CAD activities in the electronics sector, to strengthen its position in the electronic design business. Siemens's primary strength remains in the mechanical design market.

3. France

The prospects for industry-specific software and services in the French discrete manufacturing sector lie between the buoyancy of the German market, and the comparatively depressed state of the market in the United Kingdom. Exhibit III-8 gives a breakdown of the French market by delivery mode.

EXHIBIT III-8

Discrete Manufacturing Sector
Software and Services Market Forecast, 1990-1995
France

CAGR (Percent)

Delivery Mode	1990	1995	CAGR (Percent)
Processing Services	240	260	2
Network Services	150	450	24
Software Products	400	800	15
Professional Services	520	1,500	24
Systems Integration	38	131	28
Turnkey Systems	420	840	15
Systems Operations	60	220	30

▧ 1990
⧄ 1995

Overall CAGR = 18%

User Expenditures ($ Millions)

Four of the leading ten companies in the European discrete manufacturing sector are French. These are the two major car manufacturers: Renault and Peugeot; and electronics companies: CGE and Thomson-CSF. France also has a very strong presence in the European aerospace sector through the Airbus consortium, and companies such as Aerospatiale and Dassault Breguet. France also has a majority stake in the Ariane space launch venture.

The automotive and aerospace sectors continue to be regarded by software and services vendors as the most promising industries within French discrete manufacturing industry. However, Peugeot has just postponed development of new facilities in Europe, and appears to be becoming increasingly concerned about the health of the European car market.

Unlike the discrete manufacturing software and services market in Germany, where the indigenous equipment manufacturers play a major role, in France the leading group consists of French professional services companies. The two market leaders are CGS and Sligos. Indeed, these two companies are the leading independent vendors serving the discrete manufacturing sector of Europe as a whole.

Their leadership position in the sector has recently been further strengthened by acquisition. CGS has acquired Hoskyns and SCS, while Sligos has purchased Mesarteam. As well as increasing their overall market shares in the discrete manufacturing sector, these acquisitions have further improved each company's coverage outside France.

Bull has recently moved to make its production management system, HDMS Plus, more European in outlook, by incorporating both multilanguage and multicurrency features.

Besides those shown in Exhibit III-9, leading independent vendors in France serving the discrete manufacturing sector include EDS, Dataid, Sema Group and Steria.

Discrete Manufacturing Sector
Leading Vendors
France, 1989

Rank	Company	Target Share (Percent)	Estimated Revenues ($ Millions)
1	CGS	5.8	92
2	Sligos	5.0	80
3	IBM	4.0	63
4	Prime	3.0	47
5	GSI	2.1	34
6	Bull	2.1	33
7	Soproga	2.0	32
8	CISI	1.8	29
9	Intergraph	1.6	26
10	CGI	1.6	25
	Others	71.0	1,139
	Total	100.0	1,600

Software and services revenues from the discrete manufacturing sector within France

4. United Kingdom

For much of 1990, the discrete manufacturing sector in the U.K. has been depressed. The primary cause of this depression is the high level of interest rates in the United Kingdom. In this environment, many software and services companies are finding that they are asked to bid for projects which are then indefinitely postponed. With this slowdown in growth, vendors are finding that the market is becoming very competitive, with increasing price competition. A breakdown of the U.K. market by delivery mode is given in Exhibit III-10.

EXHIBIT III-10

Discrete Manufacturing Sector
Software and Services Market Forecast, 1990-1995
United Kingdom

CAGR
(Percent)

Processing Services
170
210
4

⊠ 1990
◻ 1995

Overall CAGR = 14%

Network Services
120
270
17

Software Products
250
400
10

Professional Services
290
690
19

Systems Integration
55
130
19

Turnkey Systems
350
560
10

Systems Operations
40
160
31

0   500   1000   1500

User Expenditures ($ Millions)

As in the rest of Europe, the healthiest subsectors of the U.K. discrete manufacturing industry are, in order of level of optimism:

• Automotive
• Aerospace
• Electronics

MEIDO

In the automotive sector, the market for industry-specific software and services is being buoyed by the demand from Japanese entrants. This demand is having a particularly beneficial impact for software and services vendors in the automotive components sector. Here, the indigenous suppliers are benefiting from increased demand for their products. In addition, new entrants from Germany and Japan are arriving to service the new vehicle assemblers. All this activity is favourable to software and services vendors.

Exhibit III-11 shows the leading vendors offering industry-specific software and services to the discrete manufacturing sector. As well as Istel, Hoskyns, the Sema Group, Thorn EMI and EDS, other leading independent vendors include SD-Scicon and Andersen Consulting.

EXHIBIT III-11

Discrete Manufacturing Sector
Leading Vendors
United Kingdom, 1989

Rank	Company	Target Share (Percent)	Estimated Revenues ($ Millions)
1	Istel	7.2	81
2	Prime	6.5	73
3	IBM	6.3	71
4	Hoskyns	5.4	61
5	McDonnell Douglas	4.1	46
6	ICL	3.5	39
7	Intergraph	2.3	26
8	Sema	2.2	25
9	Thorn	2.1	24
10	EDS	2.0	23
	Others	58.4	631
	Total	100.0	1,100

Software and services revenues from the discrete manufacturing sector within the United Kingdom

Although Istel is the leading vendor in the U.K., this position owes more to the company's former parent than its overall penetration of the discrete manufacturing sector. The bulk of its revenues in the discrete manufacturing sector are still derived from the Rover Group. The company could now be expected to try to penetrate the lucrative aerospace sector, on the basis of the Rover Group's present ownership by British Aerospace. Istel, now owned by AT&T, is also known to have ambitions of establishing itself more widely in Western Europe. Subject to the agreement of AT&T, this could be expected to take the form of acquisitions in France and Germany.

U.S.-based vendors such as Intergraph, Prime/Computervision, IBM, and—at the low end of the market—Autodesk dominate the CAD market in the United Kingdom.

Similarly, though there are some successful U.K.-based vendors of production management systems, such as Kewill and CSD (now AT&T Istel Impcon Solutions), the United Kingdom market has been heavily penetrated by U.S. vendors, such as:

- Computer Associates, with IBM mainframe-based systems
- ASK and CINCOM, with DEC-based systems
- SSA and Dun & Bradstreet, with AS/400-based systems

The United Kingdom production management systems market is also coming under attack from SAP, which is targeting high levels of European growth.

5. Italy

While the large discrete manufacturing companies in Northern Italy, such as Fiat, can be expected to be at the forefront of JIT, factory automation and systems integration, much of the Italian discrete manufacturing sector is unsophisticated. This means that users require comparatively low levels of functionality in their systems. The nature of Italian accounting also presents difficulties for non-indigenous vendors.

As a result, Italy is an area where many vendors would like to increase their sales, but where they have had comparatively low levels of success to date. This is particularly true for production management software product vendors, such as ASK and CINCOM.

As elsewhere in Western Europe, considerable growth is expected in systems integration and manufacturing consultancy over the next few years. However, the discrete manufacturing sector in Italy was slightly depressed in the first half of 1990. In the longer term, the country's textiles sector is at risk from cheap imports. Growth and expenditure forecasts by delivery mode for the Italian market are shown in Exhibit III-12.

EXHIBIT III-12

**Discrete Manufacturing Sector
Software and Services Market Forecast, 1990-1995
Italy**

CAGR (Percent)

Category	1990	1995	CAGR
Processing Services	110	120	2
Network Services	70	190	22
Software Products	200	410	16
Professional Services	190	540	23
Systems Integration	35	120	28
Turnkey Systems	200	380	14
Systems Operations	25	95	31

▨ 1990
◨ 1995

Overall CAGR = 18%

User Expenditures ($ Millions)

With many of the major European professional services companies seeking to increase their presence in Italy, a certain amount of merger and acquisition activity can be expected over the next few years. One very recent example of this is Sligos's acquisition of Mesarteam, an Italian vendor specialising in the discrete manufacturing sector.

MEIDO

One earlier collaboration which appears to have generated only low levels of business is that between Olivetti and EDS. In 1987, Olivetti and EDS established a joint venture company called Integrated Systems Management, in Milan, targeting factory automation systems integration projects.

Exhibit III-13 shows the leading vendors in the Italian discrete manufacturing software and services market. Three of the top five vendors are equipment vendors: Olivetti, IBM, and Bull. Syntax is a subsidiary of Olivetti.

EXHIBIT III-13

Discrete Manufacturing Sector
Leading Vendors
Italy, 1989

Rank	Company	Target Share (Percent)	Estimated Revenues ($ Millions)
1	Olivetti	8.8	61
2	IBM	7.8	54
3	Finsiel	6.8	47
4	Bull	1.6	11
5	Syntax*	1.4	10
6	CGS	1.4	10
7	Prime	1.3	9
8	Andersen	1.3	9
9	Sicit	1.3	9
10	Unisys	1.2	8
	Others	67.1	462
	Total	100.0	690

* An Olivetti subsidiary

CGS maintains its position as the leading independent professional services vendor serving the Western European discrete manufacturing sector. CGS is in the top ten vendors in France, the United Kingdom and Italy, and is also a significant vendor in Germany.

D
Key Delivery Modes

1. Overview

Exhibit III-14 shows the growth in industry-specific revenues for the Western European discrete manufacturing sector by delivery mode.

EXHIBIT III-14

Western European Discrete Manufacturing Sector Software and Services Market Forecast by Delivery Mode, 1990-1995

Delivery Mode	1990	1995	CAGR (Percent)
Processing Services	1,100	1,300	3
Network Services	640	1,900	24
Software Products	1,700	3,500	16
Professional Services	1,900	5,400	23
Systems Integration	280	940	28
Turnkey Systems	2,100	4,300	16
Systems Operations	180	660	30

Overall CAGR = 18%

User Expenditures ($ Millions)

The forecast average growth rate over the period 1990-1995 is 18%. However, there is considerable variation from this average by delivery mode.

As the emphasis in the discrete manufacturing industry changes, so the turnkey systems and application software products markets will slow down. Over the same period, higher levels of growth will be seen in the professional services and systems integration sectors. This is because the emphasis in the discrete manufacturing sector is no longer on implementing standalone applications such as CAD and production management. The larger discrete manufacturing companies have been using such systems for some years and are now keen to integrate their existing application areas. The implementation of higher levels of integration can take several forms. One approach is to link the existing systems using either IS staff or a professional services vendor. The other approach is for the user to replace all existing applications with a new set of applications that are known to be readily integratable. Both of these approaches are being observed in the marketplace.

Other high-growth delivery modes are network services and systems operations. Network services will benefit from the substantial increase in the use of EDI, as users start to evolve from the trial stage and markedly extend the number of transactions being performed via networks.

Systems operations will also grow, as information systems departments come under increasing cost pressures in the discrete manufacturing sector.

2. Software Products

The major application areas supported by software products in the discrete manufacturing sector are shown in Exhibit III-15. The two principal applications in 1990 remain production management and CAD/CAM, though shopfloor data collection and control and production engineering applications are increasing in importance.

Western European Discrete Manufacturing Sector Software Products Market by Application 1990

Shopfloor Data Collection and Control — 12%

Production Management 36%

Production Engineering 19%

CAD/CAM 33%

Total Market = $1,700 million
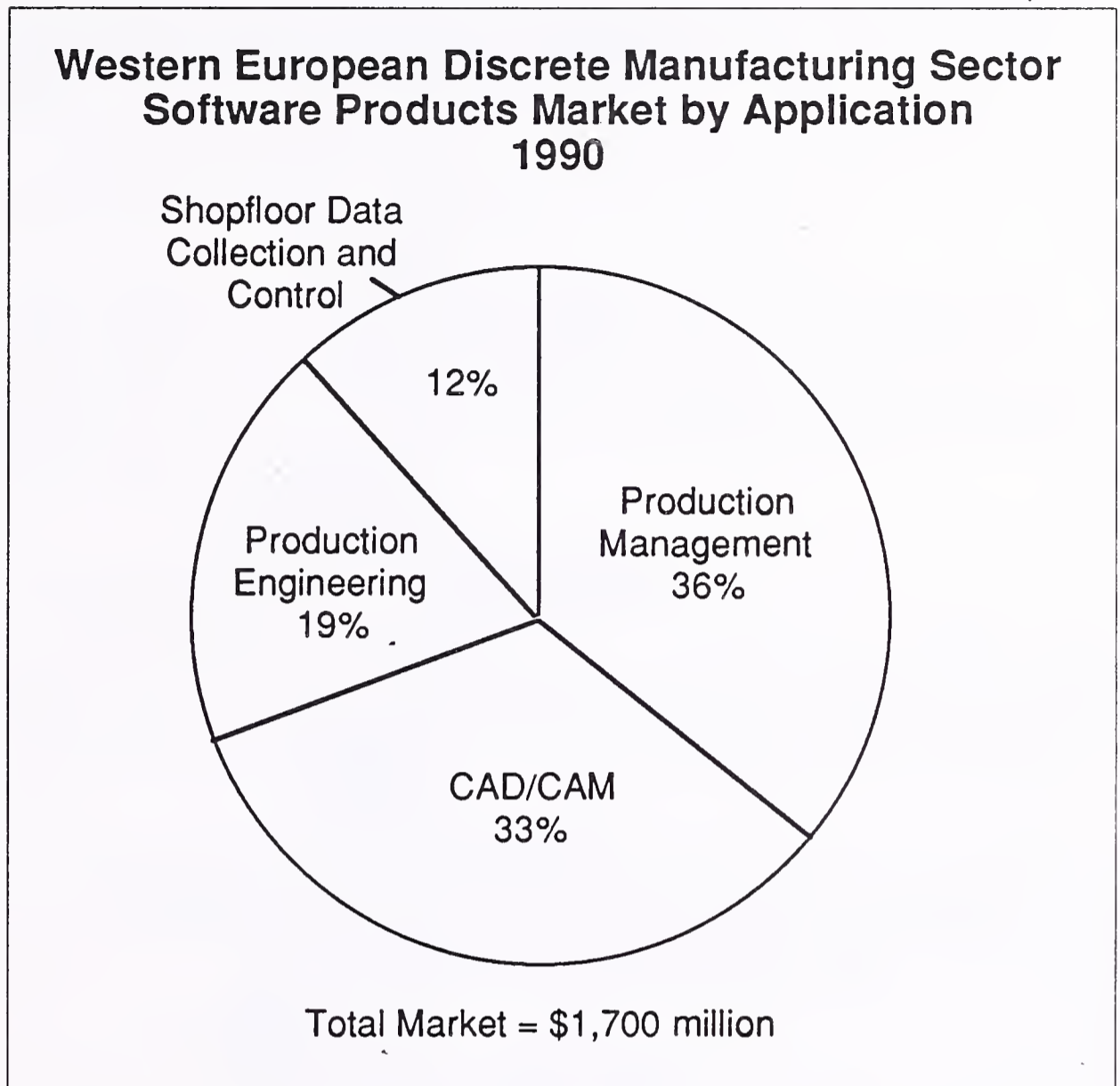
The market forecast for software products in the discrete manufacturing sector is shown in Exhibit III-16.

Levels of growth are expected to be very low for mainframe-based software. For example, CAD is no longer typically implemented on mainframes. The workstation, and to a lesser extent the microcomputer, have become the primary CAD equipment platforms. One of the most important influences in the CAD market has been, and will remain, the rapidly decreasing "cost per seat". Even IBM is publicly recognizing this trend, with increased emphasis on the RS/6000 as the equipment platform for products such as CATIA. IBM has also recently introduced micro-computer-based CAD systems, to provide entry-level systems.

Similarly for production management systems, the emphasis is changing in favour of minicomputer-based systems. For example, Xerox—formerly one of the major suppliers of mainframe-based MRPII systems—has just announced a new MRPII product, which will also run on the RS/6000 and DEC VAX. Support for the AS/400 and UNIX-based systems are planned for future release. Likewise, Dun & Bradstreet has just launched AMAPS/400, a production management system for the AS/400, and is developing UNIX versions.

EXHIBIT III-16

Western European Discrete Manufacturing Sector Software Products Market Forecast, 1990-1995

CAGR (Percent)

| | 1990 |
| | 1995 |

Overall CAGR = 16%

Mainframe Software — 140 (1990), 170 (1995), CAGR 4

Minicomputer Software — 530 (1990), 960 (1995), CAGR 13

Workstation Software — 340 (1990), 830 (1995), CAGR 20

Microcomputer Software — 690 (1990), 1,540 (1995), CAGR 17

User Expenditures ($ Millions)
0   500   1000   1500   2000

Overall, the level of growth in software products is much higher for minicomputers than mainframes. Minicomputers remain the basic workhorse for MRPII installations, though there appear to be signs of a slowdown in the Digital VAX-based market. Certainly, many of the major vendors of Digital-based MRPII systems are developing the latest versions of their systems to run under UNIX. This route is being taken by both ASK and CINCOM.

One sector showing strong growth in 1990 is the market for AS/400-based production management systems. In addition to companies migrating from System/38 and System/36, there is a significant move to AS/400 from companies formerly running their production management systems on mainframes. This is true for both IBM and non-IBM mainframe users.

Overall, IBM is now placing considerable emphasis on its intermediate computer-integrated manufacturing (I-CIM) products, such as:

- AS/400 and MAAPICS DB
- RS/6000 and CATIA
- Industrial computers and SFDC

Growth will remain highest at the microcomputer level. Much of the growth in the CAD market is taking place at the low end of the market. Major CAD vendors, such as Intergraph and Prime/Computervision, have responded to the success of Autodesk by launching their own microcomputer-based products:

- Intergraph with the Microstation drafting product
- Prime/Computervision with Personal Designer

Similarly, there is appreciable demand from small discrete manufacturing organisations for microcomputer-based production management systems. The importance of this sector of the market in 1990 is shown in Exhibit III-17.

EXHIBIT III-17

Western European Discrete Manufacturing Sector Production Management Software Products Breakdown by Equipment Type 1990

Total Market = $620 million

Proportion of production management software products sold by type of equipment in 1990
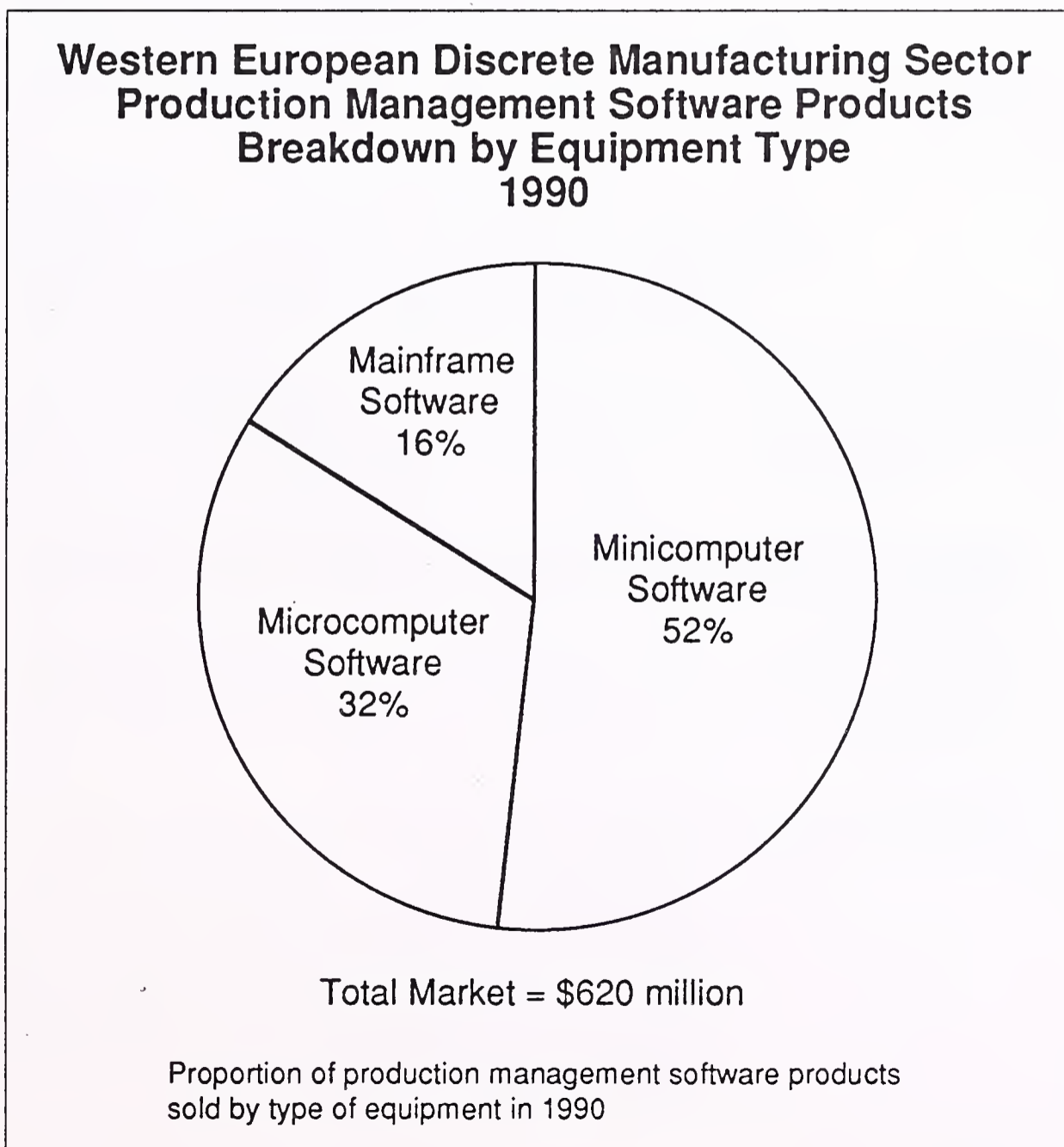
Exhibit III-18 shows the levels of demand forecast by users across the major application areas, and Exhibit III-19 illustrates vendor expectations, broken down by equipment type.

EXHIBIT III-18

Discrete Manufacturing Sector
User Purchasing Intentions

Application	Level of Purchasing Intent
Shopfloor data collection and control	High
Production management	Medium
CAD/CAM	Medium
Engineering data management	Low

Summary of buying intentions stated by Western European discrete manufacturing users

EXHIBIT III-19

Vendors' Perception of Growth in Discrete Manufacturing Sector—Software Products by Application and Equipment Platform

Equipment Platform	Application			
	CAD/CAM	Engineering Database Management	Production	Shopfloor Data Collection and Control
Microcomputer and workstation	High	Low	Medium	High
Minicomputer	Low	High	Medium	High
Mainframe	Low	High	Low	Low

A high level of demand is forecast by both users and vendors for shopfloor data collection and control systems, reflecting the increased need to closely monitor events on the factory floor and maintain tighter control over production schedules. Such systems give production managers the levels of feedback necessary to provide a more flexible and responsive service to their customers.

Production management systems can expect moderate levels of growth overall. The minicomputer-based production management software market is now primarily a replacement market. However, there could be a fresh surge of growth if a significant move to UNIX-based systems occurs in the discrete manufacturing sector.

Engineering data/document management is one of the principal growth areas targeted by the major hardware vendors, such as IBM and Digital, and by the specialist CAD vendors. However, apart from a few leading-edge users, such as British Aerospace, there is little sign of user activity in this area at present. Nor is this application currently planned for implementation by the typical user.

3. Turnkey Systems

The market forecast for turnkey systems in the discrete manufacturing sector is shown in Exhibit III-20, and the composition of the turnkey systems market by application is shown in Exhibit III-21.

The turnkey systems delivery mode remains the key delivery mode for CAD/CAM systems. However, there are few European vendors amongst the leading CAD suppliers to the discrete manufacturing sector. Most of the leading vendors are U.S.-based. The principal European vendors are:

- Siemens
- Cisigraph
- Pafec

CAD is a key technology for users in the discrete manufacturing sector, as they endeavour to reduce the time required to introduce new products and to reduce production costs. Accordingly, the leading CAD vendors are seeking to develop the use of concurrent engineering and engineering data management.

Production management systems are also an important area for turnkey systems vendors. Traditionally, this was particularly true for the mid-range proprietary equipment vendors, such as Nixdorf and Mannesmann Kienzle. In addition, all the mainframe equipment vendors—such as IBM, Siemens, Bull and ICL—offer turnkey production management systems.

Turnkey systems based on UNIX will become increasingly important in the future, particularly on midrange equipment platforms.

EXHIBIT III-20

Western European Discrete Manufacturing Sector Turnkey Systems Market Forecast 1990-1995

CAGR
(Percent)

Equipment
900
1700   13

Packaged Software
740
1500   15

Custom Software
250
470   13

▨ 1990
▨ 1995
Overall CAGR = 16%

Other Professional Services
210
630   25

0   500   1000   1500   2000

User Expenditures ($ Millions)

EXHIBIT III-21

**Western European
Discrete Manufacturing Sector
Turnkey Systems by Application
1990**

Production
Engineering

4%

CAD/CAM   41%   42%   Production
Management

13%

Shopfloor Data
Collection and Control

Total Market = $2,100 million

Exhibit III-22 shows the importance that vendors attach to shopfloor data collection and control (SFDCC). SFDCC is increasingly becoming an integral part of the software products vendors' MRP II systems. However, SFDCC is also important as an application in its own right. Shopfloor data collection and control covers a number of uses, such as:

- Inventory and WIP tracking
- Workforce monitoring
- Cell control

and is now being extended to cover areas such as:

- Maintenance
- Statistical process control

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Vendor Attitudes to Shopfloor Data Collection and Control

Positive   Neutral   Negative

- A growth area

- The operational control area is growing

- A principal product area

- Have alliances with suppliers of SDC systems

- We provide "application development platforms"

Sample Attitude Profile

Positive ///////////// 5

Neutral ///////////////////// 9

Negative 0

0   2   4   6   8   10
Number of Vendors

Sample of 14 Western European software and services vendors. CAD vendors are excluded from the sample.

4. Professional Services

In the period 1990-1995, professional services revenues and systems integration revenues will grow rapidly in line with the need of the discrete manufacturing sector to integrate the major application areas.

Although some users will carry out the necessary work to integrate their systems in-house, an increasing proportion will turn to professional services vendors for assistance.

The growth in professional services will also be driven by the enabling products being provided by the major equipment vendors—such as IBM, Unisys and Digital. These companies are providing architectures to

enable their users to move towards computer-integrated manufacturing. Although these architectures and enabling products provide a mechanism for establishing the appropriate links between applications, considerable bespoke work is still required to make this happen, as shown in Exhibit III-23.

EXHIBIT III-23

Western European Discrete Manufacturing Sector Professional Services Market Forecast 1990-1995
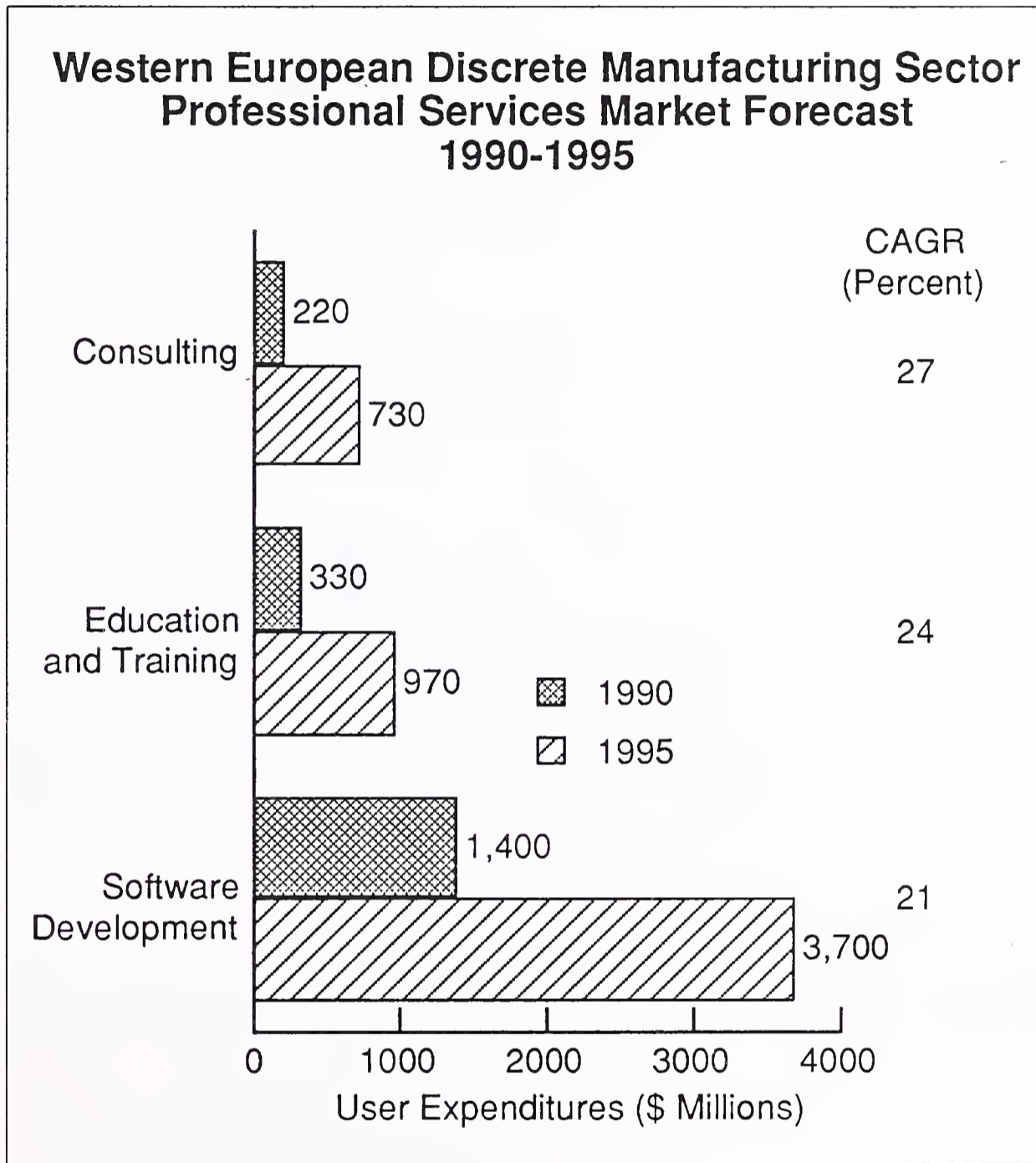

As information systems move down the organisation to the shopfloor, education and training become even more important in ensuring successful implementation.

The key areas requiring integration are shown in Exhibit III-24. The larger and even medium-sized discrete manufacturing companies have been using production management systems for many years now. The users' current need is to integrate these systems with their CAD systems and the shopfloor.

EXHIBIT III-24

User Integration Plans

Number of users planning integration between applications. Sample of five European discrete manufacturing companies
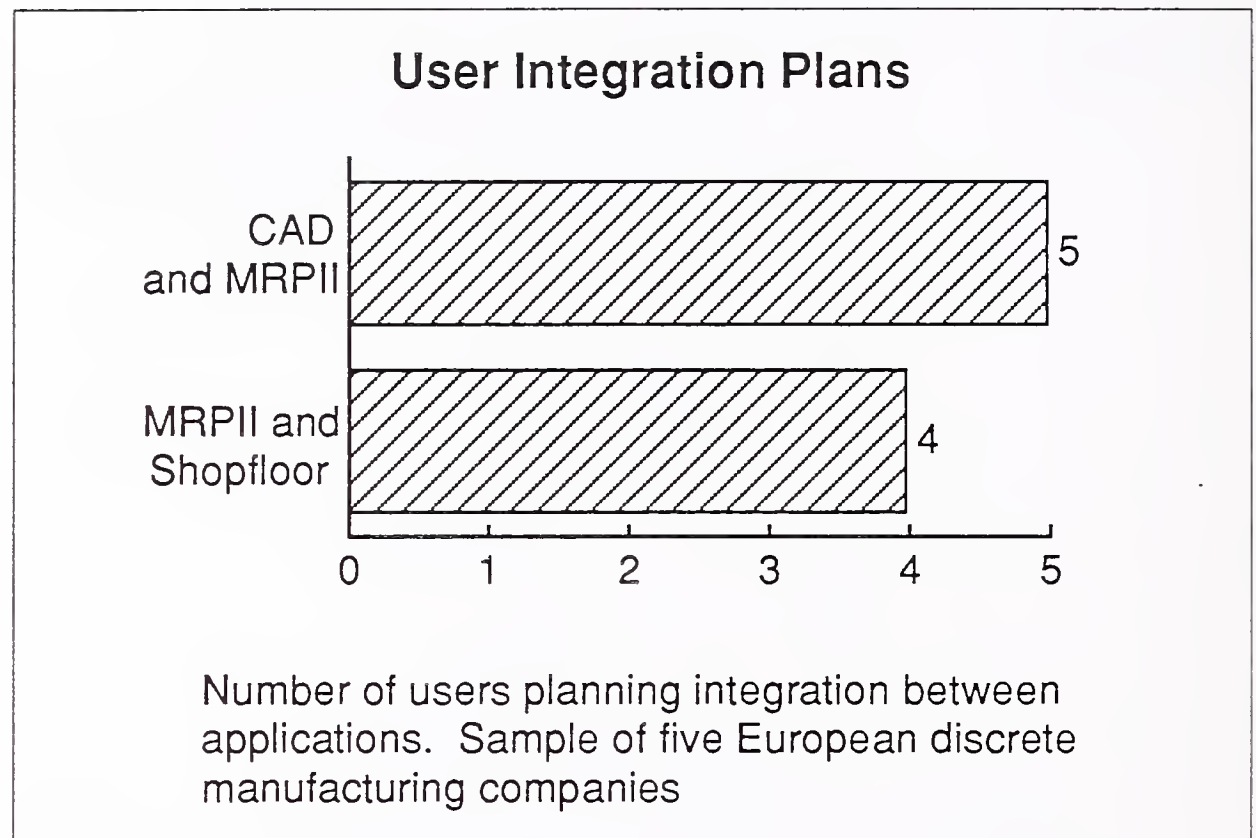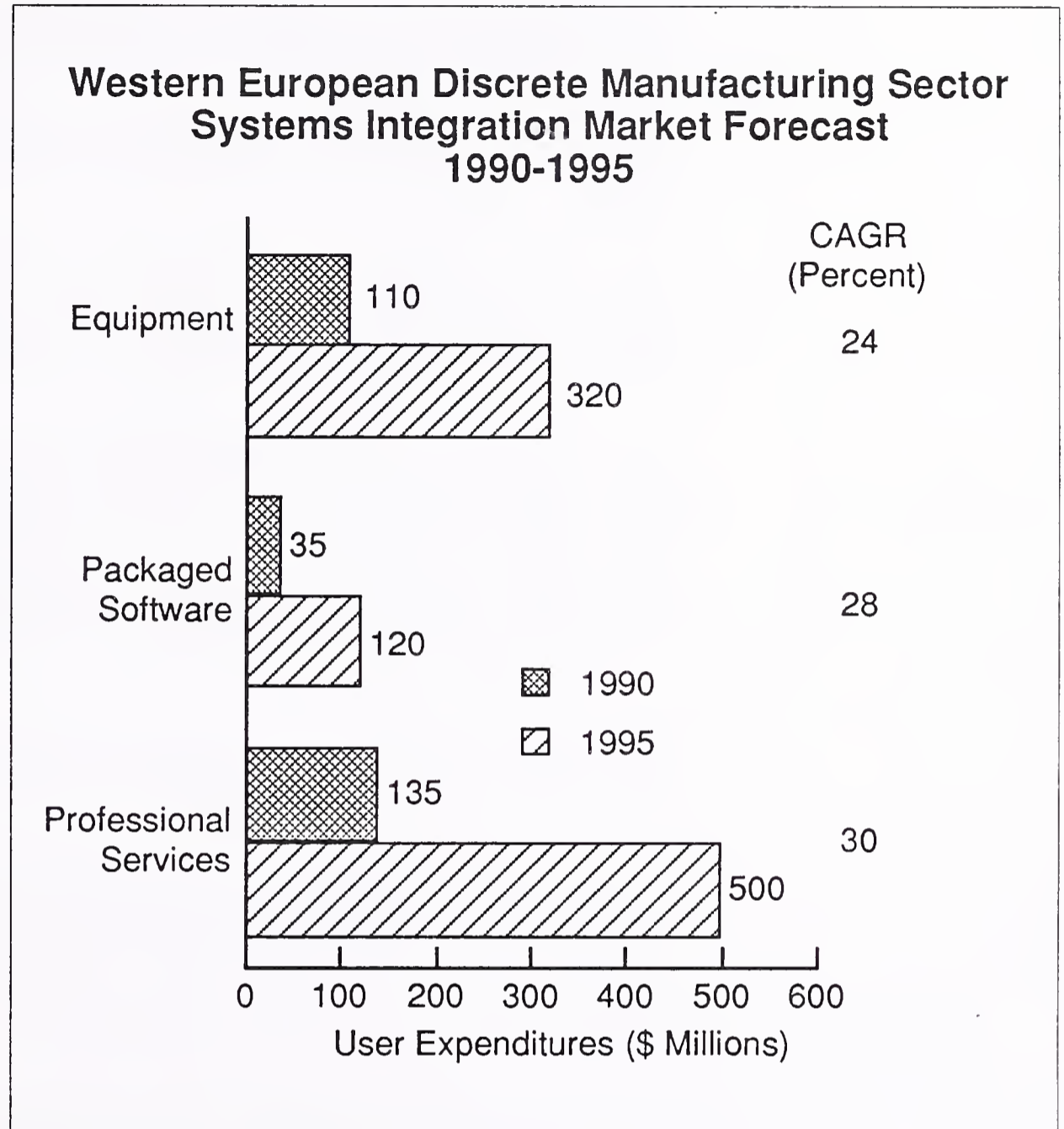
Many of the large users will attempt to carry out this integration in-house, but as cost pressures increase on IS departments, an increasing proportion of vendors will turn to professional services vendors for assistance.

5. Systems Integration

Many users are looking in the long-term to move towards a computer-integrated manufacturing environment. In a fully integrated environment, closed-loop management systems would apply to production and design cycles. At the design stage, these systems would lead to lower cost and more reliable products being brought to market more rapidly. At the production stage, the consequences would be tighter management of both office and shopfloor procedures, leading to reduced delivery times and greater responsiveness to clients. However, such systems are a long way from reality at the present time.

Nonetheless, users are moving steadily towards this goal, and considerable activity is being seen at both ends of production management systems. The level of activity is shown in Exhibit III-25.

EXHIBIT III-25

Western European Discrete Manufacturing Sector Systems Integration Market Forecast 1990-1995

The main players in systems integration in the discrete manufacturing sector in Western Europe are the professional services vendors, such as:

- CGS
- Sligos
- Sema Group
- Andersen
- EDS

The major consultancies—such as Coopers & Lybrand, Deloitte, and Price Waterhouse—are looking to increase their presence.

However, the major threat to the professional services companies comes from the major equipment vendors such as IBM, Digital, Siemens and Unisys.

All of these companies are now targeting system integration within the discrete manufacturing sector. Siemens has the added advantage of being a manufacturer of PLCs and thus has considerable credibility in factory automation projects.

However, in spite of the CIM architectures and enabling products being provided by the equipment vendors, the systems integration market remains difficult for any single vendor to tackle on its own. Hence collaboration—whether for additional software products, particular industry expertise or technical skills—remains important.

6. Network Services

EDI is forecast to be a major growth area for the discrete manufacturing sector over the period 1990-1995.
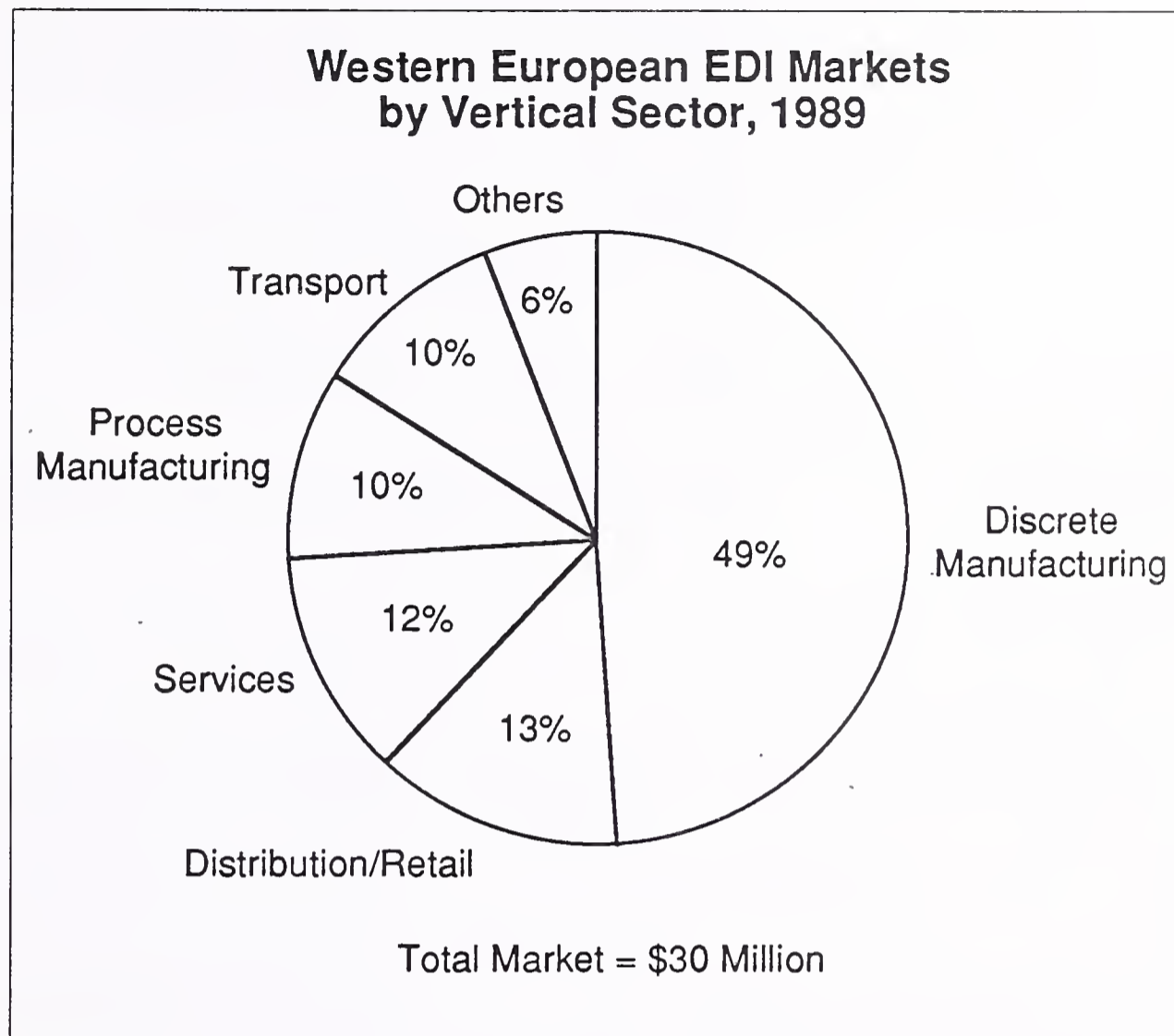
Led by the motor manufacturers, EDI is already used to a limited extent by many discrete manufacturing companies, and this level of use was sufficient to make the discrete manufacturing industry the leading sector in the introduction of EDI within Western Europe in 1989, as shown in Exhibit III-26.

However, there remains considerable scope to extend the use of EDI in terms of the number of organisations linked and the variety of transactions. In the automotive sector, Daimler Benz, Volvo and General Motors seem likely to insist on EDI capability from their suppliers within the next few years.

In the United Kingdom, an Electrical Industry Electronic Data Interchange group has recently been formed to promote EDI within the electrical sector. The group consists of a number of major manufacturers and wholesalers—including GTE Sylvania, MK Electric and Philips Lighting.

Here, as in other sectors, the major concerns relate to the use of standards. In particular, the lack of global standards appropriate for companies operating factories across Western Europe is causing users concern.

EXHIBIT III-26

Western European EDI Markets by Vertical Sector, 1989

Others

Transport

Process Manufacturing

6%

10%

10%

Discrete Manufacturing

49%

12%

Services

13%

Distribution/Retail

Total Market = $30 Million

If the standards issue is not resolved, the exchange of CAD data may overtake the electronic exchange of commercial data as the most important application for discrete manufacturing companies. There is a strong need for graphics exchange within the manufacturing sector.

This need is particularly true for the automotive, aerospace and textiles sectors. In the automotive sector, for example, the vehicle assemblers are developing much closer relationships with their component suppliers. This closeness necessitates frequent exchange of design data, and the Automobile Industry Action Group is undertaking the task of establishing standards for the exchange of computer graphics files. At present, it is common for a subcontractor to acquire the same make of CAD system as the subcontractor's major client, so that data can readily be exchanged via magnetic tape.

7. Systems Operations

For many systems operations vendors, the discrete manufacturing sector lags in importance. However, this lag may now be starting to change, particularly in France and the United Kingdom. Pressures on IS departments in the manufacturing sector are increasing, as there are increasing doubts concerning cost-effectiveness and the ability to deliver. Accord-

ingly, users are reporting a reduction in IS department staffing and an increasing reliance on external vendors. Initially, these trends may just mean an increased spending on professional services, but in some cases, they will also lead to the adoption of systems operations by the user.
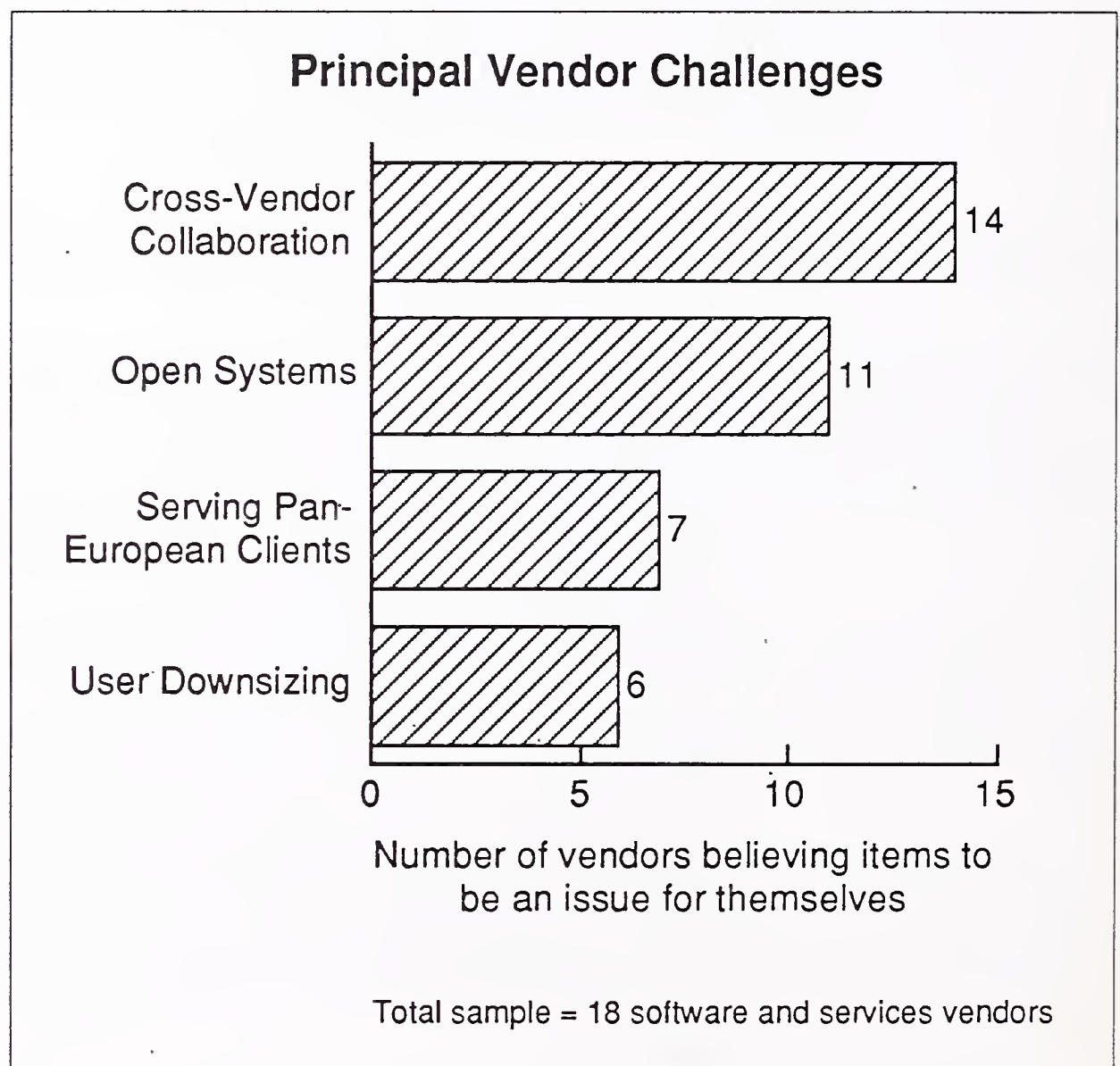
Another factor likely to lead to increased use of third parties is the changing pattern of work required—less emphasis on commercial systems and increased emphasis on integration with factory automation systems. Obviously, these changes require new skills that may not be readily available to the user in-house.

E
Vendor Issues

The principal challenges facing software and services vendors targeting the discrete manufacturing sector are shown in Exhibit III-27.

EXHIBIT III-27

Principal Vendor Challenges

Challenge	Number of vendors
Cross-Vendor Collaboration	14
Open Systems	11
Serving Pan-European Clients	7
User Downsizing	6

Number of vendors believing items to be an issue for themselves

Total sample = 18 software and services vendors

1. Need for Increased Collaboration

As one leading vendor remarked, "Three years ago, we sold mainly standalone products. Now we are increasingly selling complete business solutions."

This tendency of users to look for a complete business solution, rather than one-off applications, is one of the factors contributing to vendors' perceptions of an "increasing need for collaboration" with other software and services vendors. There is now clear recognition on the part of vendors that they cannot service the whole range of manufacturing applications themselves, and are looking for specialist partners with complementary products and services.
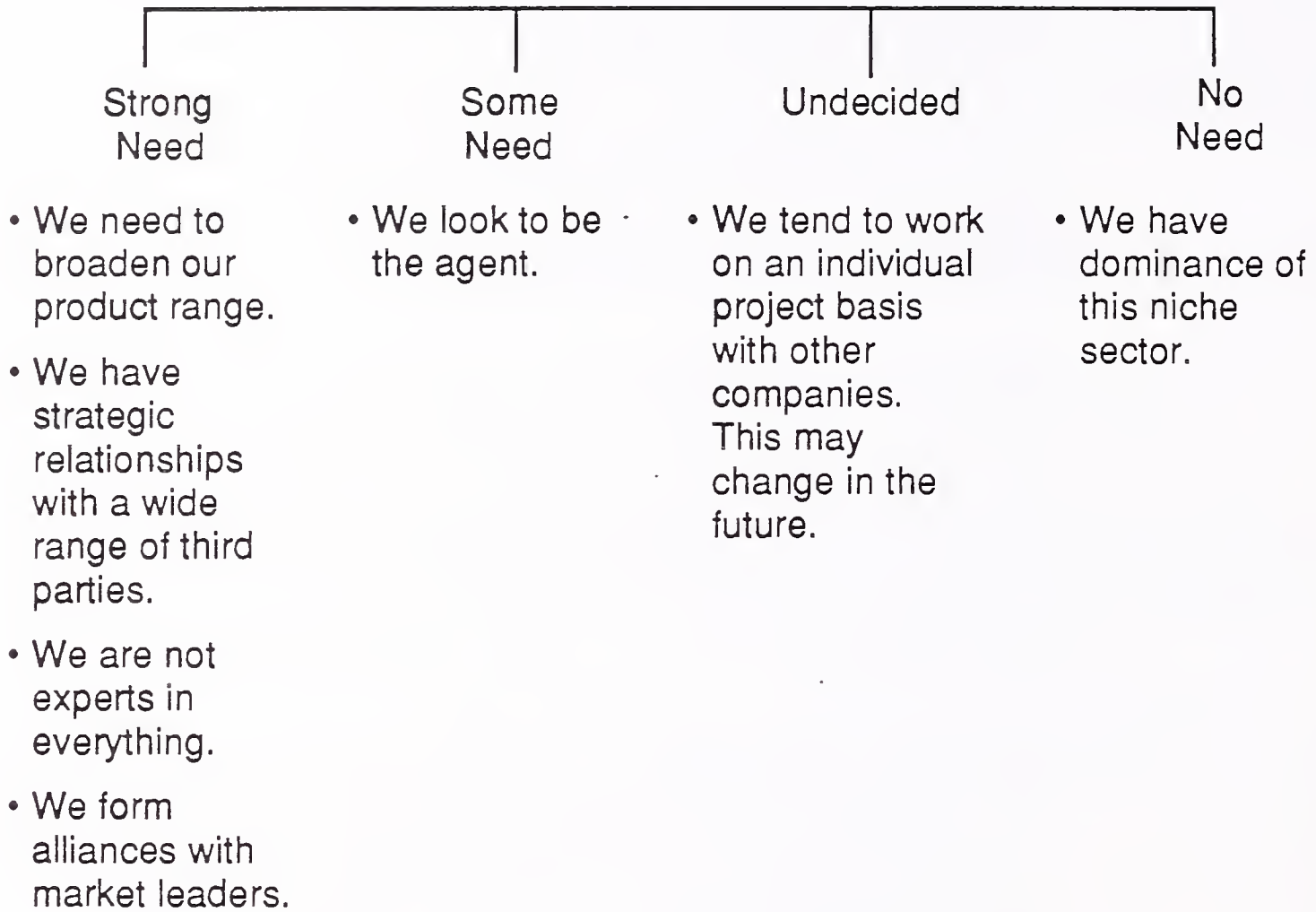
This trend to increased collaboration is shown in Exhibit III-28. The exhibit shows the attitude of 16 software and services vendors—all with a significant presence in the discrete manufacturing sector—towards the need for increased collaboration. Eleven companies showed a strong need for increased levels of collaboration.

Another factor is that, particularly in areas such as manufacturing resource planning (MRPII), no single package is appropriate to the whole of the discrete manufacturing sector. For example, production processes such as jobbing, discrete batch, and assembly line each have differing requirements. There are also specialist sector requirements, such as the defence sector's need for traceability and contract accounting. Overall, these requirements mean that each package is best targeted at specific segments of industry, rather than discrete manufacturing as a whole.

In addition, although a case can be made for professional services vendors' needing software products to entice prospects, there is also a potential conflict between offering both software products and overall project management. The vendor's ownership of software products may inhibit the project management unit from offering alternative products and thus maximising project management revenues. Similarly, the software products unit may be inhibited from forming alliances with other professional services companies.

EXHIBIT III-28

Need for Increased Collaboration
Vendor View

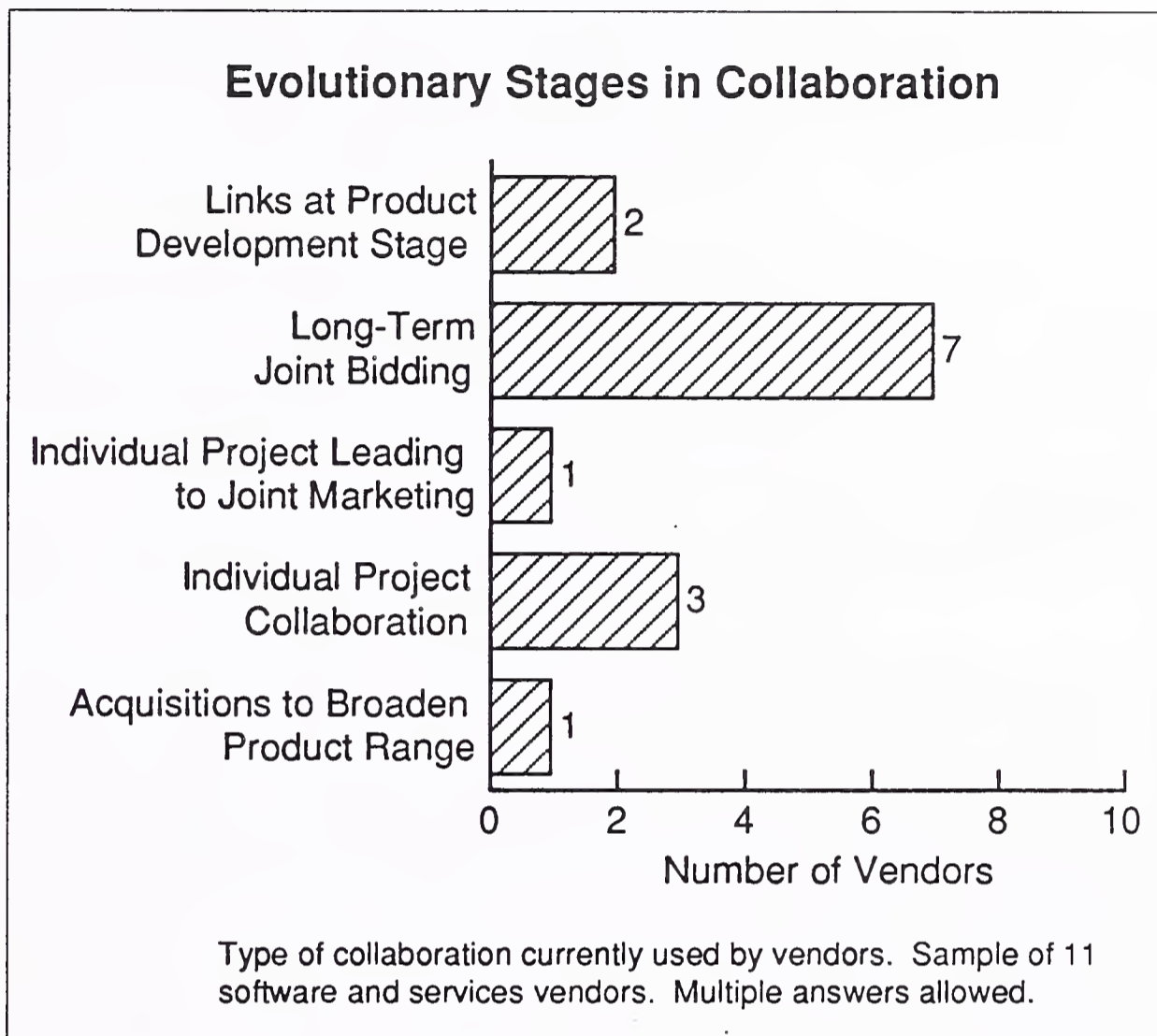| Strong Need	Some Need	Undecided	No Need
• We need to broaden our product range. • We have strategic relationships with a wide range of third parties. • We are not experts in everything. • We form alliances with market leaders.	• We look to be the agent.	• We tend to work on an individual project basis with other companies. This may change in the future.	• We have dominance of this niche sector.

Sample Attitude Profile
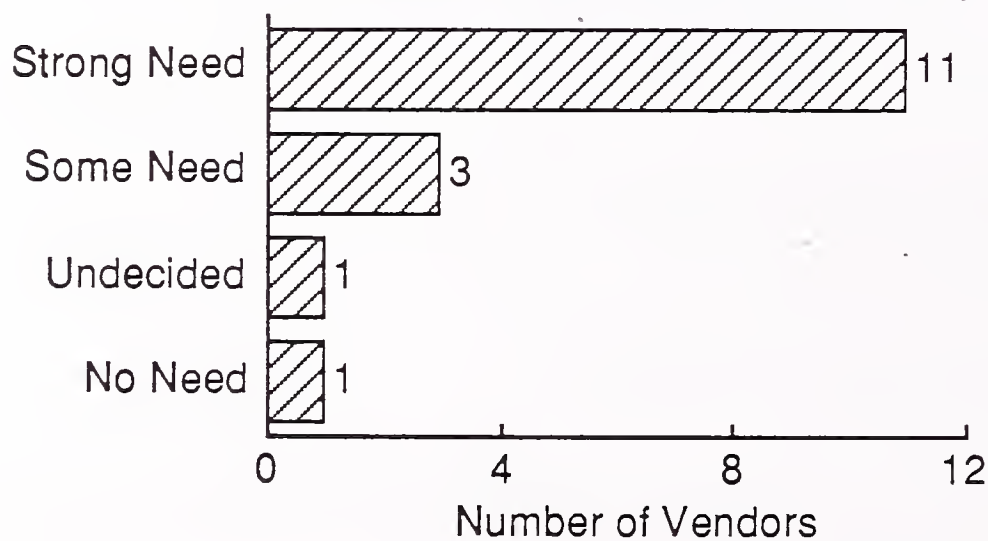
Attitude towards need for increased collaboration stated by software and services vendors. INPUT survey of 16 European software and services vendors. The specialist CAD vendors are excluded from this sample.

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Exhibit III-29 shows the profile of the types of collaboration currently being employed by software and services vendors.

EXHIBIT III-29

Evolutionary Stages in Collaboration

Links at Product Development Stage — 2

Long-Term Joint Bidding — 7

Individual Project Leading to Joint Marketing — 1

Individual Project Collaboration — 3

Acquisitions to Broaden Product Range — 1

Number of Vendors (0, 2, 4, 6, 8, 10)

Type of collaboration currently used by vendors. Sample of 11 software and services vendors. Multiple answers allowed.

Although some companies are still looking for acquisitions to broaden their application software portfolios, this approach is no longer as popular as it was a few years ago. Applications software product development is increasingly seen as a specialised and high-risk business that is best left to the small entrepreneurial company.

The individual project is still frequently the initial driving force behind collaboration between companies. A number of vendors form a consortium to assemble the range of application software products and services appropriate to a particular prospect. Then, after two or three similar proposals have been put forward, the relationship develops into a more formal one that involves co-ordinated joint targeting of particular sectors.

This is the stage that the majority of software and services vendors surveyed have now reached. For example, IBM has appointed a number of Approved Industrial Systems Integrators; DIGITAL has strategic relationships with a wide range of third parties in the fields of application software products and professional services/systems integration.

An even more advanced stage of collaboration is where companies work together at the software product development stage. There are clear signs that such collaboration is an increasing trend in servicing the manufacturing sector. For example, DIGITAL and ASK have recently collaborated in developing a manufacturing management system for the process sector, while a professional services company is involved with third parties in developing systems to tackle engineering documentation management.

A summary of the services typically required by application software product vendors, professional services vendors, systems integration vendors and equipment vendors is shown in Exhibit III-30. These types of vendors are particularly important in serving the discrete manufacturing sector.

EXHIBIT III-30

Level of Interest in Service from Partners

Services of Interest	Vendor Category		
	Application Software Product Vendors	Professional Services and Systems Integration Vendors	Equipment Vendors
Complementary application packages	High	High	High
Specialised professional services	High	Low	Medium
Overall systems integration	Medium	No interest	Low

The principal services of interest have been separated into complementary application packages, specialised professional services, and overall systems integration. The latter is used to describe the project management of a large project, typically involving the linkage of a number of application software products. Specialised professional services refers to a more specific task requiring specialist skills, such as shopfloor linkages.

Overall systems integration is being strongly targeted by the professional services vendors, so it is not an area they typically wish to subcontract. Overall systems integration is also being increasingly targeted by the major equipment vendors—such as IBM, DIGITAL and Unisys—that wish to be prime contractors for major projects. However, at the present time, these vendors still lack the breadth and depth of discrete manufacturing sector knowledge that would enable them to outperform the major professional services companies in this area.

Over the next few years, the major equipment vendors will increasingly become prime contractors themselves and reduce the areas of systems integration subcontracted to very specialist areas where they still lack the necessary skills. For example, IBM's list of Approved Industrial Systems Integrators already shows a bias towards companies (such as Evets and the BEC Group) with systems integration skills at the shopfloor and factory automation level.

All categories of vendors are seeking to establish partnerships with leading suppliers of complementary application packages. In particular, the professional services and systems integration vendors seem less intent on developing or owning application software products and are increasingly looking to offer the most appropriate product for each market segment. This outlook was expressed by one professional service vendor as: "Large companies will become the prime contractors providing the glue in the form of project management. We can give credibility to the package supplier".

However, application software product vendors are also aware of the trend for users to request a complete business solution and are actively forming their own alliances. For example, CINCOM stresses its CIM Alliance programme and the ability of its open architecture to provide integration with CAD/CAM, factory data collection, and quality and automated materials handling. Similarly, one of CINCOM's major competitors stated that the company had alliance partners for shopfloor data collection, CAD, quality, CAPP, payroll, forecasting and CIM consultancy.

Among vendors serving the European discrete manufacturing sector, there is an increasing divergence into specialist package development companies and integration specialists. Groups of companies are then forming consortia to offer complete business systems to users. Accordingly, it is becoming important for vendors operating in the discrete manufacturing sector to develop partnerships with other vendors that offer complementary products and services. Vendors that do not take this approach may have difficulty in supplying the full range of services required by prospects.

However, vendors' high level of need for complementary software packages presents a significant opportunity to innovative applications software product vendors that should be able to take advantage of the sales efforts of the major professional services vendors and equipment vendors.
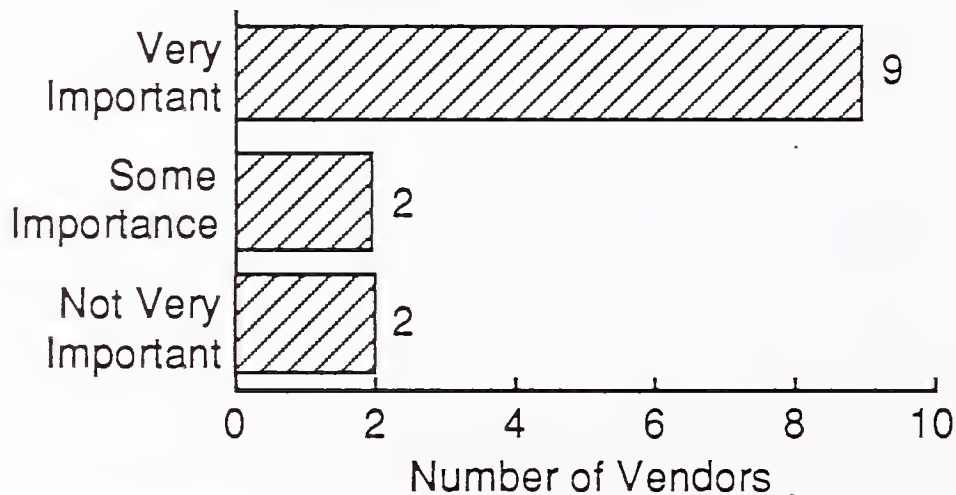
2. Open Systems

The perceived importance of UNIX to software and services vendors serving the discrete manufacturing sector is shown in Exhibit III-31.

EXHIBIT III-31

Perceived Importance of UNIX

Very Important	Some Importance	Not Very Important
• We are looking to take market share with UNIX. • User acceptance of UNIX is growing every day. • UNIX helps in gaining new clients. • Open systems are coming to the fore	• UNIX is having an impact at plant automation level. Not important at business/environment level.	• UNIX is not an issue with medium/large companies. • Smaller companies might buy into UNIX.

Sample Attitude Profile

Sample of 13 software and services vendors. The specialist CAD vendors are excluded from the sample.

Overall, there is a strong consensus that UNIX is becoming increasingly important in the discrete manufacturing sector, and that user acceptance of UNIX is growing. Obviously, UNIX has dominated the CAD market for some years, and so the CAD vendors were not included in this sample.

The areas where vendors felt that UNIX would make the most impact initially were in the smaller companies, and at the plant automation level. UNIX-based systems were felt to be making least impact with the larger discrete-manufacturing companies and at the business/commercial level. The larger companies were thought likely to retain their IBM and Digital purchasing policies for some time yet, and the AS/400 is proving to be a formidable competitor to UNIX at present. Nonetheless, some vendors believed that UNIX-based systems represented the best chance of winning business from IBM and Digital.

Similarly, in application terms UNIX was believed to be making least headway in the discrete manufacturing sector in commercial applications, such as production management systems. However, one trend that must be worrying for IBM and Digital is the speed and consistency with which many of their traditional production management software products vendors are basing the latest generations of their products on UNIX. These moves are particularly prevalent amongst companies that formerly used Digital equipment as their main platform.

3. Users Become Pan-European

As shown by the comments in Exhibit III-32, another issue raised by vendors and confirmed by INPUT's end-user research is that users are becoming much more pan-European, or even global, in outlook. This change in outlook has probably been prompted by the focus on the Single European Market across Europe. Indeed, some Swedish and Swiss companies are being more proactive than organisations within the European Community as they fear exclusion from its markets from 1992 onward. As a result, there is considerable refocusing and merger activity as discrete manufacturing companies seek to establish themselves as major European concerns in their chosen sectors.

One consequence of this activity is that companies are endeavouring to manage their operations on a common basis across Europe, and to compare performance across plants in a meaningful way. To achieve this, companies are standardising on the equipment platforms and software products used. In addition to facilitating comparison between plants, such measures make it easier to transfer information—such as design data—or even production between plants.

Other implications of this move to European standardisation include:

• An increased tendency for users to accept standard software
• A need for this software to be pan-European in functionality
• A move to distributed systems in the future

Users Become More Pan-European

- "Mergers and acquistions are generating truly pan-European companies."

- "Companies want a single information system across Europe."

- "Companies are looking to standardize on manufacturing management systems across plants to that they can compare 'apples' with 'apples'."

- "They are looking for common systems down to production management level."

- "Multinationals are increasingly recommending uniform platforms to their operating units."

Overall, these trends create opportunities for vendors with the infrastructure to support pan-European clients. For those vendors with limited European coverage, it becomes even more imperative to seek international mergers or collaborations.

4. User Downsizing

Another trend, reflected by the vendor comments in Exhibit III-33, is that as the processing power of computers continues to increase, and as the support costs for mainframes remain high, there is a downsizing of systems by users. This downsizing is likely to accelerate once the level of acceptance of distributed systems increases within the discrete manufacturing community.

Obviously, this trend is particularly pronounced in the CAD market, where workstations and microcomputers are now the norm. Downsizing is now becoming more pronounced in other areas, such as production management systems, as well.

For example, the number of software product vendors that largely target the mainframe-based end of the production management systems market has decreased markedly over the last few years. As the mainframe segment has declined in importance, these software products vendors have increasingly emphasized the proprietary minicomputer versions of their products or developed new products to run on the AS/400 or under UNIX.

EXHIBIT III-33

User Downsizing

- "People are no longer putting manufacturing management systems on IBM mainframes."

- "A noticeable number of companies are downsizing their manufacturing management applications from 370 architecture to AS/400."

- "One large customer is evaluating how to move from mainframe-based to UNIX-based distributed systems."

- "PC networking will become an issue (for manufacturing management systems)."

This downsizing extends all the way down the market. Even turnkey suppliers marketing minicomputers to the smaller discrete manufacturing companies are expecting to be affected by an increased demand for microcomputer LAN-based production management systems over the next few years.

F
Vendor Strategies

1. Vendor Targeting

Exhibit III-34 shows the principal opportunities in the discrete manufacturing sector and the extent to which they are targeted by equipment vendors, professional services vendors and application software product vendors.

The systems integration market is being strongly targeted by the major equipment vendors—such as IBM, Unisys, DEC, Siemens, Bull and ICL—and the leading professional services vendors, such as CGS, Sligos and the Sema Group. However, at present the equipment vendors are in the process of building their systems integration capabilities. As a result, vendors currently lack the depth of skills and the industry expertise to dominate the market, and are having to subcontract much of the work to professional services vendors.

Two approaches to the systems integration market are being followed by professional services vendors. Some vendors believe that ownership (or sole distribution rights) of a full portfolio of applications software products are a prerequisite to compete in the market. Other vendors believe that ownership restricts their flexibility and that partnerships with key software product vendors are the key to success.

EXHIBIT III-34

Vendor Targeting of Growth Areas

Growth Area	Vendor Category		
	Equipment Vendors	Professional Services Vendors	Application Software Product Vendors
Systems integration	H	H	-
Systems operations	-	H	-
Software products			
- SFDCC	H	M	M
- Engineering data management	H	-	L
- Completion of "CIM Wheel"	M	L	H
- MRPII replacement	M	H	H

Level of targeting of growth area by vendor category.

H = High level of targeting
M = Medium level of targeting
L = Low level of targeting
- = No vendor interest

Systems operations is currently targeted by a minority of professional services vendors. However, other professional services vendors antici-pate systems operations becoming increasingly important in the discrete manufacturing sector, and would like a share of the business. The prospect of the major equipment vendors, particularly IBM, becoming more active in systems operations in Western Europe poses a strong perceived threat to the vendors currently active in this sector.

Turning to software products, shopfloor data collection and control is targeted by all three categories of vendor. An increasing number of application software product companies are moving towards SFDCC, while equipment vendors are providing software products and enablers. Enablers provide users with the means to tailor their own systems by using a high-level interface. SFDCC is also a very important area for

professional services companies, because substantial tailoring of systems is typically required—whether a software product or an enabler is used as the basis for the system.

Engineering data management is one of the areas for development currently favoured by the major equipment vendors. Digital in particular is strongly pushing the virtues of concurrent engineering. Concurrent engineering is also an important area for the CAD vendors, which see widespread sharing of CAD data as a key driver of workstation sales.

The production management systems market has become largely a replacement market for large and medium-sized discrete manufacturing companies. However, the production management systems market remains a large market of considerable importance to all categories of vendor. Much of the growth in production management systems is now coming from the process manufacturing sector, such as the food and chemical industries, rather than from the discrete manufacturing sector.

"Completion of the CIM wheel" refers to other applications leading to a full computer-integrated manufacturing environment. Examples include computer-aided process planning (CAPP) and finite scheduling. Applications such as statistical process control (SPC) and maintenance are increasingly becoming part of SFDCC.

Exhibit III-35 shows the importance of the principal integration areas to each category of vendor.

EXHIBIT III-35

Importance of Area of Integration to Vendors

Vendor Category	Area of Integration	
	Shopfloor to Production Management	CAD/CAM to Production Management
Principal equipment vendors	M	H
CAD vendors	-	H
Professional services vendors	H	L
Application software vendors	L	-

H = High level of interest
M = Medium level of interest
L = Low level of interest
- = No interest

The equipment vendors are endeavouring to provide frameworks, using their equipment, that encompass all aspects of computer-integrated manufacturing. Accordingly, vendors are strongly targeting CAD-to-production-management integration and integration of production management systems with the shopfloor. The primary emphasis of CAD vendors is integrating their products with production engineering departments and production management systems. On the other hand, professional services vendors tend to be more concerned with the links between production management systems and the shopfloor.

The application software products vendors tend not to be involved in CAD and production management markets, with the exception of some vendors providing microcomputer-based solutions. However, application software product vendors are steadily extending the scope of their applications. For example, production management software vendors are extending their offerings to include functionality for shopfloor data collection and distribution areas.

2. Generic Strategies

The major equipment manufacturers are endeavouring to provide frameworks that will enable users to build complete CIM systems. Similarly, the systems integration market is becoming more important to these vendors as they seek to control their major accounts.

IBM will endeavour to impose its own CIM architecture on users and will, on the whole, provide access to UNIX-based systems, rather than adopting UNIX solutions itself. In the move towards providing a complete CIM environment, IBM is stressing its engineering database and its plant floor systems. The shopfloor area is one in which IBM has traditionally had a comparatively low market share, compared to Digital. The company has now introduced the IBM Plant Floor Series to rectify this state of affairs. The Plant Floor Series supports the development of a customised distributed factory floor supervisory system for the monitoring and control of production processes. IBM is also continuing to collaborate with software products vendors to put the company in a position to offer a complete range of application software products for manufacturing companies. One of IBM's latest moves, and one that complements the Plant Floor Series, is the marketing of the Trimax Maintenance Management System.

IBM is also stating to put more emphasis on its intermediate computer-integrated manufacturing offerings based on the AS/400 and RS/6000.

The professional services vendors, such as CGS and EDS, are also targeting the systems integration market. Here there are two major issues for vendors to resolve. First is the question of how vendors should tackle pan-European coverage. Second is the question of how to meet the

complete requirements of discrete manufacturing companies. There are two approaches to this second question. One approach is to build a complete range of products and services in-house. Although this approach obviously has some appeal, it is expensive and inflexible. It is also likely to be quite restrictive in terms of coverage of the various sectors of the discrete manufacturing marketplace.

The other approach is to build an extensive framework of partnerships in much the same way as equipment vendors such as Digital.

Application software products vendors are finding their strategies dictated by the pressures to downsize and open systems. Although many of the vendors who primarily targeted IBM mainframes are now looking to the AS/400, the vendors who formerly used Digital-based equipment are now moving towards UNIX and database independence. They are also entering into partnerships with professional services vendors and other application software product vendors.
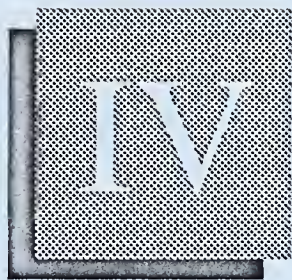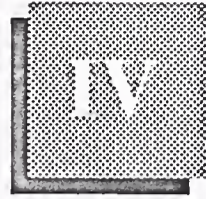
IV

Discrete Manufacturing Sector: Driving Forces

IV

Discrete Manufacturing Sector: Driving Forces

Driven by the need to become major players in the Single European Market, many discrete manufacturing companies are identifying their core businesses and seeking to establish themselves on a pan-European basis. Typically, these changes involve acquiring operations across the major countries of Western Europe.

EXHIBIT IV-1

Pressures on the Western European Discrete Manufacturing Sector

Reduced costs   Improved product quality   Shorter lead times   Increased responsiveness

Discrete manufacturing sector

One example is Valeo, a French company that is second only to Bosch in the European automotive components sector. Valeo is seeking to establish itself across Europe as the market leader in clutches, engine cooling, climate control gear, and lighting. In support of this strategy, the company has recently acquired Neimann—a large French car component group—and Delanair—a U.K.-based manufacturer of air conditioning systems.

Buying market share and local credibility is, however, only the first step. To remain competitive in the long term, European discrete manufacturing companies typically need to reduce the time to introduce new products, improve product quality, and reduce manufacturing costs to the levels achieved by the best global competitors.

For example, a recent study of the European car industry concluded that it takes European manufacturers almost double the engineering effort to develop a car, and twice as many hours as the Japanese to assemble a vehicle.

Software and services play a key role in each of these areas. Firstly, concurrent engineering can assist at the design stage in achieving each of these goals. It does so by ensuring that current design data is readily available, not only to design engineers but also to all other relevant departments, such as production engineering and marketing.

This multidisciplinary approach assists in ensuring that the product is designed with ease of manufacturing, unit cost, and reliability taken into account from the start of any design project. Manufacturers are recognising that product design may be a more important determinant of unit cost than the process technology used in manufacture.

In addition to sharing information within a company, there is also a move towards sharing the design process with clients and suppliers. Using another example from the automotive sector, automotive component manufacturers are starting to take more responsibility for component R&D. They are becoming key members of the vehicle manufacturers' development teams. As such, they need rapid access to the manufacturer's design data.

In return, they are more likely to receive single-source, long-term contracts. Delivery lead times and production costs may then be further reduced by use of just-in-time (JIT) manufacturing, which is itself greatly facilitated by use of electronic data interchange (EDI).

Finally, to manage the production process, discrete manufacturing companies need consistent, up-to-date information on which to act, and the back-office systems need to support actual production in a timely fashion. These goals can only be achieved if a high level of integration is established between each of the major application areas.

The pressures on users are summarised in Exhibit IV-1, and some of the major trends, as seen by users, that are arising from these pressures are shown in Exhibit IV-2.

EXHIBIT IV-2

Major Trends
Users in Discrete Manufacturing Sector

Trend	Probability of Adoption
• Standardised systems across Europe	Very high
• Standardised systems across each factory	Very high
• Increasing reliance on packages	High
• User hardware downsizing	Medium
• Distributed production management systems	Low-Medium
• Widespread use of UNIX	Low

Major trends anticipated by users in Western European discrete manufacturing sector

As discrete manufacturing companies establish facilities across Europe, they are standardising the information systems used in each plant. Standardisation is typically taking place at least down to the level of the production management system. This activity is creating opportunities for those software and services vendors in a position to support the users' operations on a multinational basis. For example, one of the users sampled was implementing SAP's production management software in Germany. Once the system had proved itself, it was intended to implement the SAP production management system elsewhere in Europe, replacing those systems currently in use.

While some interest in distributed systems was expressed, it is still too early for companies in the discrete manufacturing sector to have implemented this approach. Systems are still frequently centralised, and one discrete manufacturing company was using a mainframe to run multiple copies—one per factory—of a production management system. At present, users are unsure of the feasibility of distributed systems. However, they are likely to adopt distributed systems for production management, when the technology becomes more established.

Another significant trend is discrete manufacturing companies transferring their production management systems from mainframes to minicomputers. The move to AS/400 systems—in some cases from non-IBM mainframes—is particularly pronounced. The high cost of mainframe systems software, with the levels of in-house support required for mainframe systems, are important factors in this migration. On the other hand, many companies will continue to use mainframes as the basis for their production management systems for the foreseeable future.

While the majority of software and services vendors believe UNIX to be increasingly important in the discrete manufacturing sector, there is little sign of its being adopted by mainframe users in the short term.

As the cost pressures on discrete manufacturing companies increase, they are beginning to affect IS departments and the factory floor in a number of ways. Firstly, it is becoming increasingly difficult for IS departments to justify further investments in systems. Secondly, the staffing of some user IS departments is being reduced. This is creating opportunities for professional services vendors in the short term. For the long term, it is forecast that the use of systems operations by discrete manufacturing companies will rise by 30% per annum over the forecast period.

Overall, a very high level of intent to integrate existing applications was found among users. This applies both to integration between CAD and production management systems, and between production management systems and the shopfloor.

Integration between CAD and production management systems ensures that the appropriate design version is used by all departments. It prevents mismatches arising between bills of materials and assists in engineering change management. Integration between production management systems and the shopfloor leads to effective shopfloor control and prompt feedback on the status of work in progress. Software products vendors are increasingly seeing shopfloor data collection and control as an integral part of production management systems and they are marketing it accordingly.

V

The Opportunities

V
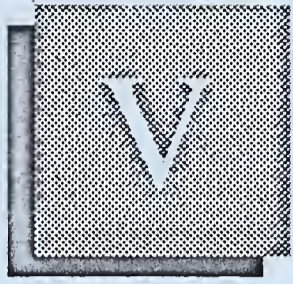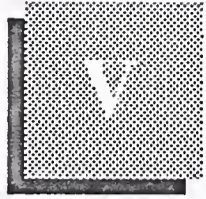
The Opportunities

The principal opportunities for software and services vendors in the discrete manufacturing sector arise out of the increasing horizontal and vertical integration within manufacturing companies. These opportunities are shown in Exhibit V-1.

EXHIBIT V-1

Western European Discrete Manufacturing Sector Areas of Opportunity

- Applications software products
- Integration of systems
- Electronic data interchange
- Systems operations
- Partnerships

Firstly, manufacturing companies are establishing operations across Western Europe and are standardising the systems used in each of their plants. This provides a significant opportunity for those software and services vendors that can support the major manufacturers on a truly pan-European basis.

To enhance their long-term competitiveness, discrete manufacturing companies need to increase the degree of integration between their computer applications. This is creating opportunities for both professional services and systems integration vendors. Some companies are slowly evolving towards computer-integrated manufacturing, while others are replacing the bulk of their applications with ones they know can be readily integrated.

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The use of EDI by discrete manufacturing companies is also expected to grow rapidly over the period 1990-1995. Many major manufacturers have conducted limited trials of EDI, but there remains considerable opportunity for the use of EDI to be extended, both in terms of interconnection between companies and in the range of document types exchanged. There is also a strong need within the discrete manufacturing sector to exchange CAD data, as manufacturers and their suppliers move closer to joint development of new products.

Cost pressures now also apply to IS departments as well as to production managers. This will lead to some reduction in personnel by users over the forecast period, with an accompanying increase in the use of external agencies for both professional services and complete systems operations.

This move by users towards more complete business solutions and wider geographical coverage means that it is currently very difficult for any one vendor to service a major client without outside assistance. Hence, collaboration among vendors is becoming essential. This offers considerable opportunities for the smaller vendors to fill the gaps in the service offerings of the major players and to take advantage of their marketing muscle.

EXHIBIT V-2

Western European Discrete Manufacturing Sector Application Software Product Opportunities

- Full European coverage e.g., MRPII
- Engineering data/document management
- Shopfloor data capture and control
- Completion of "CIM Wheel"

For the industry-specific application software products delivery mode, the major opportunities, as shown in Exhibit V-2, are:

- MRPII replacement
- Engineering data/document management
- Shopfloor data capture and control
- Completion of the CIM Wheel

Growth in the market for production management systems has slowed appreciably, but the market remains a very significant one. As discrete manufacturing companies standardise their production management systems throughout Europe, this creates opportunities for the major players. Similarly, as the market moves steadily towards the use of

UNIX-based systems, opportunities arise for vendors to establish themselves in this arena. It is by no means certain that the traditional production management system vendors will be the leading vendors in the UNIX-based marketplace.

Engineering data management is obviously an important link between CAD and production management systems and is being heavily promoted by the leading equipment vendors. As yet, user awareness is low, but is expected to increase over the forecast period.

Shopfloor data capture and control will experience high growth between 1990 and 1995, as discrete manufacturers look to improve their control of the production process and improve their responsiveness to clients.

Obviously, new application areas will become more important as gaps in the vendors' CIM offerings become apparent. Application areas that have recently started to grow include finite scheduling and computer-aided process planning. Just-in-time procedures have also made a major impact on production management systems in recent years.

More detailed growth prospects for some of the principal application areas, broken down by equipment platform, are shown in Exhibit V-3.

EXHIBIT V-3

Growth in Discrete Manufacturing Sector Software Products by Application and Hardware Platform

Hardware Platform	Application			
	CAD	Production Management	Shopfloor Data Collection and Control	Production Engineering
Microcomputer	High	Medium	High	High
Minicomputer	Low	Medium	High	High
Mainframe	Low	Low	Low	Low

Within the CAD market, growth will remain high for microcomputer-based products—an area now targeted by IBM, Intergraph, and Prime/Computervision, as well as Autodesk.

For production management systems, growth will be low in the mainframe sector, as user downsizing and moves to distributed computing begin to take effect. Growth is currently moderate in the minicomputer
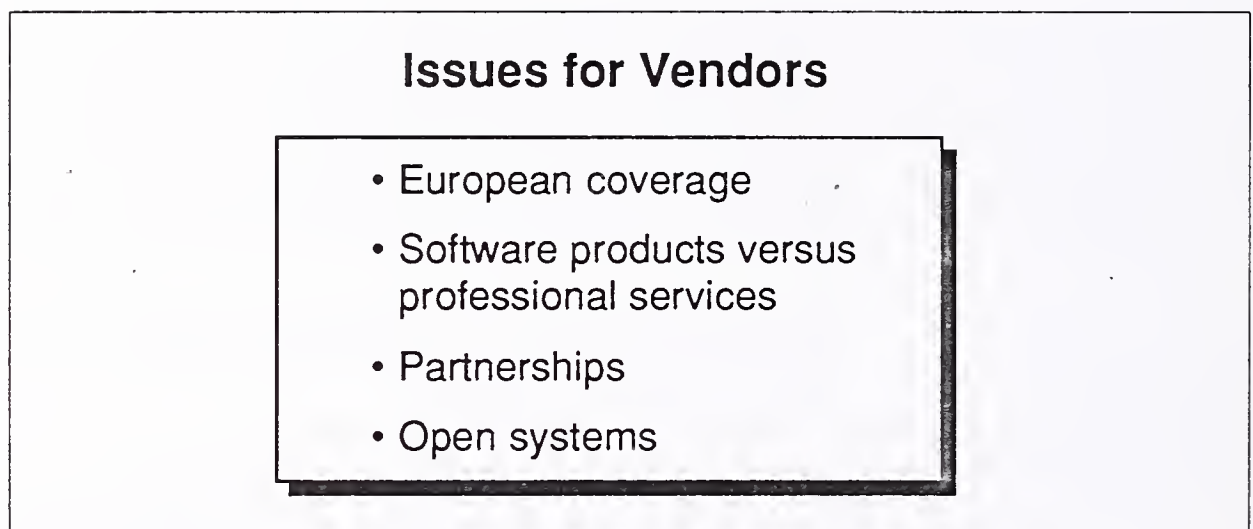
and microcomputer segments. The minicomputer segment is now essentially a replacement market, though AS/400-based products are showing comparatively high growth.

Shopfloor data collection and control (SFDCC) is the traditional preserve of the Digital minicomputer. IBM is now targeting SFDCC with both the RS/6000 and its industrial microcomputers, and SFDCC is expected to remain a growth area for both minicomputer and microcomputer-based systems.

Growth in production engineering applications is forecast to be largely at the microcomputer end of the market.

The principal issues facing vendors are summarised in Exhibit V-4.

EXHIBIT V-4

Issues for Vendors

- European coverage
- Software products versus professional services
- Partnerships
- Open systems

Vendors targeting the major discrete manufacturing companies in Europe, or that have such companies in their client base, need to recognise the European ambitions of these companies. To ensure their success, vendors need to offer truly pan-European products, and to provide Europe-wide support. In many cases, this will necessitate collaboration among vendors.

There is also an increasing divergence between professional services vendors and application software product vendors. The application software products business is by its nature a high-risk business, requiring high levels of R&D expenditure. On the other hand, professional services is on the whole a people-based, low-risk business—excluding the traumas of some fixed-price contracts. Accordingly, professional services companies need to decide which business they wish to be in.

Offering software products is a prerequisite to attracting business. Another view is that partnerships are the best approach. Either way, increased collaboration among vendors is essential in serving the discrete manufacturing sector.
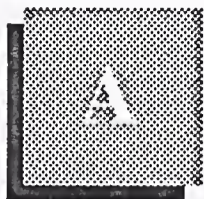
The partnership approach is likely to be increasingly favoured, as vendors are faced with the cost of porting their application software products to UNIX.

Appendixes

Definition of Terms

A
Delivery Modes

1. Service Categories

The following exhibit presents the structure of the information services industry. Several of the delivery modes can be grouped into higher-level **Service Categories**, based on the kind of problem the user needs to solve. These categories are:

- *Business Application Solutions (BAS)* - prepackaged or standard solutions to common business applications. These applications can be either industry-specific (e.g., mortgage loan processing for a bank), cross-industry (e.g., payroll processing), or generic (e.g., utility timesharing). In general, BAS services involve minimal customization by the vendor, and allow the user to handle a specific business application without having to develop or acquire a custom system or system resources. The following delivery modes are included under BAS:

  - *Processing Services*
  - *Applications Software Products*
  - *Turnkey Systems*

- *Systems Management Services (SMS)* - services which assist users in developing systems or operating/managing the information systems function. Two key elements of SMS are the customization of the service to each individual user and/or project, and the potential for the vendor to assume significant responsibility for management of at least a portion of the user's information systems function. The following delivery modes are included under SMS:

  - *Systems Operations*
  - *Systems Integration*

EXHIBIT A-1

Information Services Industry Structure—1990

MAMAP-Alt C-9/90

Source: INPUT

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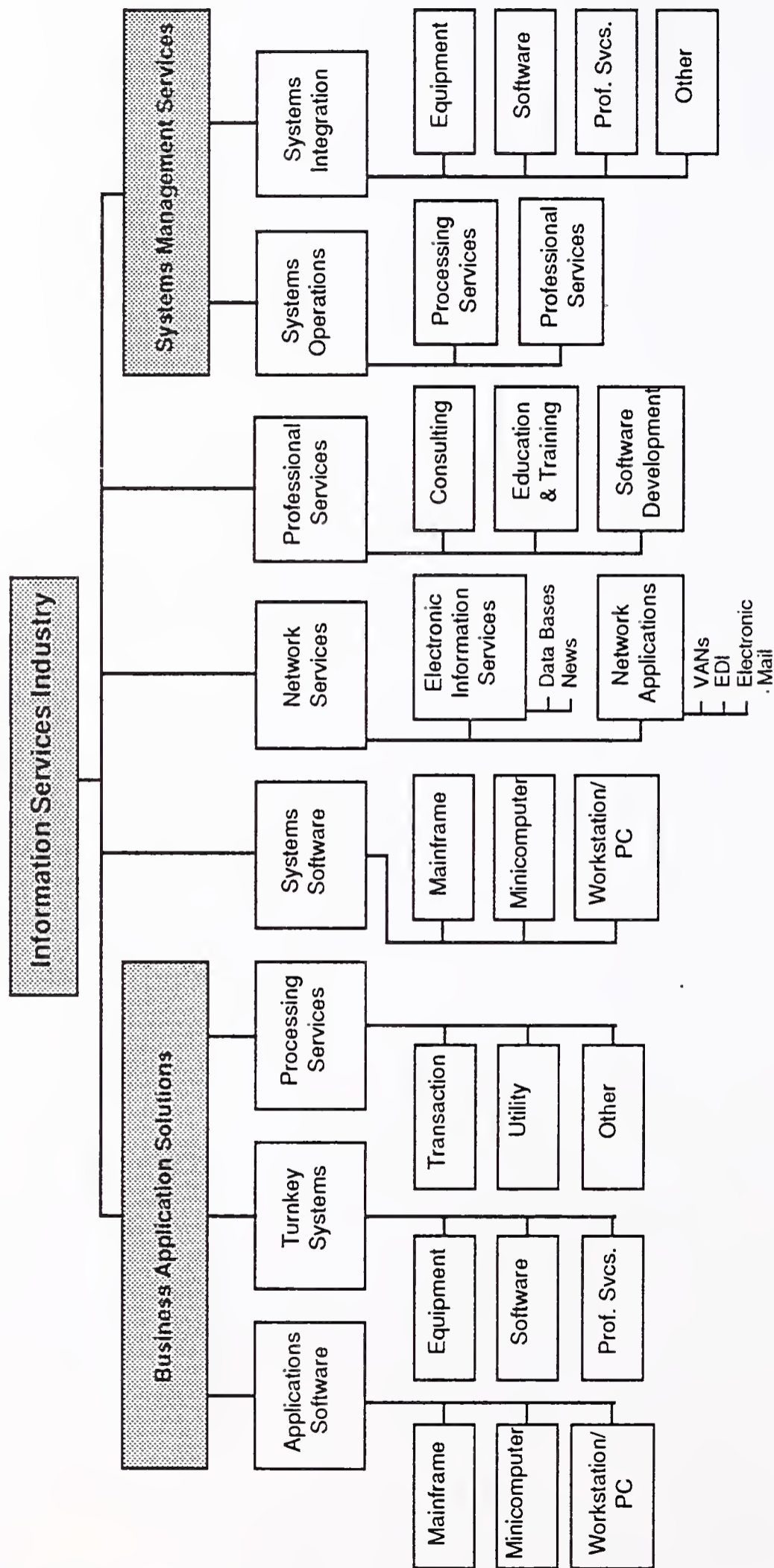
Each of the remaining three delivery modes represents a separate service category:

- *Professional Services*
- *Network Services*
- *System Software Products*

Note: These service categories are a new concept introduced in the 1990 MAP Program. They are purely an aggregation of lower-level delivery mode data. They do not change the underlying delivery modes or industry structure.

2. Software Products

There are many similarities between the applications and systems software delivery modes. Both involve user purchases of software packages for in-house computer systems. Included are both lease and purchase expenditures, as well as expenditures for work performed by the vendor to implement or maintain the package at the user's sites. Vendor-provided training or support in operation and use of the package, if bundled in the software pricing, is also included.

Expenditures for work performed by organizations other than the package vendor are counted in the category of professional services. Fees for work related to education, consulting, and/or custom modification of software products are counted as professional services, provided such fees are charged separately from the price of the software product itself.

- *Systems Software Products*

  Systems software products enable the computer/communications system to perform basic machine-oriented or user interface functions. These products include:

  - *Systems Control Products* - Software programs that function during application program execution to manage computer system resources and control the execution of the application program. These products include operating systems, emulators, network control, library control, windowing, access control, and spoolers.

  - *Operations Management Tools* - Software programs used by operations personnel to manage the computer system and/or network resources and personnel more effectively. Included are performance measurement, job accounting, computer operation scheduling, disk management utilities, and capacity management.

  - *Applications Development Tools* - Software programs used to prepare applications for execution by assisting in designing, programming, testing, and related functions. Included are traditional

programming languages, 4GLs, data dictionaries, database management systems, report writers, project control systems, CASE systems and other development productivity aids. Also included are system utilities (e.g., sorts) which are directly invoked by an applications program.

- *Application Software Products*

  - *Industry-Specific Application Software Products* - Software products that perform functions related to solving business or organizational needs unique to a specific vertical market and sold to that market only. Examples include demand deposit accounting, MRPII, medical recordkeeping, automobile dealer parts inventory, etc.

  - *Cross-Industry Application Software Products* - Software products that perform a specific function that is applicable to a wide range of industry sectors. Applications include payroll and human resources systems, accounting systems, word processing and graphics systems, spreadsheets, etc.

3. Turnkey Systems

A turnkey system is an integration of equipment (CPU, peripherals, etc.), systems software, and packaged or custom application software into a single system developed to meet a specific set of user requirements. Value added by the turnkey system vendor is primarily in the software and support services provided. Most CAD/CAM systems and many small business systems are turnkey systems. Turnkey systems utilize standard computers and do not include specialized hardware such as word processors, cash registers, process control systems, or embedded computer systems for military applications.

Hardware vendors that combine software with their own general-purpose hardware are not classified by INPUT as turnkey vendors. Their software revenues are included the appropriate software category.

Most turnkey systems are sold through channels known as value-added resellers.

- *Value-Added Reseller (VAR)* - A VAR adds value to computer hardware and/or software and then resells it to an end user. The major value added is usually application software for a vertical or cross-industry market, but also includes many of the other components of a turnkey systems solution, such as professional services.

Turnkey systems are divided into two categories:

- *Industry-Specific Systems* - Systems that serve a specific function for a given industry sector, such as automobile dealer parts inventory, medical recordkeeping, or discrete manufacturing control systems.

- *Cross-Industry Systems* - Systems that provide a specific function that is applicable to a wide range of industry sectors, such as financial planning systems, payroll systems, or personnel management systems.

4. Processing Services

This category includes transaction processing, utility processing, and other processing services.

- *Transaction Processing* - Client uses vendor-provided information systems—including hardware, software and/or data networks—at vendor site or customer site, to process transactions and update client databases. Transactions may be entered in one of four modes:

  - *Interactive* - Characterized by the interaction of the user with the system for data entry, transaction processing, problem solving and report preparation: the user is on-line to the programs/files stored on the vendor's system.

  - *Remote Batch* - The user transmits batches of transaction data to the vendor's system, allowing the vendor to schedule job execution according to overall client priorities and resource requirements.

  - *Distributed Services* - Users maintain portions of an application database and enter or process some transaction data at their own site, while also being connected through communications networks to the vendor's central systems for processing other parts of the application.

  - *Carry-in Batch* - Users physically deliver work to a processing services vendor.

- *Utility Processing* - Vendor provides basic software tools (language compilers, assemblers, DBMSs, graphics packages, mathematical models, scientific library routines, etc.), generic applications programs and or databases, enabling clients to develop their own programs or process data on vendor's system.

- *Other Processing Services* - Vendor provides services—usually at vendor site—such as scanning and other data entry services, laser printing, computer output microfilm (COM), CD preparation and other data output services, backup and disaster recovery, etc.

5. Systems Operations

Systems operations involves the operation and management of all or a significant part of the user's information systems functions under a long-term contract. These services can be provided in either of two distinct submodes:

• *Professional Services* - The vendor provides personnel to operate client-supplied equipment. Prior to 1990, this was a submode of the Professional Services delivery mode.

• *Processing Services* - The vendor provides personnel, equipment and (optionally) facilities. Prior to 1990, this was a submode of the Processing Services delivery mode.

In the federal government market the processing services submode is called COCO (Contractor-Owned, Contractor-Operated), and the professional services mode is referred to as GOCO (Government-Owned, Contractor-Operated).

Systems operations vendors now provide a wide variety of services in support of existing information systems. The vendor can plan, control, provide, operate, maintain and manage any or all components of the user's information systems (equipment, networks, systems and/or application software), either at the client's site or the vendor's site. Systems operations can also be referred to as resource management or facilities management.

There are two general levels of systems operations:

• *Platform/network operations* - The vendor operates the computer system and/or network without taking responsibility for the applications.

• *Application operations* - The vendor takes responsibility for the complete system, including equipment, associated telecommunications networks, and applications software.

Note: Systems Operations is a new delivery mode introduced in the 1990 research programme. It was created by taking the Systems Operations submode out of both Processing Services and Professional Services. No other change has been made to the delivery mode definitions, and the total forecast expenditures for these three delivery modes are identical to the total forecast expenditures of the two original modes before the breakout of Systems Operations.

6. Systems Integration (SI)

Systems integration is a business offering that provides a complete solution to an information system, networking or automation requirement through the custom selection and implementation of a variety of information system products and services. A systems integrator is responsible for the overall management of a systems integration contract and is the single point of contact and responsibility to the buyer for the delivery of the specified system function, on schedule and at the contracted price.

To be included in the information services market, systems integration projects must involve some application processing component. In addition, the majority of cost must be associated with information systems products and/or services.

The systems integrator will perform, or manage others who perform, most or all of the following functions:

- Program management, including subcontractor management

- Needs analysis

- Specification development

- Conceptual and detailed systems design and architecture

- System component selection, modification, integration and customization

- Custom software design and development

- Custom hardware design and development

- Systems implementation, including testing, conversion and post-implementation evaluation and tuning

- Life cycle support, including
  - System documentation and user training
  - Systems operations during development
  - Systems maintenance

- Financing

7. Professional Services

This category includes consulting, education and training, and software development.

- *Consulting* - Services include management consulting (related to information systems), information systems consulting, feasibility analysis and cost-effectiveness studies, and project management assistance. Services may be related to any aspect of information systems, including equipment, software, networks and systems operations.

- *Education and Training* - Products and services related to information systems and services for the professional and end user, including computer-aided instruction, computer-based education, and vendor instruction of user personnel in operations, design, programming, and documentation.

- *Software Development* - Services include user requirements definition, systems design, contract programming, documentation and implementation of software performed on a custom basis. Conversion and maintenance services are also included.

8. Network Services

Network services typically include a wide variety of network-based functions and operations. Their common thread is that most of these functions could not be performed without network involvement. Network services is divided into two major segments: *Electronic Information Services,* which involve selling information to the user, and *Network Applications,* which involve providing some form of enhanced transport service in support of a user's information processing needs.

- *Electronic Information Services*

   Electronic information services are databases that provide specific information via terminal- or computer-based inquiry, including items such as stock prices, legal precedents, economic indicators, periodical literature, medical diagnosis, airline schedules, automobile valuations, etc. The terminals used may be computers themselves, such as communications servers or personal computers. Users typically inquire into and extract information from the databases. Although users may load extracted data into their own computer systems, the electronic information vendor provides no data processing or manipulation capability, and the users cannot update the vendor's databases.

   The two kinds of electronic information services are:

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- *On-line Databases* - Structured, primarily numerical data on economic and demographic trends, financial instruments, companies, products, materials, etc.

- *News Services* - Unstructured, primarily textual information on people, companies, events, etc.

While electronic information services have traditionally been delivered via networks, there is a growing trend toward the use of CD ROM optical disks to support or supplant on-line services, and these optical disk-based systems are included in the definition of this delivery mode.

• *Network Applications*

- *Value-Added Network Services (VAN Services)* - VAN services are enhanced transport services that involve adding such functions as automatic error detection and correction, protocol conversion, and store-and-forward message switching to the provision of basic network circuits.

While VAN services were originally provided only by specialized VAN carriers (Tymnet, Telenet, etc.), today these services are also offered by traditional common carriers (AT&T, Sprint, etc.). Meanwhile, the VAN carriers have also branched into the traditional common carriers' markets and are offering unenhanced basic network circuits as well.

INPUT's market definition covers VAN services only, but includes the VAN revenues of all types of carriers.

- *Electronic Data Interchange (EDI)* - Application-to-application exchange of standardized business documents between trade partners or facilitators. This exchange is commonly performed using VAN services. Specialized translation software is typically employed to convert data from organizations' internal file formats to EDI interchange standards; this software may be provided as part of the VAN service or may be resident on the organization's own computers.

- *Electronic Information Exchange (EIE)* - Also known as Electronic Mail (E-Mail), EIE involves the transmission of messages across an electronic network managed by a services vendor, including facsimile transmission (FAX), voice mail, voice messaging, and access to Telex, TWX, and other messaging services. This also includes bulletin board services.

- *Other Network Services* - This segment contains videotex and pure network management services. Videotex is actually more a delivery mode than an application. Its prime focus is on the individual as a

consumer or in business. These services provide interactive access to databases and offer the inquirer the capability to send as well as receive information for such purposes as home shopping, home banking, travel reservations, and more.

Network management services included here must involve the vendor's network and network management systems as well as people. People-only services, or services that involve the management of networks as part of the broader task of managing a user's information processing functions, are included in Systems Operations.

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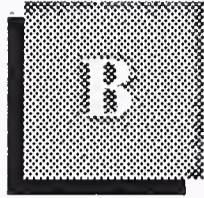
Related INPUT Reports

- *Applications Software Opportunities—Western Europe, 1988-1993*

- *Toward the Fifth Generation—European Market Opportunities, 1988-1993*

- *Network Services—Western European Market Opportunities, 1988-1993*

- *Commercial Systems Integration—Western Europe, 1988-1993*

- *Turnkey Systems Opportunities—Western Europe, 1989-1994*

- *Western Europe Electronic Information Services, 1989-1994*

- *Professional Services Opportunities—Western Europe, 1989-1994*

- *The Challenge of the Single European Market—1992 and Beyond*

- *The Western European Market for Computer Software and Services, 1989-1994*

- *European Software and Services Market, 1990-1995—Insurance Sector*

- *European Software and Services Market, 1990-1995—Banking and Finance Sector*

- *European Software and Services Market, 1990-1995—Distribution Sector*

- *Industry Sector Markets: 1988-1993, Discrete Manufacturing Sector (U.S.)*

- *Industry Sector Markets: 1989-1994, Discrete Manufacturing Forecast Update (U.S.)*
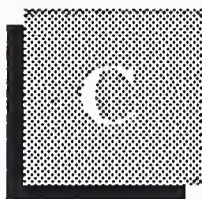
# U.S. Dollar Average Exchange Rates and Inflation Assumptions

EXHIBIT C-1

U.S. Dollar Average Exchange Rates and Inflation Assumptions

Country	Currency	Dollar Exchange Rate	Inflation Assumptions
Austria	Sch	12.77	4.0
Belgium	BF	38.06	4.0
Denmark	DK	7.05	5.0
Finland	FM	4.21	6.0
France	FF	6.17	4.5
Germany	DM	1.81	4.0
Italy	LR	1,336.00	7.0
Netherlands	DFI	2.05	3.0
Norway	NK	6.85	5.0
Spain	Pta	115.8	6.5
Sweden	SK	6.39	7.0
Switzerland	SF	1.61	5.0
U.K.	£	0.631	7.0

Source: Exchange rates—IMF (average rates for fourth quarter 1989)
Inflation—Barclays Bank (1989)
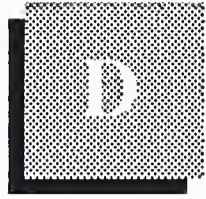
Vendor Questionnaire

1. Which sectors of the manufacturing industry does your company target?

2. What are your principal products and services for the discrete manufacturing sector?

	Delivery Mode	Growth Rate
CAD	_____	_____
Manufacturing management	_____	_____
Shopfloor automation	_____	_____
Manufacturing consultancy	_____	_____
Systems integration	_____	_____
Network services	_____	_____
Systems operations	_____	_____
Other	_____	_____

How is each of these products and services delivered?

_____

_____

How fast do you think each of these areas will grow over the next few years?

_____

_____

3.   What changes are you experiencing in the manufacturing sector that affect the demand for software and services?

_____

_____

_____

4.   Which sectors and applications do you think will grow in importance over the next few years?

           Sectors   Applications

_____   _____

_____   _____

_____   _____

5.   What are the three most important issues facing your organisation in tackling the discrete manufacturing sector over the next few years?

_____

_____

_____

6.   How do you see your product and service range for the discrete manufacturing sector evolving in response to these changes over the next few years?

_____

_____

_____

7. Do you see a need for increased collaboration with other software and services vendors?

_____

_____

If so, along what lines?

_____

_____

8. Is systems integration an issue for your company?

_____

_____

If so, how do you propose to tackle this opportunity?

_____

_____

Who are your major competitors in this area?

_____

_____

9. Do you intend to increase the level of management consultancy offered to manufacturing companies over the next few years?

_____

_____

If so, why?_____

_____

Who are your major competitors in management consultancy?

_____

_____

10. Is systems operations (facilities management) an issue for your company?

    _____

    _____

    If so, who are your major competitors in the discrete manufacturing sector?

    _____

    _____

11. Are you targeting, or planning to target, network services within the discrete manufacturing sector?

    _____

    _____

    If so, what are you offering or planning to offer?

    _____

    _____

    Who are your major competitors in network services within the discrete manufacturing sector?

    _____

    _____

12. Which are the most important European markets for your company in the discrete manufacturing marketplace?

    Germany

    France

    Italy

    U.K.

    Other (please state)

13. How do you expect your geographic coverage to change over the next few years?

_____

_____

_____

14. What revenues does your company derive from the discrete manufacturing sector in Western Europe?

_____

_____

How are these broken down?

By product _____   By sector _____   By country _____

Thank you very much for allowing me to take up so much of your time. Are there any major issues that you think we have not covered that are of major importance in relation to the discrete manufacturing sector over the next few years?
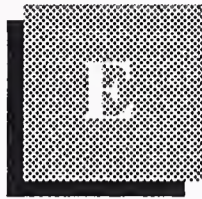
Forecast Database

Germany
User Expenditures

	DM Millions						CAGR (Percent)
	1990	1991	1992	1993	1994	1995	
Processing Services	472	485	496	505	514	522	2
Network Services	232	300	404	548	724	929	32
Software Products	726	856	1,040	1,300	1,520	1,730	19
Professional Services	749	945	1,210	1,540	1,930	2,380	26
Systems Integration	217	293	389	510	659	838	31
Turnkey Systems	1,040	1,230	1,480	1,760	2,060	2,390	18
Systems Operations	36	45	60	78	101	134	30
Total	3,472	4,154	5,079	6,241	7,508	8,923	21

France
User Expenditures

	FF Millions						CAGR (Percent)
	1990	1991	1992	1993	1994	1995	
Processing Services	1,460	1,510	1,540	1,570	1,600	1,620	2
Network Services	944	1,150	1,440	1,780	2,220	2,770	24
Software Products	2,440	2,780	3,200	3,750	4,350	4,910	15
Professional Services	3,190	3,890	4,940	6,280	7,660	9,350	24
Systems Integration	234	302	395	512	642	808	28
Turnkey Systems	2,580	3,020	3,500	4,020	4,590	5,190	15
Systems Operations	370	494	666	870	1,100	1,380	30
Total	11,218	13,146	15,681	18,782	22,162	26,028	18

EXHIBIT E-3

United Kingdom
User Expenditures

	£ Millions						CAGR (Percent)
	1990	1991	1992	1993	1994	1995	
Processing Services	109	115	121	124	129	133	4
Network Services	76	88	101	120	143	167	17
Software Products	155	163	176	201	225	250	10
Professional Services	182	211	247	302	365	435	19
Systems Integration	33	40	47	57	68	80	19
Turnkey Systems	220	237	256	287	321	353	10
Systems Operations	26	36	49	63	80	102	31
Total	801	890	997	1,154	1,331	1,520	14

EXHIBIT E-4

Italy
User Expenditures

	LR Millions						CAGR (Percent)
	1990	1991	1992	1993	1994	1995	
Processing Services	148	152	155	158	160	164	2
Network Services	91	110	132	159	199	255	23
Software Products	263	310	366	425	485	553	16
Professional Services	254	305	369	457	576	715	23
Systems Integration	45	56	68	88	119	156	28
Turnkey Systems	265	313	365	417	470	509	14
Systems Operations	32	40	52	71	96	128	32
Total	1,098	1,286	1,507	1,775	2,105	2,480	18

EXHIBIT E-5

Rest of Europe
User Expenditures

	$ Millions						CAGR (Percent)
	1990	1991	1992	1993	1994	1995	
Processing Services	362	377	390	402	411	420	3
Network Services	174	209	251	301	373	470	22
Software Products	450	536	637	746	857	987	17
Professional Services	508	610	738	900	1,107	1,373	22
Systems Integration	35	43	53	67	84	107	25
Turnkey Systems	560	672	800	936	1,076	1,228	17
Systems Operations	34	42	53	66	85	108	26
Total	2,123	2,489	2,922	3,418	3,993	4,693	17

MEIDO

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Report Quality Evaluation

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To ensure that the highest standards of report quality are maintained, INPUT would appreciate your assessment of this report. Please take a moment to provide your evaluation of the usefulness and quality of this study. When complete, simply fold, staple, and drop in the post.

Thank You.

1. Report title: **European Software and Services Market, 1990-1995** (MEIDO)
   Discrete Manufacturing Sector

2. Please indicate your reason for reading this report:
   - ☐ Required reading
   - ☐ Area of high interest
   - ☐ Area of general interest
   - ☐ New product development
   - ☐ Business/market planning
   - ☐ Product planning
   - ☐ Future purchase decision
   - ☐ Systems planning
   - ☐ Other _____

3. Please indicate extent report used and overall usefulness:

	Extent		Usefulness	(1=Low,	5=High)		
	Read	Skimmed	1	2	3	4	5
Executive Overview	☐	☐	☐	☐	☐	☐	☐
Complete Report	☐	☐	☐	☐	☐	☐	☐
Part of Report (_____ %)	☐	☐	☐	☐	☐	☐	☐

4. How Useful was:

	1	2	3	4	5
Data presented	☐	☐	☐	☐	☐
Analyses	☐	☐	☐	☐	☐
Recommendations	☐	☐	☐	☐	☐

5. How useful was the report in these areas:

	1	2	3	4	5
Alert you to new opportunities or approaches	☐	☐	☐	☐	☐
Cover new areas not covered elsewhere	☐	☐	☐	☐	☐
Confirm existing ideas	☐	☐	☐	☐	☐
Meet Expectations	☐	☐	☐	☐	☐
Other _____	☐	☐	☐	☐	☐

6. Which topics in the report were the most useful? Why?_____

   _____

7. In what ways could the report have been improved? _____

   _____

8. Other comments or suggestions: _____

   _____

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Thank you for your time and cooperation.

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