

SOFTWARE AND SERVICES MARKET
PROCESS MANUFACTURING OPPORTUNITIES
EUROPE 1992 - 1997

INPUT

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SOFTWARE AND SERVICES MARKET, EUROPE

1992-1997

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***Software and Services Market, Europe,
1992-1997—Process Manufacturing
Opportunities***

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Abstract

This report analyses the market for software and services in the European process manufacturing sector. It identifies the major issues and opportunities for vendors together with the driving forces influencing the use of software and services in the process manufacturing sector. Market forecasts are provided 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 applications software products, professional services, systems integration, network services and systems operations. The leading vendors within each country market are identified.

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Table of Contents

I	Introduction	I-1
	A. Objectives	I-1
	B. Scope	I-1
	C. Methodology	I-2
	D. Report Structure	I-3
<hr/>		
II	Executive Overview	II-1
	A. Process Manufacturers Sustain Demand for Services	II-1
	B. Key Industries and Market Forecasts	II-2
	C. Applications Software Products and Turnkey Systems	II-5
	D. Systems Integration and Professional Services	II-8
	E. Network Services and Systems Operations	II-10
	F. User Pressures	II-12
	G. Vendor Issues and Strategies	II-15
	H. Logistics	II-20
	I. Key Opportunities	II-23
<hr/>		
III	European Software and Services Overview	III-1
	A. European Overview	III-1
	B. Key Industries	III-3
<hr/>		
IV	Country Forecasts	IV-1
	A. Overview	IV-1
	B. Germany	IV-1
	C. France	IV-5
	D. United Kingdom	IV-6
	E. Italy	IV-9

Table of Contents (Continued)

V	Key Delivery Modes	V-1
	A . Overview	V-1
	B . Software Products	V-1
	C . Turnkey Systems	V-6
	D . Professional Services	V-7
	E . Systems Integration	V-8
	F . Network Services	V-11
	G . Systems Operations	V-13

VI	Vendor Issues and Strategies	VI-1
	A . Vendor Issues	VI-1
	1 . Overview	VI-1
	2 . Acceptance of UNIX	VI-2
	3 . Suitability of Product/Service Portfolio	VI-2
	B . Vendor Strategies	VI-8
	1 . Equipment Vendors	VI-8
	2 . Professional Services Vendors	VI-9
	3 . Applications Software Product Vendors	VI-10

VII	User Issues	VII-1
	A . User Pressures	VII-1
	B . Key Trends	VII-3

VIII	Logistics	VIII-1
	A . Introduction	VIII-1
	B . Driving Forces	VIII-1
	C . Subsector Trends	VIII-4
	1 . Overall Demand	VIII-4
	2 . Food and Drink	VIII-4
	3 . Pharmaceuticals	VIII-5

Table of Contents (Continued)

VIII	D. Opportunities E. Case Study	VIII-5 VIII-6
IX	Opportunities	IX-1
Appendixes	A. Forecast Database B. Forecast Reconciliation C. Exchange Rates 1. European Exchange Rates 2. European Inflation Rates D. Related INPUT Reports	A-1 B-1 C-1 C-1 C-3 D-1

List of Exhibits

II

- | | | |
|------|--|-------|
| - 1 | Software and Services Market Forecast, 1992-1997
Process Manufacturing Sector, Europe | II-3 |
| - 2 | Software and Services Market, Percentage Distribution
by Country, 1992—Process Manufacturing Sector, Europe | II-4 |
| - 3 | Industries—Growth Prospects
Process Manufacturing Sector, Europe | II-5 |
| - 4 | Market Forecast, 1992-1997
Applications Software Products and Turnkey Systems
Process Manufacturing Sector, Europe | II-6 |
| - 5 | Software Product Trends
Process Manufacturing Sector, Europe | II-7 |
| - 6 | Software Product Trends—Increasing Demand for UNIX at
Production Management Level—Process Manufacturing
Sector, Europe | II-8 |
| - 7 | Market Forecast, 1992-1997
Systems Integration and Professional Services
Process Manufacturing Sector, Europe | II-9 |
| - 8 | Planned Levels of Integration
Process Manufacturing Sector, Europe | II-9 |
| - 9 | Market Forecast, 1992-1997
Network Services and Systems Operations
Process Manufacturing Sector, Europe | II-11 |
| - 10 | Planned Usage of EDI—User Perception
Process Manufacturing Sector, Europe | II-11 |
| - 11 | Increasing Usage of Systems Operations
Process Manufacturing Sector, Europe | II-13 |
| - 12 | User Pressures—Process Manufacturing Sector, Europe | II-13 |
| - 13 | Technological Trends
Process Manufacturing Sector, Europe | II-14 |
| - 14 | Software and Services Leading Vendors (1991)
Process Manufacturing Sector, Europe | II-15 |
| - 15 | Vendor Issues—Process Manufacturing Sector, Europe | II-16 |
| - 16 | Vendor Strategies—Process Manufacturing Sector, Europe | II-18 |
| - 17 | Need To Develop Product/Service Portfolio
Process Manufacturing Sector, Europe | II-19 |

Exhibits (Continued)

II

- | | | |
|-----|--|-------|
| -18 | Business Pressures—Logistics
Process Manufacturing Sector, Europe | II-20 |
| -19 | Levels of Demand for Logistics Systems
Process Manufacturing, Europe | II-21 |
| -20 | Major Opportunities in Logistics
Process Manufacturing, Europe | II-22 |
| -21 | Key Opportunities—Process Manufacturing Sector, Europe | II-23 |
| -22 | Key Opportunities—Applications Software Products
Process Manufacturing Sector, Europe | II-24 |

III

- | | | |
|----|--|-------|
| -1 | Software and Services Market Forecast, 1992-1997
Process Manufacturing Sector, Europe | III-2 |
| -2 | Leading Software and Services Vendors
Process Manufacturing Sector—Europe, 1991 | III-3 |
| -3 | Production by Subsector—Process Manufacturing
Sector—Europe, 1991 | III-5 |
| -4 | Growth Prospects by Subsector | III-6 |

IV

- | | | |
|----|---|------|
| -1 | Software and Services Market Forecast by Country,
1992-1997—Process Manufacturing Sector, Europe | IV-2 |
| -2 | Software and Services Market
Process Manufacturing, Germany | IV-3 |
| -3 | Leading Software and Services Vendors
Process Manufacturing Sector—Germany, 1991 | IV-4 |
| -4 | Software and Services Market
Process Manufacturing, France | IV-5 |
| -5 | Leading Software and Services Vendors
Process Manufacturing Sector—France, 1991 | IV-6 |
| -6 | Software and Services Market
Process Manufacturing, United Kingdom | IV-7 |
| -7 | Leading Software and Services Vendors
Process Manufacturing Sector—U.K., 1991 | IV-8 |

Exhibits (Continued)

IV

- | | | |
|-----|---|-------|
| - 8 | Software and Services Market
Process Manufacturing, Italy | IV-10 |
| - 9 | Leading Software and Services Vendors
Process Manufacturing Sector—Italy, 1991 | IV-10 |

V

- | | | |
|------|--|------|
| - 1 | Software and Services Market
Process Manufacturing, Europe | V-2 |
| - 2 | Software Product Trends—User Perception
Process Manufacturing Sector, Europe | V-3 |
| - 3 | Software Product Trends—Vendor Perception
Process Manufacturing Sector, Europe | V-4 |
| - 4 | Expectation of Increasing Demand
for Production Management Systems by Vendor Category | V-5 |
| - 5 | Professional Services Trends—Vendor Perception
Process Manufacturing Sector, Europe | V-8 |
| - 6 | User Integration Plans
Process Manufacturing Sector, Europe | V-9 |
| - 7 | Timing of Integration of SCADA and
Production Management Systems—Vendor Perception | V-10 |
| - 8 | European EDI Markets by Vertical Sector, 1991 | V-12 |
| - 9 | Increasing Usage of EDI
Process Manufacturing Sector, Europe | V-13 |
| - 10 | Increasing Usage of Systems Operations
Process Manufacturing Sector, Europe | V-14 |

VI

- | | | |
|-----|---|------|
| - 1 | Vendor Challenges—Process Manufacturing Sector, Europe | VI-2 |
| - 2 | Increasing Demand for UNIX-Based Systems
Vendor Perception | VI-3 |
| - 3 | Completeness of Offerings for the
Process Manufacturing Sector, Europe | VI-4 |
| - 4 | Need to Extend Offerings for Process Manufacturing Sector
Applications Software Products, Europe | VI-5 |
| - 5 | How Gaps in Applications Software Products
Portfolio Will Be Filled | VI-6 |

Exhibits (Continued)

VI

- | | | |
|------|---|-------|
| - 6 | Need To Extend Offerings for Process Manufacturing Sector Professional Services, Europe | VI-7 |
| - 7 | How Gaps in Systems Integration Portfolio Will Be Filled | VI-8 |
| - 8 | Strategy: Equipment Vendors
Process Manufacturing Sector, Europe | VI-9 |
| - 9 | Strategy: Professional Services Vendors
Process Manufacturing Sector, Europe | VI-10 |
| - 10 | Strategy: Applications Software Product Vendors
Process Manufacturing Sector, Europe | VI-11 |

VII

- | | | |
|-----|--|-------|
| - 1 | User Pressures—Process Manufacturing Sector, Europe | VII-2 |
| - 2 | Key User Trends—Process Manufacturing Sector, Europe | VII-3 |
| - 3 | Major Technological Trends—User Perception
Process Manufacturing Sector, Europe | VII-4 |
| - 4 | User Adoption of UNIX
Process Manufacturing Sector, Europe | VII-5 |

VIII

- | | | |
|-----|---|--------|
| - 1 | Business Pressures—Logistics
Process Manufacturing Sector, Europe | VIII-2 |
| - 2 | Key Logistics Challenges—Process Manufacturing, Europe | VIII-3 |
| - 3 | Level of Demand for Logistics Systems
Process Manufacturing Sector, Europe | VIII-4 |
| - 4 | Major Opportunities in Logistics
Process Manufacturing Sector, Europe | VIII-5 |
| - 5 | The Distribution Network—Case Study | VIII-7 |
| - 6 | Major Multiples—Issues | VIII-8 |
| - 7 | Doorstep Deliveries—Issues | VIII-8 |
| - 8 | Depots—Issues | VIII-9 |
| - 9 | User Objectives—Case Study | VIII-9 |

Exhibits (Continued)

IX

- | | | |
|-----|--|------|
| - 1 | Principal Opportunities
Process Manufacturing Sector, Europe | IX-1 |
| - 2 | Principal Opportunities—Applications Software Products
Process Manufacturing Sector, Europe | IX-2 |
| - 3 | Key Industrial Sectors—Vendor Perspective
Process Manufacturing Sector, Europe | IX-3 |
| - 4 | Issues for Vendors
Process Manufacturing Sector, Europe | IX-4 |

Appendixes

- | | | |
|-----|---|-----|
| A | | |
| - 1 | Software and Services Market
Process Manufacturing, Europe | A-1 |
| B | | |
| - 1 | Process Manufacturing Sector—Reconciliation
of Market Forecast, Europe | B-1 |
| C | | |
| - 1 | U.S. Dollar and ECU Exchange Rates, 1992 | C-2 |
| - 2 | Inflation Assumptions, 1991 and 1992 | C-3 |

I Introduction

A Objectives

This report is an update of the sector report published by INPUT in 1991, containing new market size and forecast estimates. The principal objectives of this report are:

- To forecast the size of the market for software and services in the process manufacturing sector for Europe and for each of the major country markets over the period 1992-1997.
- To forecast the size of the market for software and services in the process manufacturing sector by delivery mode.
- To identify the leading software and services vendors to the process manufacturing sector in each of the major country markets.
- To identify the major issues facing software and services vendors targeting the process manufacturing sector.
- To identify the driving forces influencing the demand for software and services within the process manufacturing sector.
- To identify the changing role of logistics in the process manufacturing sector.
- To identify the opportunities arising for software and services vendors in this sector over the period 1992-1997.

B Scope

This report analyses the market for software and services within the European process manufacturing sector over the period 1992-1997.

The process manufacturing sector is defined as:

- food, drink and tobacco industry
- timber industry
- manufacturing of paper and paper products
- chemical industry
- man-made fibres industry
- processing of rubber and plastics
- extraction of petroleum and natural gas
- mineral oil refining
- extraction and briqueting of solid fuels
- extraction and processing of other non-energy producing minerals

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 1992-1997 for each of the key delivery modes, namely:

- industry-specific applications software products
- turnkey systems
- professional services
- systems integration
- network services
- systems operations
- processing services

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 leading vendors and users active in the European process manufacturing sector, together with ten interviews of users and vendors focussing on logistics software and services.
- INPUT's ongoing research of the 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.

Chapter II is the 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 process manufacturing sector.

Chapter III contains market forecasts at the European level and considers the overall prospects for the major subsectors of the process manufacturing sector.

Chapter IV contains market forecasts for France, Germany, the United Kingdom and Italy and lists the leading vendors in each country.

Chapter V analyses the software and services market by delivery mode across the process manufacturing sector. For each delivery mode, a market forecast is provided and the major trends identified.

Chapter VI identifies the major issues facing software and services vendors in the process manufacturing sector and the generic strategies being followed by the main types of vendor.

Chapter VII discusses the driving forces within the process manufacturing sector and the issues facing users in this sector.

Chapter VIII looks at the changing role of logistics within the process manufacturing sector.

Chapter IX lists the major opportunities within the process manufacturing sector for software and services vendors, and summarises some of the major issues facing vendors.

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II Executive Overview

A Process Manufacturers Sustain Demand for Services

As the manufacturing industry strives for better, cheaper, faster products and processes, the process sector is investing more readily in software and services than its discrete manufacturing counterpart. In particular, food, energy and pharmaceuticals subsectors are proving more immune than most to recessionary economic pressures.

Recession is accelerating the trends to IT downsizing and outsourcing in Europe's process manufacturing industries. Only five years ago there was little evidence that IT was being applied in any innovative integrated sense. Today, by and large, the technology is available to implement worthwhile CIM (computer-integrated manufacturing) strategies. It is a matter of when and how companies decide to invest in improving their business processes through their use of IT.

The need to reduce business costs and the desire to improve competitive edge and change the way the business is run coincides with the availability of affordable technology in the form of smaller, faster systems. This is stimulating software and services investment to the extent that INPUT is forecasting 14% growth in 1992 and a compound annual growth of 16% to 1997.

There is growing evidence of successful downsizing—to AS/400s, to UNIX and to networked PC/workstations—as IT responsibilities are devolved down to plant or department levels of management. For some subsectors the necessity to consolidate plant and reduce costs is driving these changes, particularly for pan-European or global operations. Downsizing takes many forms with, for example, Germany favouring UNIX, but still with emphasis on in-house development of applications, while Italy favours the application package approach.

For companies such as oil and chemicals, it is already second nature to outsource many manufacturing operations. For many companies, the concept of outsourcing IT and simplifying the tasks of management is attractive at a time when their full attention is needed to drive the business forward. Outsourcing systems operations offers the management the opportunity to be rid of responsibility for complex data centres, a well established trend in France and the U.K.

Systems integration and network services are the other delivery modes that are enjoying high growth in this sector. Both delivery modes are driven by the same need—to share more information. In the first case between units within a business, and in the second to pass information (e.g., EDI) back and forth along the supply chain.

Overall the process manufacturing sector still offers significant growth opportunities (7% higher than the average across Europe) to those software and services vendors that have specialised in this sector and that can add real value to their clients' in-house IT skills.

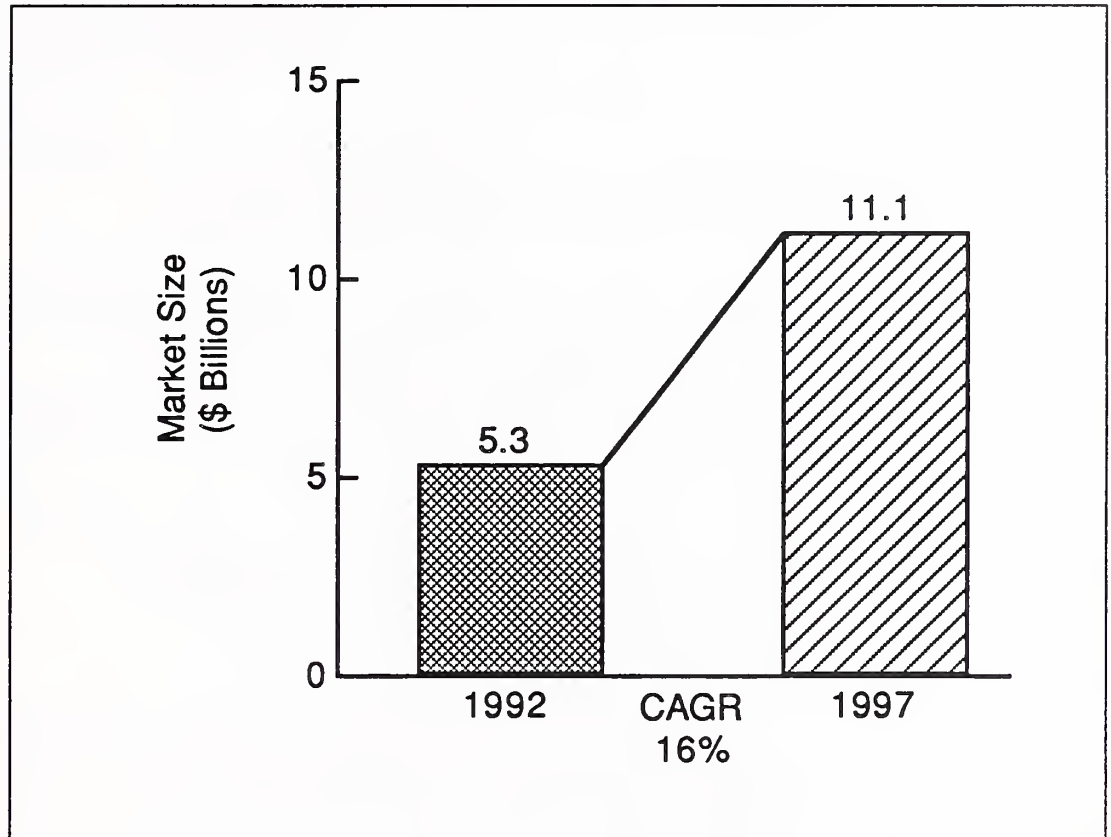
B

Key Industries and Market Forecasts

INPUT forecasts that the market for industry-specific software and services within the European process manufacturing sector will grow strongly over the next five years, as shown in Exhibit II-1.

EXHIBIT II-1

Software and Services Market Forecast 1992-1997 Process Manufacturing Sector, Europe



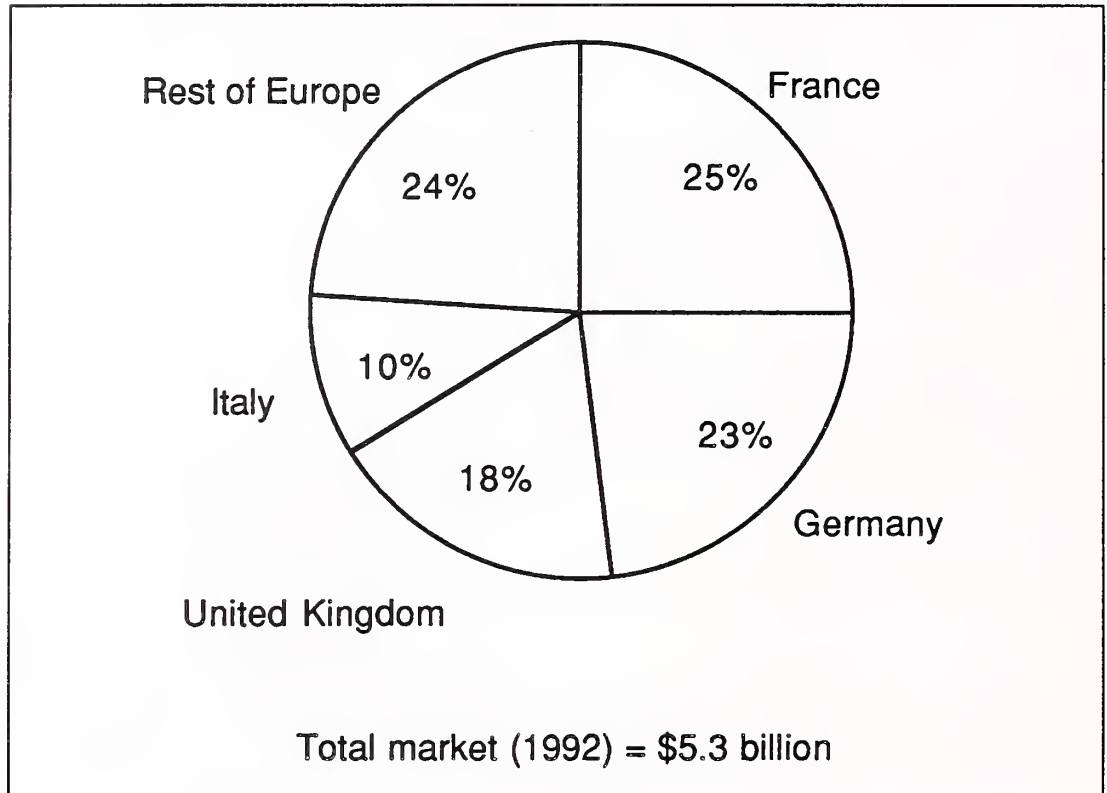
This comparatively high level of growth in the present economic climate is initially being fuelled by the take-up of production management systems, and will be subsequently maintained by the integration of these systems with systems for supervisory control and data acquisition (SCADA) linked to the process plant.

Although the growth rate for the whole of the software and services market obviously shows some variation from country to country and amongst delivery modes, these differences are less marked than those in the discrete manufacturing sector. The country differences are less dramatic because the principal sectors, such as food and pharmaceuticals, are to some extent recession-proof, and the impact of the present high oil price has had a fairly comparable effect on the petrochemicals sector in each of the major countries.

Exhibit II-2 shows the market for software and services within the process manufacturing sector in Europe broken down by country.

EXHIBIT II-2

**Software and Services Market
Percentage Distribution by Country, 1992
Process Manufacturing Sector, Europe**



At the present time, the largest single national market is France with a market value of \$1,340 million, followed by Germany and the United Kingdom. While Germany is expected eventually to become the most important national market in this sector, comparatively similar growth rates are forecast for the major national markets over the next five years, with Germany—growing at 17% per annum—only slightly ahead of France, the United Kingdom and Italy.

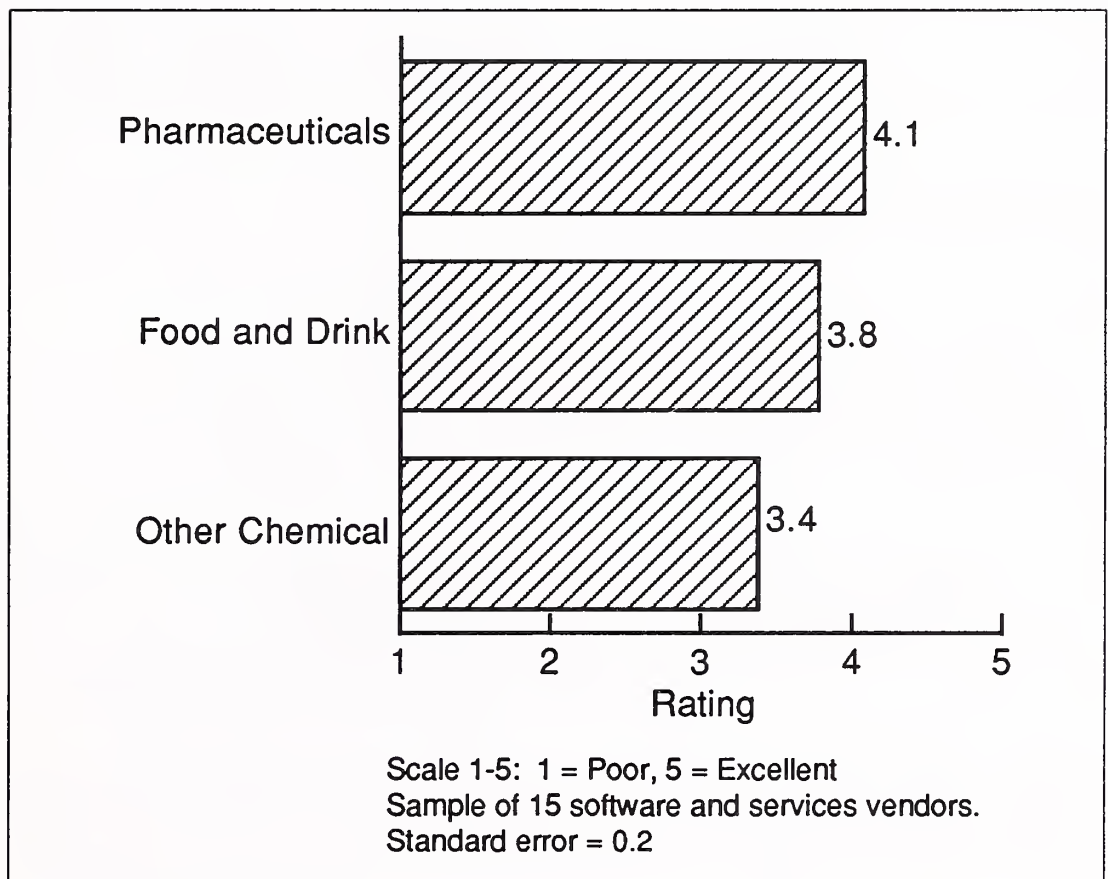
Growth in software and services within the process manufacturing sector in the United Kingdom is not expected to fall to the levels seen in the discrete manufacturing sector since, despite cutbacks in capital expenditure by companies such as ICI, the food and pharmaceuticals sectors are expected to show some resistance to recession. Only the petrochemicals sector is highly susceptible to the present economic situation, and this applies equally to companies in Germany, France and Italy, many of which are very dependent on basic, rather than speciality, chemicals. For example, BASF announced reduced profit forecasts and a number of plant closures.

Overall, as shown in Exhibit II-3, software and services vendors believe the most promising industries for their services in Europe to be pharmaceuticals

and food and beverages. However, there were noticeable differences in attitude to the food and drink sector amongst vendor categories. The food and drink sector was highly rated by the equipment vendors and by the applications software product vendors. However, it was perceived to be only a moderately promising sector by the professional services vendors, which in some cases were finding the food and drink sector fragmented and difficult to penetrate.

EXHIBIT II-3

Industries—Growth Prospects Process Manufacturing Sector, Europe



Overall, the European process manufacturing sector is perceived as offering considerable opportunities to software and services vendors over the next few years.

C Applications Software Products and Turnkey Systems

At present, as shown in Exhibit II-4, there is strong growth in the applications software product and turnkey systems markets. This growth is fuelled by users' increasing acceptance of industry-specific application

packages. While the application showing highest levels of demand is production management, other important application areas include:

- Supervisory control and data acquisition (SCADA)
- Production supervision and control
- Integrated quality management systems (including in-line quality testing)

Maintenance management is another important application in the process manufacturing sector but it is already well-established there, and is not considered to be a major area of opportunity for vendors.

EXHIBIT II-4

Market Forecast, 1992-1997 Applications Software Products and Turnkey Systems—Process Manufacturing Sector, Europe

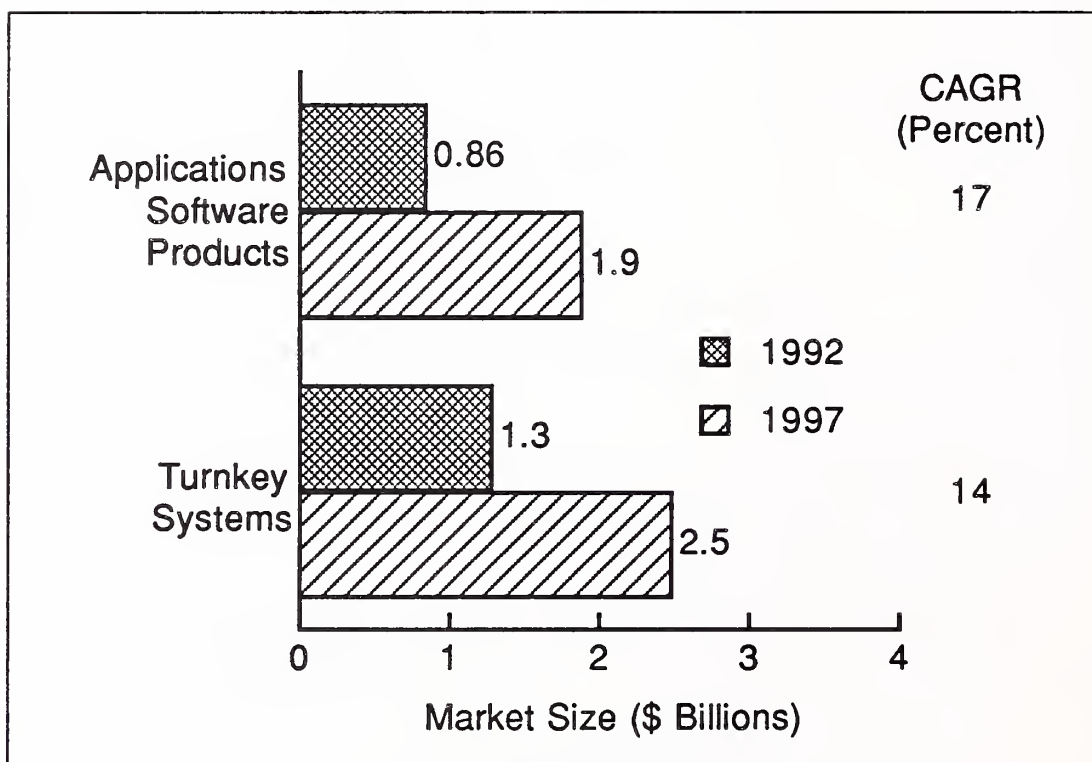


Exhibit II-5 shows users' and vendors' perceptions of these key trends. Until recently production management systems in the process manufacturing sector were typically developed in-house by users. This now seems to be largely a thing of the past. Even so, in some countries there may still be a small time lag before this trend becomes established and users recognise the suitability of the packages now being developed for their industry.

EXHIBIT II-5

Software Product Trends Process Manufacturing Sector, Europe

Trend	Likelihood of Adoption by Trend	
	Users' Perception	Vendors' Perception
Increasing reliance on packages	Very High	High
Increasing demand for production management systems	Very High	High

This change in the market has been recognised by the equipment vendors and the traditional production management software product vendors, and is leading to high levels of competition.

On the other hand, the noticeable gap between the perceptions of users and vendors in estimating the extent of the increased demand for production management systems is largely caused by the stance taken by a number of professional services vendors, which do not seem to be well positioned to offer software products to this sector.

The embryonic nature of the market overall is illustrated by the figures released by ASK, stating that of the company's 3,200 customers worldwide, only 100 were process manufacturing companies using ASK software and Digital hardware in 1990.

At present, many of the production management systems being installed are centralised systems, but over the next few years there will be an increasing trend to distributed systems as the technology becomes both available and proven.

There is also an increasing demand for UNIX as the platform for systems in general and production management systems in particular. The level of acceptance of UNIX shown in Exhibit II-6 is much higher in the process manufacturing sector than in the discrete manufacturing sector, particularly among large organisations, and the market growth of UNIX-based systems is likely to be significantly higher in the process manufacturing sector over the next few years. Proprietary architectures are much more entrenched in the discrete manufacturing sector, and attitudes towards UNIX are more conservative. In the process manufacturing sector, UNIX is frequently seen as the key to achieving computer-integrated processing and compatibility between applications software products.

EXHIBIT II-6

Software Product Trends Increasing Demand for UNIX at Production Management Level Process Manufacturing Sector, Europe

Sample Group	Degree of Agreement That Demand Is Increasing
Users	Medium
Vendors	Medium

Another difference between the two sectors is the difference in attitude towards UNIX at the shopfloor and production administration levels. In the discrete manufacturing sector, UNIX is expected to initially gain a foothold at the shopfloor level and only slowly move up to the production administration level. However, in the process manufacturing sector, UNIX is expected to make a significant impact initially at the production administration level.

D Systems Integration and Professional Services

Users in the process manufacturing sector are increasingly using external vendors for consultancy and for integrating the various application areas.

Both users and vendors report:

- An increase in use of external software development staff
- Corresponding increase in external spending for software and services
- Some reduction in user staff levels

However, in many instances, the initial priority is to implement production management systems, which will delay the commencement of any integration work for several years. The resulting overall growth in these delivery modes is shown in Exhibit II-7.

EXHIBIT II-7

**Market Forecast, 1992-1997
Systems Integration and Professional Services
Process Manufacturing Sector, Europe**

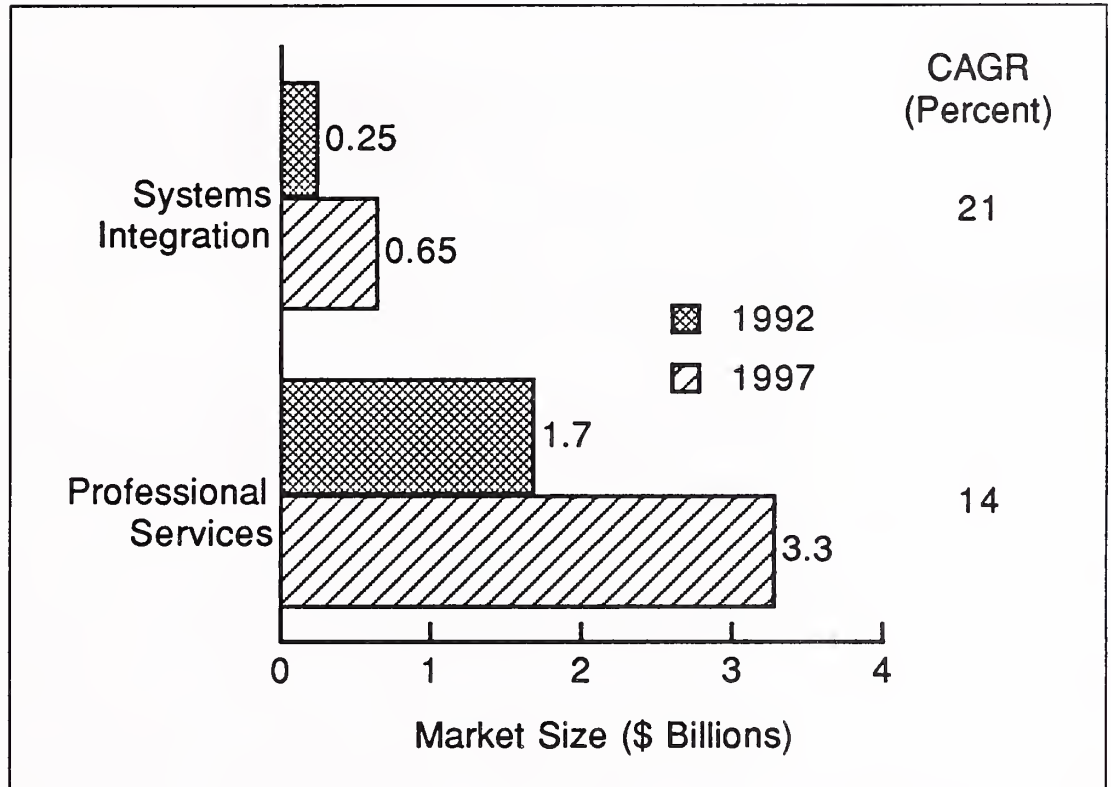


Exhibit II-8 shows that users in the process manufacturing sector have firm intentions of integrating their production management systems with the process control equipment via supervisory control and data acquisition (SCADA) systems and of moving towards a computer-integrated processing environment.

EXHIBIT II-8

**Planned Levels of Integration
Process Manufacturing Sector, Europe**

Integration of production management and SCADA systems	High
Full computer-integrated manufacturing	High

Although some companies are planning to integrate these components of their systems in the short term, process manufacturing companies are

typically expecting to link their production management and process control systems in one to five years' time. Integration will prove of major benefit to users in improving their responsiveness to customers by providing them with up-to-date information on production achievements. Integration will also greatly assist users in achieving high levels of quality and in demonstrating their control of consistent quality levels.

Overall the major equipment vendors have been more proactive than many of the professional services vendors in establishing their ability to offer systems integration to users in the process manufacturing sector.

E

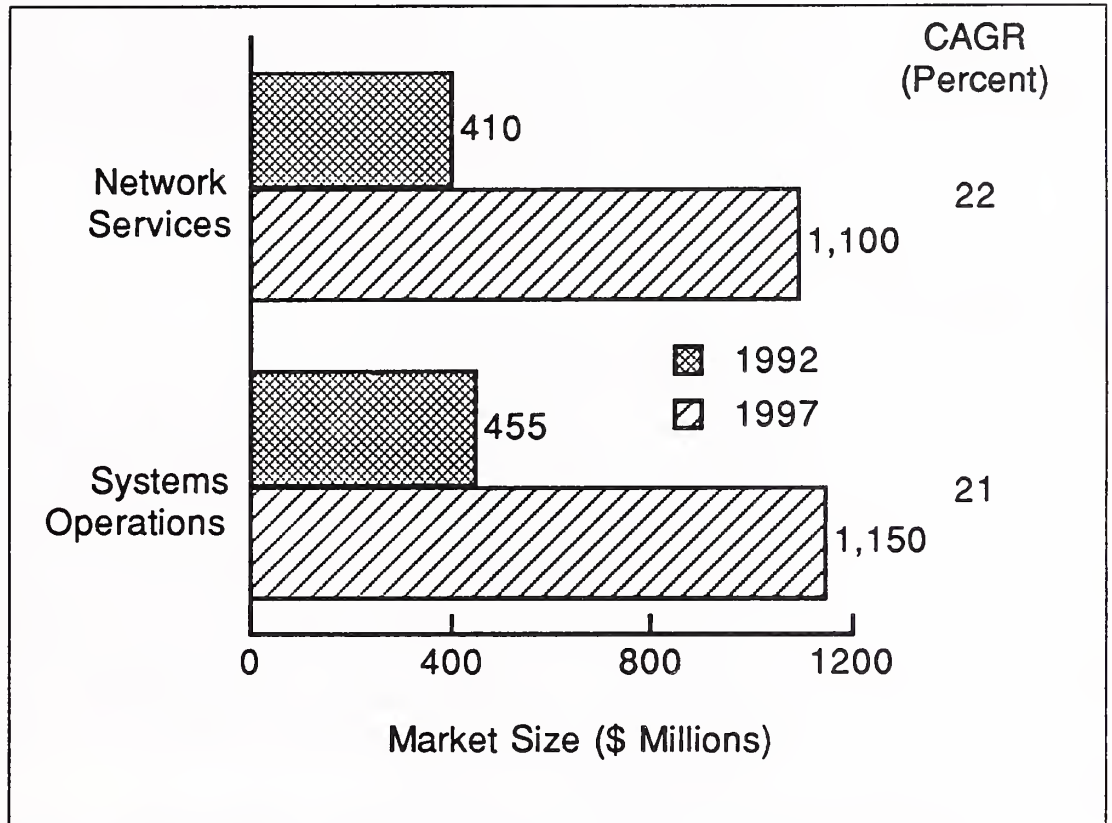
Network Services and Systems Operations

Exhibit II-9 shows the market growth forecast for network services and systems operations between 1992 and 1997. Growth in both of these delivery modes is forecast to be appreciably lower in the process manufacturing sector than in the discrete manufacturing sector.

In particular, this low growth is true for the usage of electronic data interchange. In the discrete manufacturing sector, growth in electronic data interchange is being largely driven by the major manufacturers' need to link to their key suppliers, which becomes increasingly important with the use of just-in-time procedures. In the process manufacturing sector, there is less demand for electronic data interchange between manufacturer and supplier, and even between manufacturer and wholesaler. The major driving force tends to be the major retailers. However, some companies have found that even electronic data interchange links with major retailers have been characterised by comparatively low take-up of the service.

EXHIBIT II-9

**Market Forecast, 1992-1997
Network Services and Systems Operations
Process Manufacturing Sector, Europe**



Overall, comparatively low levels of growth in EDI are anticipated by users in the process manufacturing sector, as indicated in Exhibit II-10, and the pattern of usage of EDI is quite different from that found in the discrete manufacturing sector.

EXHIBIT II-10

**Planned Usage of EDI—User Perception
Process Manufacturing Sector, Europe**

Links to customers	Moderate
Links to suppliers	Low

The driving forces encouraging the process manufacturing sector to adopt systems operations are shown in Exhibit II-11. Although not to the same extent as the discrete manufacturing sector, the process manufacturing sector has its own cost pressures. These pressures arise from factors such

as attempts by central governments to reduce health-care expenditure, from own-label goods, and from rising oil prices. The subsectors particularly affected in the process manufacturing sector are the low value-added businesses such as petrochemicals, rubber and plastics processing, and synthetic fibres. Accordingly, these are the subsectors that are most susceptible to use of systems operations. Other factors that may encourage companies in the process manufacturing sector to adopt systems operations include the high levels of system redevelopment taking place and the changing nature of the equipment platform used, leading to a need for transition management services.

F**User Pressures**

As illustrated in Exhibit II-12, much of the process manufacturing industry is moving into a more competitive environment. This environment is characterised by the developments in the food industry where manufacturers are coming under increasing pressure from supermarkets and the major purchasing co-operatives. This pressure can take several forms. For example, own-label goods have large market shares in some product areas, and retailers are frequently looking for special packaging or tighter delivery schedules from their suppliers. These pressures are forcing food manufacturers up-market with the corresponding need for them to develop high levels of quality and to produce a more diverse range of products in smaller batches.

The result is that manufacturers are seeking improvements in manufacturing control, particularly in areas such as:

- Quality management and lot traceability
- Tighter monitoring of production against plan
- More complete production scheduling

EXHIBIT II-11

Increasing Usage of Systems Operations Process Manufacturing Sector, Europe

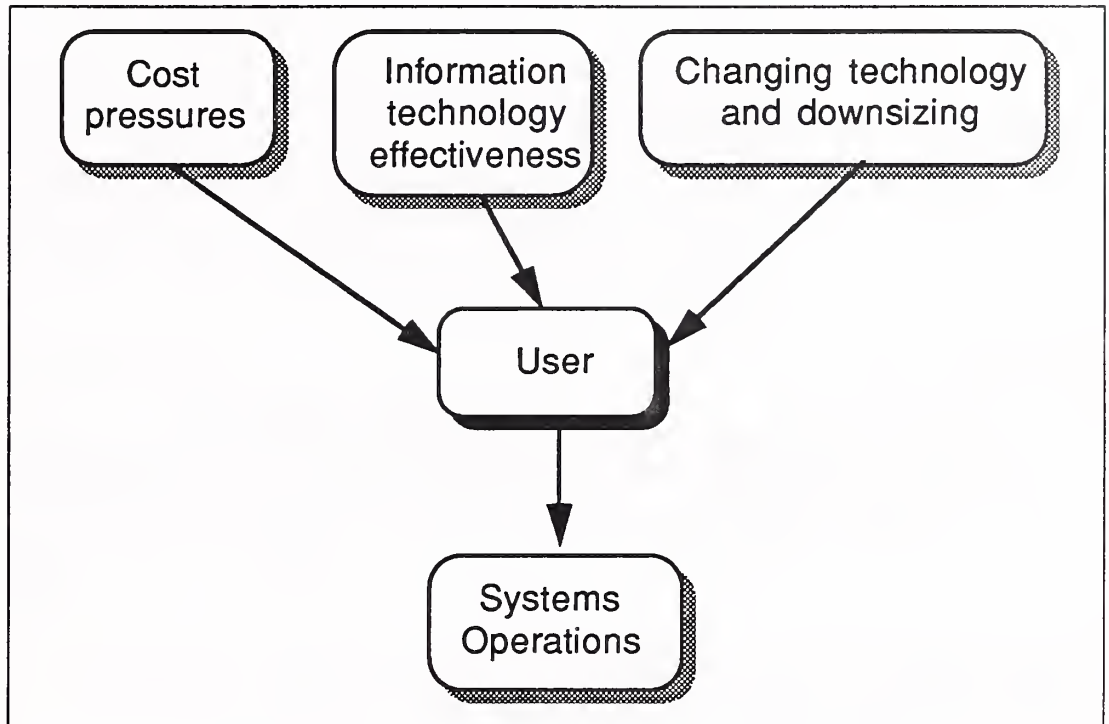
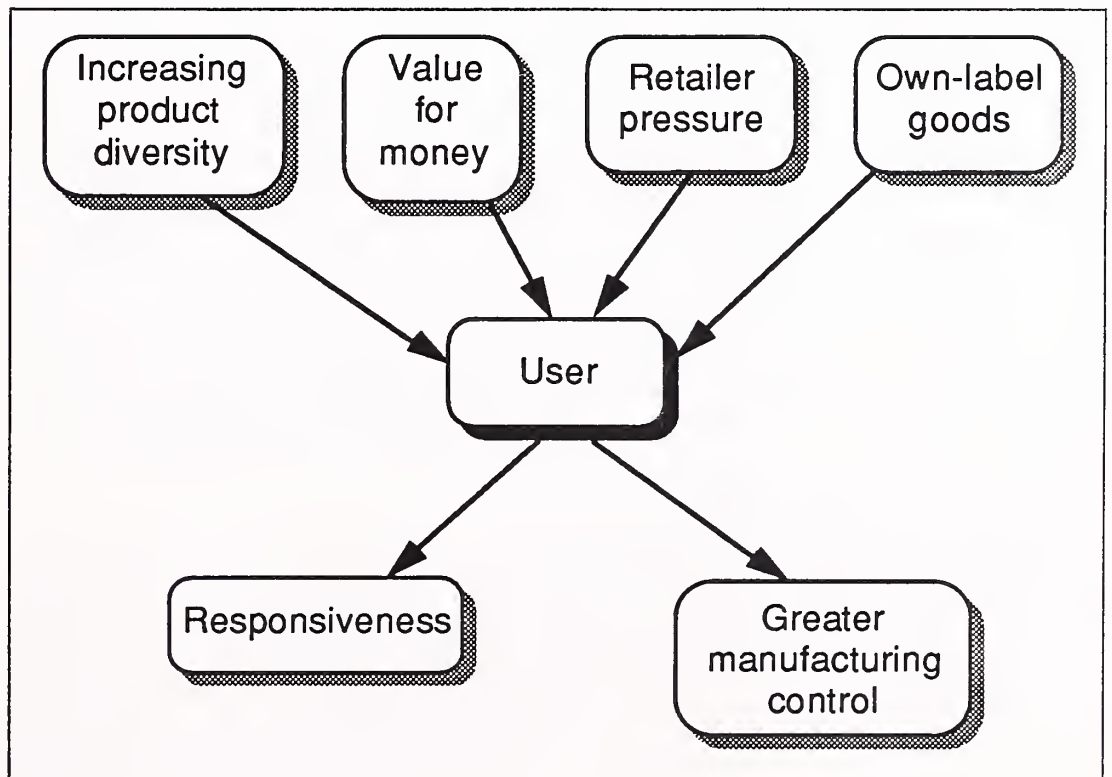


EXHIBIT II-12

User Pressures Process Manufacturing Sector, Europe



These improvements can be achieved partially by the implementation of production management systems and substantially through their subsequent integration with process control via integrated quality management and production supervision and control systems.

Some of the major technological trends in the process manufacturing sector are shown in Exhibit II-13. One of the consequences of the process manufacturing sector adopting production management software products much later than the discrete manufacturing sector is that technology has progressed in the intervening period. As a result, the process manufacturing sector has more sophisticated architectures in which to introduce its applications.

EXHIBIT II-13

Technological Trends Process Manufacturing Sector, Europe

Trend	Likelihood of Adoption
Standardised systems	High
Relational databases	High
Downsizing	Moderate
Distributed systems	Moderate

For example, a plan to introduce computer-integrated processing will typically exist before the first production management software product is implemented. Similarly, the process manufacturing sector has a high expectation of using products based on a relational database. There is also a strong intention to standardize the information systems used across plants and subsidiaries. Obviously there are limits to the extent that this approach can be adopted given the widely differing processes that may be found within a large process manufacturing organisation, but, where it is feasible, users will attempt to standardize the information systems and packages used.

Initially many production management systems will be operated on a centralised basis with one system covering a number of plants. This centralisation will gradually change as distributed systems become a proven reality, but this will always depend on the nature of the individual plant. Some process plants have production runs that continue for weeks or even years and so have little need to constantly reschedule or monitor production.

Other plants will be making a more rapid transition to short production runs that produce a greater variety of product and so will have a greater requirement for local production management and tighter control of product output.

As in other sectors, there is a general trend away from the use of mainframes. While the IBM AS/400 is one of the principal beneficiaries of this trend in the short term, there are signs that the process manufacturing sector may adopt UNIX-based systems—such as the RS/6000—for commercial use comparatively rapidly.

G

Vendor Issues and Strategies

As shown in Exhibit II-14, equipment vendors figure prominently as suppliers to the process manufacturing sector, and have recently been very active in positioning themselves for the new wave of activity just commencing in the process manufacturing sector.

EXHIBIT II-14

Software and Services Leading Vendors (1991) Process Manufacturing Sector, Europe

Company	Estimated Revenues (\$ Millions)*	Market Share (%)
IBM	225	4.8
Siemens-Nixdorf	135	2.9
CAP Gemini Sogeti	135	2.9
EDS	130	2.8
Digital	90	1.9

* Includes industry-specific revenues only

The process manufacturing sector has been an area of traditional strength for vendors such as Digital and Hewlett-Packard with experience in linking to process control and laboratory systems. To a certain extent, the same is true for Bull, via its association with Honeywell's control activities, and Siemens with its experience in automation and programmable logic controllers. These companies are now complementing this traditional expertise with production administration products for the process manufacturing sector.

However, IBM has been particularly active in positioning itself in the process manufacturing sector and has developed an exclusive product portfolio that includes its innovative production supervision and control product called POMS (Process Operations Management System).

Many of the larger professional services vendors—with a few exceptions such as EDS-Scicon and EDS-GFI—have tended to specialize more strongly in the discrete manufacturing sector and are currently not particularly strong in the process manufacturing sector.

Applications software product vendors have traditionally had a very low presence in the process manufacturing sector in industry-specific applications, with the majority of production administration systems being written in-house, but this situation is starting to change dramatically.

As the market for software and services in the process manufacturing sector enters a growth phase, vendors must seek to establish themselves as leading suppliers to this industry and build market share. Accordingly, the main issues in the market-place are to establish credibility in the sector and successfully introduce new products and services, as shown in Exhibit II-15.

EXHIBIT II-15

Vendor Issues Process Manufacturing Sector, Europe

- Introducing new products and services
- High user acceptance of open systems
- Service development

For example, many vendors of production management systems introduced products for the process manufacturing sector in 1990 and many more vendors announced products in 1991. Examples of vendors that announced production management systems for the process manufacturing section in 1990 include ASK with Manman/Process, SD-Scicon via its partnership with Pioneer Computer Systems concerning the Promix product, and IBM with Marcam's Prism product, while AT&T Istel acquired Deritend and its ProcessMarc package in 1989.

Vendors announcing versions of their products specifically tailored for the process manufacturing sector recently include:

- CINCOM
- SSA
- Pansophic
- SAP
- D&B Software

Hence, this product/market has become very competitive and there is no guarantee that the leading vendors in the process manufacturing sector will be the same as the leaders in the discrete manufacturing sector. Indeed, while it is important for vendors to be able to point to a sizeable installed base, vendors will need to dissociate themselves from their activities in the discrete manufacturing sector and demonstrate their knowledge of, and the suitability of their product for, the process manufacturing sector.

A further complication is the high user acceptance of UNIX in the process manufacturing sector. When to introduce a UNIX-based approach will be a difficult decision for many vendors. It is likely that comparatively large companies in the process manufacturing sector will adopt UNIX for commercial applications ahead of their counterparts in the discrete manufacturing sector.

For the professional services vendors, the main challenges are to respond quickly to the emerging opportunities in the process manufacturing sector by building up their product and service portfolios and especially their consultancy skills for the sector, and by establishing their credibility within the industry.

The basic generic strategies being adopted by the various types of vendors are shown in Exhibit II-16.

The major equipment vendors are targeting overall systems integration within the large process manufacturing companies. Much of their success will depend on the quality of their account management and the quality of their industry consultants. Overall, these vendors are well positioned in the process manufacturing sector. They typically have architectures and enablers that provide a framework for evolving towards computer-integrated processing, and they have built good basic portfolios of products and services via partnerships with applications software product vendors and professional services vendors. Although the major equipment vendors are endeavouring to extend their own in-house capabilities, they are currently very dependent on professional services vendors for their implementation capability.

EXHIBIT II-16

Vendor Strategies Process Manufacturing Sector, Europe

Vendor Type	Strategy
Major equipment vendor	Account control Framework for integration Partnerships
Professional services vendors	Consultancy Systems integration License "best of breed"
Applications software product vendors	Credibility Partnerships New technology

There are indications that the potential importance of UNIX in this sector is recognised by the equipment vendors. Many of the middle ranking equipment vendors already offer UNIX-based solutions, primarily to medium-sized users, while the leading equipment vendors are likely to move to UNIX comparatively rapidly in serving this sector.

The major professional services vendors are also targeting systems integration within the large process manufacturing companies. However, they appear in many cases to have been slower than the equipment vendors in licensing products and setting up partnerships to assemble their product/service portfolios. It is important for the professional services vendors to offer high quality industry consultancy and to have access to "best of breed" applications software products.

Industry-specific production management systems for the process manufacturing sector are a comparatively recent development, and so the primary focus of the applications software product vendors must be to establish their credibility in the industry and increase market share. Partnerships can be a key factor in establishing credibility.

The complicating factor is again the decision regarding the timing of the development of UNIX-based systems. Introducing new products into new sectors using new technology is an extremely high-risk approach, but the demand for UNIX-based systems is likely to be considerable in the medium term.

Exhibit II-17 summarises vendors' views of the extent to which they need to further develop their product/service portfolios.

EXHIBIT II-17

Need To Develop Product/Service Portfolio Process Manufacturing Sector, Europe

Delivery Mode	Vendor Type		
	Equipment Vendor	Professional Services Vendors	Applications Software Product
Applications software products	Medium-High	Medium-High	Medium-High
Professional services	High	Low	Medium
Systems integration	High	Low	Medium

The major equipment vendors have assembled good basic portfolios of applications software products for the process manufacturing sector. Their approach to the sector is essentially one of providing consultancy, assisting the user to identify the most appropriate applications, and helping the company to choose "best of breed" products. This means that it is desirable to offer the user a choice of product for each application area to give the appearance, at least, of best fit to the user's individual circumstances. The vendors are also endeavouring to offer total computer-integrated processing frameworks and so ideally need to be able to offer products covering a wide range of applications. Both these factors point to a continuing high level of need for applications software products by the equipment vendors. The equipment vendors tend to favour licensing and partnerships for access to software products, but there is an increasing trend towards minority stakes and, in some cases, acquisition.

The major equipment vendors are also keen to develop their capabilities in professional services and systems integration. Initially they are becoming extensively involved in consultancy, while subcontracting the bulk of low-level implementation and application integration activity. In the U.S., IBM has formed a joint venture company—Meritus Consulting—in partnership with Coopers & Lybrand specifically to target computer-integrated manufacturing in the process manufacturing sector. Pharmaceuticals companies are seen as an area of initial emphasis.

The major professional services vendors consider themselves experts in systems integration and professional services already. However, there may be some acquisition activity to supplement existing skills where necessary. Some professional services vendors have been comparatively slow in developing their portfolios for the process manufacturing sector and still need to arrange licensing, or partnerships, providing access to “best of breed” applications software products.

Some applications software product vendors see the need to extend the scope of their offerings into professional services, though this is most likely to be achieved through collaboration. ASK’s relationship EDS is one example of a vendor moving in this direction.

H

Logistics

The business pressures that are driving process manufacturing companies to examine their logistics systems are listed in Exhibit II-18.

EXHIBIT II-18

Business Pressures—Logistics Process Manufacturing Sector, Europe

- The single European market (1993)
- Customer service is paramount
- Cost pressure

The impact of “1993” has encouraged companies to re-evaluate their presence in each of the national markets of the Economic Community. It has led to a significant number of acquisitions by organisations such as BSN, Nestlé and Unilever as they seek to dominate their chosen market sectors on a pan-European basis. As these national markets become increasingly homogeneous in terms of regulations and buying characteristics, it encourages organisations such as Nestlé to review the siting of their manufacturing and warehousing activities. In theory at least, the impact of “1993” should encourage manufacturers to rationalise their activities and concentrate both production and distribution at fewer, more efficient sites.

Customer service is especially important in the food and drinks subsector. Manufacturers are facing considerable pressure from the major retail chains for just-in-time deliveries aimed at specific time windows. There are also pressures for greater product and packaging variability.

Finally, having taken steps to reduce their manufacturing costs in recent years, manufacturers are now finding that their distribution networks are a major source of cost. The overall levels of interest in logistics systems within the key subsectors of the process manufacturing sector are identified in Exhibit II-19.

EXHIBIT II-19

Levels of Demand for Logistics Systems Process Manufacturing Sector, Europe

Subsector	Level of Demand
Food and drink	Medium
Pharmaceuticals	Low-Medium
Petrochemicals	Low

The food and drink subsector is the area of highest demand since it faces the greatest pressures from its key customers—the major retail chains.

There are three ways in which food and drink companies handle their distribution logistics:

- Outsourcing of entire distribution operation
- Direct plant shipments from factory
- Own-account distribution operations

Overall, the trend is towards a reduction in the proportion of companies using own-account distribution operations. Historically food and drink manufacturers sited their depots adjacent to the major centres of population to maintain proximity to the small retail outlets served. However, the food and drink sector is increasingly dominated—with the notable exception of Italy—by the major retail multiples that expect distribution to their own major distribution depots. This has removed the need for many manufacturers to maintain their secondary distribution networks. Indeed, some companies in the food and drink sector are evaluating the possibility of moving entirely to direct plant shipments.

However, other companies see their distribution network as a source of competitive advantage and are reviewing their logistics capability accordingly.

The major opportunities for software and services vendors within the logistics function of process manufacturing companies are identified in Exhibit II-20.

EXHIBIT II-20

Major Opportunities in Logistics Process Manufacturing Sector, Europe

- Long-term planning systems
- Warehouse management/automation
- Integration of major applications
- Provision of performance indicators

The first major opportunity area is in forecasting/scheduling software for both long-term planning—a month ahead—and short-term planning. The major impact on stock-holding costs of finished goods lies in correctly predicting customer demand. A number of software products that assist planning across multiple manufacturing and distribution sites are now available, and some manufacturers use knowledge-based software to take into account local factors influencing demand.

There are also opportunities for suppliers of warehouse management systems, and automated warehousing is being adopted for distribution-centre-to-distribution-centre operations. To improve warehouse operative efficiency, many systems incorporate radio transmission of picking lists to hand-held units. Other systems enable multiple orders to be picked simultaneously to reduce operative movement around the warehouse and thus increase efficiency.

In the past, many information systems supporting logistics operations, such as:

- forecasting and planning
- warehousing
- transport management
- customer service management

have existed as “islands of automation”. There is now a need to integrate these islands and to measure the performance of the logistics operation as a whole.

I**Key Opportunities**

The key opportunities for software and services vendors in the European process manufacturing sector are shown in Exhibit II-21. Exhibit II-22 highlights the principal applications software product opportunities.

EXHIBIT II-21

**Key Opportunities
Process Manufacturing Sector, Europe**

- Production administration software
- Professional services/consultancy
- Integration of production management and process control systems
- Improved logistics systems
- Open systems

The major opportunity in the process manufacturing sector in the short term is the growing market for production administration software, as users switch from systems developed in-house.

However, unlike in the early days of the production administration system market in the discrete manufacturing sector, where systems were installed in complete isolation, within the process manufacturing sector there is much more awareness of the need to implement production management as one component of an integrated system. The result is a greater level of commitment to open systems and UNIX, and substantial use of consultants to assist in planning the company's information systems requirements and approach.

Once the production administration systems have been implemented, the integration of these systems with supervisory control and data acquisition (SCADA) systems and process control equipment will become a major area of opportunity for software and services vendors.

Another emerging opportunity is the need for more comprehensive and better-integrated logistics support. Once the production function is under tight control, the next area for improvement in terms of increased customer responsiveness and greater efficiency is the distribution logistics function.

EXHIBIT II-22

Key Opportunities— Applications Software Products Process Manufacturing Sector, Europe

- Production management
- Quality systems
- Process operations management
- Supervisory control and data acquisition
- Decision support

Within applications software products, the major opportunity over the next few years will be for production management systems. However, there will also be high levels of demand for quality systems (particularly in-line quality monitoring), supervisory control and data acquisition (SCADA) systems, and production supervision and control systems.

Quality systems will be used to measure the composition of both raw materials and final products, and feed the results instantaneously to the process operator and the production management system. Production supervision and control systems, such as the IBM POMS product, ensure that the correct operating procedures are followed as well as enabling both the materials used and the plant operating conditions to be closely monitored.

Once large quantities of data start to become available from the shopfloor, there will be a need for some form of decision support system to prevent information overload on users.

III

European Software and Services Overview

A

European Overview

As shown in Exhibit III-1, the overall market for software and services within the European process manufacturing sector is forecast to grow strongly between 1992 and 1997. Indeed, this trend is so marked that many of the software and services vendors that have traditionally specialized in the discrete manufacturing sector are now looking to the process manufacturing sector for their short-term growth.

The figures shown in Exhibit III-1 include only end-user industry-specific revenues, which 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 and supervisory control and data acquisition (SCADA) systems.

As shown in Exhibit III-2, the process manufacturing sector is again dominated by the equipment vendors such as IBM, Siemens-Nixdorf and Digital. In particular, the process control area is a traditional strength of companies such as Bull and Digital. On the other hand, the CAD suppliers, such as Prime/Computervision and Intergraph, are ranked lower. Process plant design obviously has a significant role in this sector, but not quite the same prominence as product design in the discrete manufacturing sector. In 1990 Digital significantly increased its presence in the process manufacturing sector in Europe with the acquisition of Kienzle from the Mannesmann Group.

Many of the major professional services vendors—such as CGS and the Sema Group—figure strongly as suppliers to the process manufacturing sector. However, many of the European professional services companies have so far specialised predominantly in the discrete manufacturing sector and have had little involvement with the process manufacturing sector. In

contrast, one vendor with a greater emphasis on the process manufacturing sector is EDS-Scicon, together with its subsidiary EDS-GFI. Logica is another professional services vendor with a strong background in the process manufacturing sector.

Until 1990, spending on software products—apart from corporate accounting systems—had been quite low in this sector. However, applications software product vendors are now starting to focus on process manufacturing industry as packages have become more important to users.

EXHIBIT III-1

Software and Services Market Forecast 1992-1997 Process Manufacturing Sector, Europe

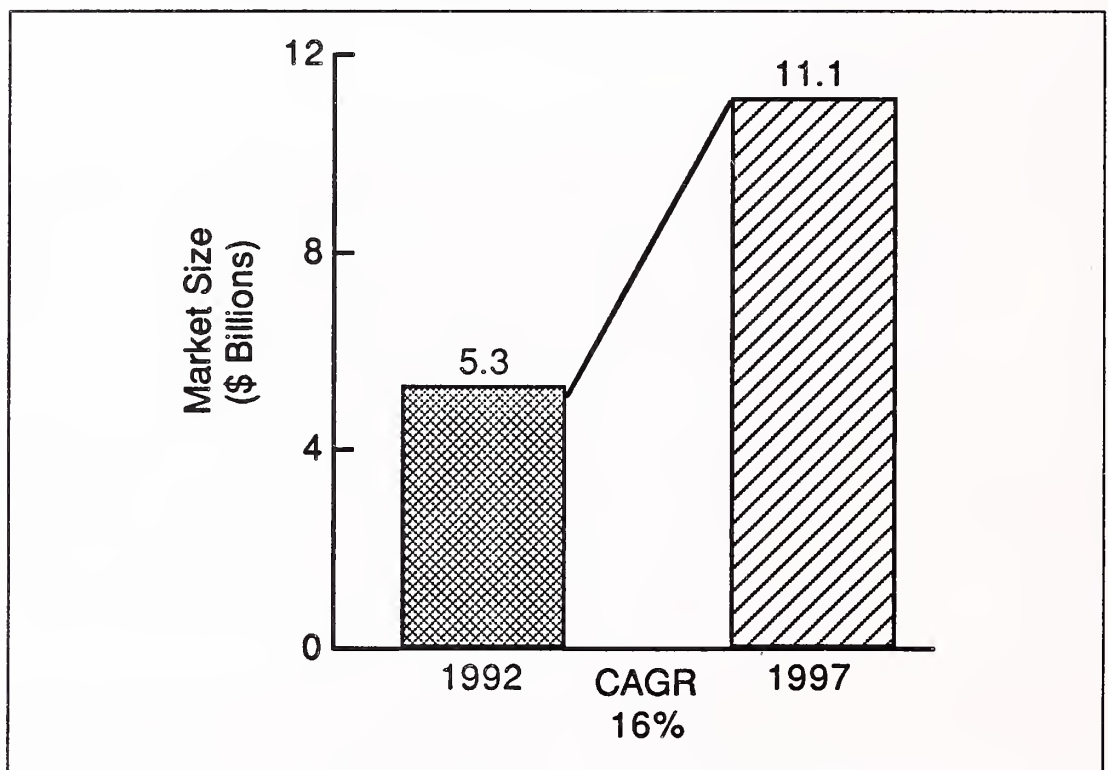


EXHIBIT III-2

Leading Software and Services Vendors Process Manufacturing Sector Europe, 1991

Rank	Vendor	Country of Origin	Estimated Sector Revenues (\$ Millions)	Market Share (Percent)
1	IBM	U.S.	225	4.8
2	CAP Gemini Sogeti	France	135	2.9
3	Siemens-Nixdorf	Germany	135	2.9
4	EDS	U.S.	130	2.8
5	Digital	U.S.	90	1.9
6	Microsoft	U.S.	85	1.8
7	Sema Group	France	70	1.5
8	Prime	U.S.	65	1.4
9	Olivetti	Italy	60	1.3
10	SAP	Germany	60	1.3
	Total Listed*		1,055	22.7
	Total Market		4,650	100.0

* Totals may not add due to rounding.

B

Key Industries

Exhibit III-3 shows the main subsectors that the process manufacturing industry comprises. The three principal subsectors are:

- food and beverages
- chemical industry (including pharmaceuticals)
- oil and gas production

The European food and beverages industry is very heterogeneous and is characterised by the fact that comparatively few products are marketed at long distances. Consequently, Unilever and Nestlé, which are the leaders in this subsector in Western Europe, both have in excess of 200 processing plants in Europe.

As in other industries, there is considerable refocusing going on within the sector, resulting in high levels of merger and acquisition activity. Two of the major trends in the food sector are the increasing demand for highly processed foods and the increasing variety of product required to maintain

consumer interest. Both of these trends point to a need for greater control of the manufacturing process.

Another very important trend in the food sector is the increasing strength of the major retail distributors compared to the manufacturers. The leading supermarket chains play a key role in the United Kingdom, while purchasing co-operatives are now in a strong position in Germany and France. One worrying aspect from the manufacturers' perspective is the increasing market share being taken by retailers' own brands, for example, Carrefour in France.

The major trend in the chemicals sector over the past decade has been the desire by many of the leading chemical companies across Europe to move downstream and concentrate on the more specialised and lucrative value-added product areas such as paints and pharmaceuticals.

Indeed, just as the period of oversupply in basic chemicals in Europe seemed to be coming to an end, the Gulf War adversely affected the petrochemical sector. This, coupled with the widespread recession, has led to a number of announcements of plant rationalisation and investment cutbacks by leading companies such as ICI and BASF.

Another trend in the chemical sector is a substantial move towards safety and environmental protection. The United Kingdom was initially thought to be lagging in this respect, but ICI towards the end of 1990 made a major policy statement aimed at significantly reducing the levels of waste product from its plants worldwide.

The pharmaceuticals sector invests a high proportion of its revenues, nearly 15%, in R&D, and is understandably concerned with maximising the returns from any new drugs before patent protection expires. In addition, the European chemical companies are facing increasing competition from U.S. and Japanese competitors, and are facing ever-increasing pressure from cost containment, typically via generic substitutes, from government departments alarmed at their increasing health care costs.

EXHIBIT III-3

Production by Subsector—Process Manufacturing Sector Europe, 1991

Subsector	Proportion of Western European Process Manufacturing Sector Production (%)
Food and drink	30
Chemicals industry	22
Oil and gas	11
Metal production and processing	10
Rubber and plastics	7
Non-metallic mineral products	7
Paper and paper products	5
Tobacco	3
All others	5

Total Production = ECU 1,500 Billion (\$2,000 Billion)

Source: INPUT Estimate, EEC

A number of software and services vendors, each with a significant presence in the process manufacturing sector, were asked to rate the growth prospects for each of the major industrial subsectors. The results are shown in Exhibit III-4.

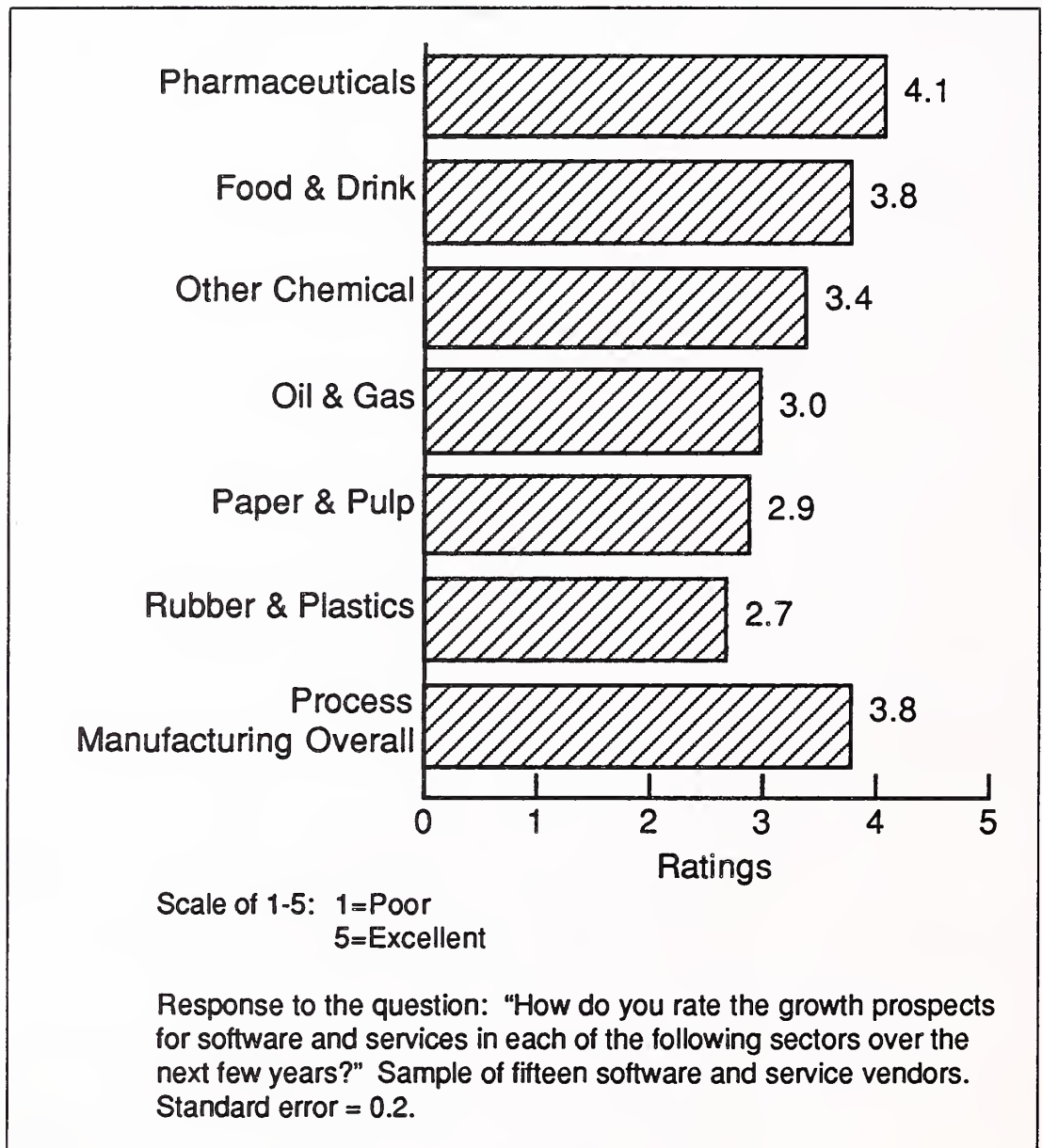
The overwhelming conclusion was that the overall process manufacturing sector was now a very promising sector to target. This view was particularly pronounced among the equipment vendors and applications software product vendors. The latter group, in particular, had been increasingly finding the discrete manufacturing sector a difficult market in 1990 and 1991, and have been turning their attention towards the process manufacturing sector.

Within the process manufacturing sector, the pharmaceuticals and food and beverages subsectors were rated most highly. However, while the pharmaceuticals sector was regarded uniformly well by all categories of vendors, professional services vendors showed markedly less enthusiasm

for the food and beverages sector than did the applications software product and equipment vendors. Some professional services vendors felt that while the food industry is tending to use third parties more than in the past, the sector is still very fragmented and difficult to penetrate.

EXHIBIT III-4

Growth Prospects by Subsector



IV Country Forecasts

A Overview

The relationships between the national markets for software and services in the process manufacturing sector show a number of contrasts from those of the discrete manufacturing sector.

Firstly, the largest national market is France rather than Germany. Secondly, while Germany is the fastest growing national market and is expected to ultimately become the largest market in Europe, growth rates are expected to be less polarised in the process manufacturing sector, as shown in Exhibit IV-1, than was the case in the discrete manufacturing sector. This is largely because the major subsectors contributing to growth in the software and services market—such as pharmaceuticals and food and beverages—are comparatively recession-proof. In addition, the United Kingdom, which is showing the worst signs of recession, has less dependence on upstream petrochemicals than France and Italy.

The software and services revenues shown for each of the countries in the following sections include industry-specific revenues only. This means that in the software products delivery mode, for example, revenues for systems software and cross-industry applications software products are excluded from the figures shown.

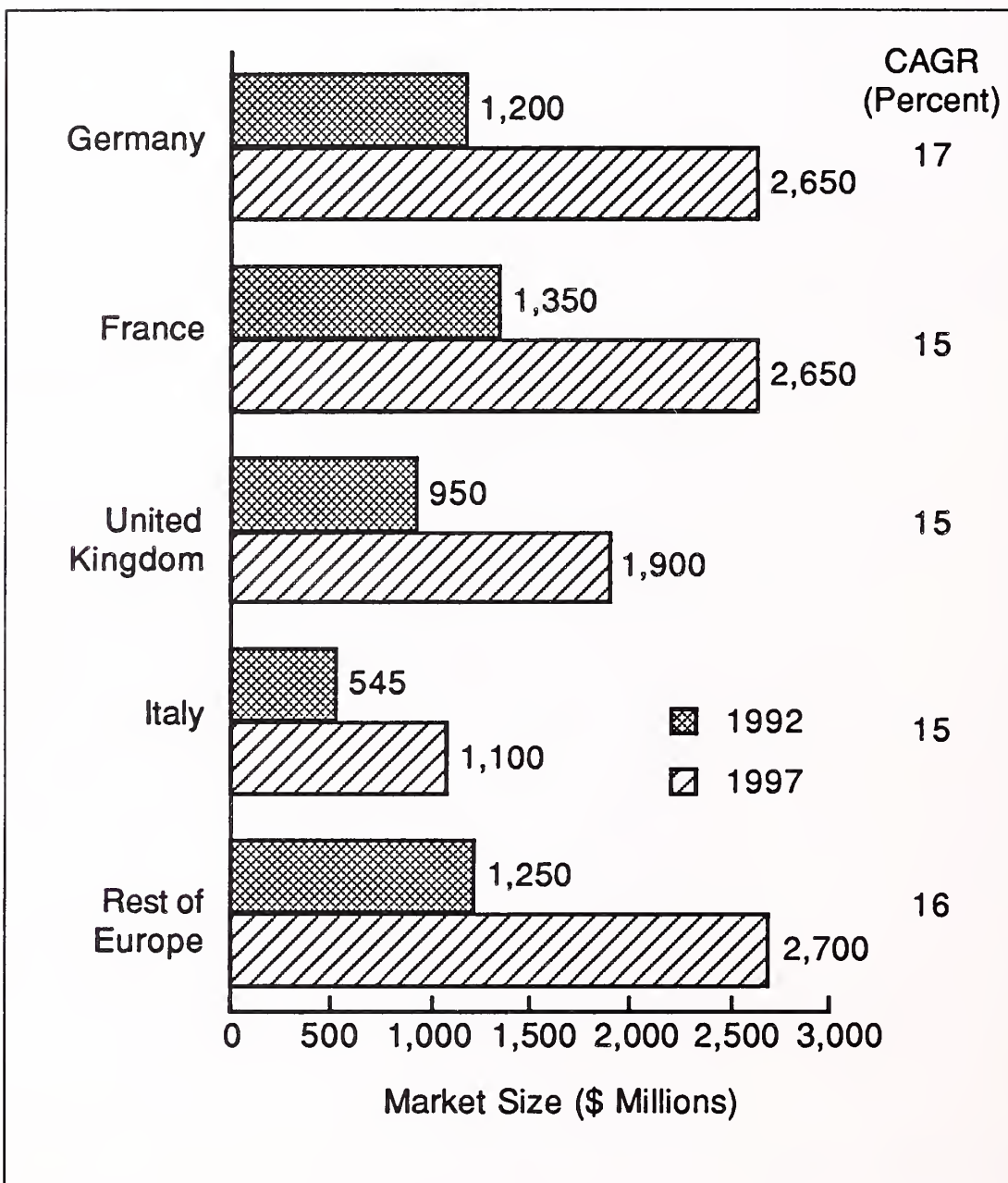
B Germany

The chemical industry in Germany is very strong and accounts for 28% of total production by value within the European Community. The three leading chemical companies in Europe—BASF, Hoechst and Bayer—are all German in origin. However, while these companies have been increasing their emphasis on speciality chemicals, they are still comparatively heavily

involved in basic chemical production and have typically shown a downturn in profitability in 1990 and 1991 influenced by the increase in oil prices.

EXHIBIT IV-1

Software and Services Market Forecast by Country, 1992-1997 Process Manufacturing Sector, Europe



Companies such as these are already pan-European, if not global, in outlook with many plants scattered around Europe and have an increasing need to co-ordinate their plants via common administrative systems.

However, the take-up of packaged production management systems is likely to start later in Germany than in the United Kingdom, where the process is strongly underway. As a result, a number of non-indigenous software product vendors perceive a much lower level of domestic competition in the process manufacturing sector than in the German discrete manufacturing sector and are hoping to meet with more success in this sector. However, the indigenous vendors, such as SAP, can be expected to give full attention to marketing versions of their products tailored to the needs of the process manufacturing sector.

The market forecast for software and services in the German process manufacturing sector is provided by delivery mode in Exhibit IV-2. High growth rates are forecast for software products in Germany over the period 1992-1997 as the move to production management systems especially designed for the process manufacturing sector gets underway and users come to accept packaged solutions in this area.

Growth in professional services and systems integration will follow later in the forecast period as users start to integrate these systems with other functions.

Another significant trend in Germany is the importance now being attached to environmental considerations, with the chemical industry, especially in the former East Germany, potentially one of the prime offenders.

EXHIBIT IV-2

**Software and Services Market
Process Manufacturing, Germany
(DM Millions)**

Delivery Mode	1991	'91-'92 AGR (%)	1992	'92-'97 CAGR (%)	1997
Transaction Processing	115	4	120	7	165
Turnkey Systems	500	10	550	14	1,050
Applications Software Products	280	18	330	18	750
Professional Services	490	16	570	17	1,250
Network Services	80	25	100	28	350
Systems Operations	30	17	35	19	85
Systems Integration	95	21	115	22	310
Industry Sector Total*	1,600	14	1,820	17	4,000

* May not compute due to rounding.

EXHIBIT IV-3

**Leading Software and Services Vendors
Process Manufacturing Sector
Germany, 1991**

Rank	Vendor	Country of Origin	Estimated Sector Revenues (DM Millions)	Market Share* (Percent)
1	Siemens-Nixdorf	Germany	135	8.4
2	IBM	U.S.	80	4.9
3	Compunet Computer	Germany	70	4.4
4	SAP	Germany	60	3.6
5	Digital	U.S.	40	2.6
6	Debis Systemhaus	Germany	40	2.5
7	PSI	Germany	35	2.2
8	mbp	Germany	30	1.9
9	Intergraph	U.S.	25	1.7
10	Prime	U.S.	25	1.7
	Total Listed*		540	33.8
	Total Market		1,600	100.0

* May not compute due to rounding.

The leading software and services vendors in the process manufacturing sector in Germany are shown in Exhibit IV-3. The German equipment vendors such as Siemens-Nixdorf are again important players in the process manufacturing sector. For example, Datarat Systemberatung, a subsidiary of SNI, offers a system for the chemical and pharmaceutical industries based around Nixdorf's Comet product. The system is offered in five languages and is available under UNIX. It is probable that UNIX-based applications software products will meet with more rapid acceptance in the process manufacturing sector than has been the case so far in the discrete manufacturing sector, with the exception of CAD systems.

In 1990 Digital acquired Kienzle from the Mannesmann Group, which strengthened the company's position in a number of vertical markets throughout Germany.

While SAP will undoubtedly be a formidable competitor in the process manufacturing sector, the company is lagging slightly in the development of process industry-specific software and is consequently appearing more vulnerable than in the discrete manufacturing sector.

In 1990 Intergraph, which is very successful in Germany, opened an office in East Germany to offer systems specifically for the process manufacturing sector.

C France

France has two state-controlled oil groups in Total and Elf Aquitaine, both of which are attempting to move their activities further downstream into high value-added products. Elf is moving strongly into chemicals and pharmaceuticals while Total is still much more dependent on its exploration, production and refining activities.

In the chemicals sector, the major French company is Rhone-Poulenc, which has had problems in its traditional sectors such as synthetic fibres, but is now increasingly focusing on its agrochemical and pharmaceutical interests.

In the food sector, BSN is the third largest European food company. Over the past few years, the company has had an aggressive acquisition strategy in Europe—acquiring, for example, the HP and Lea & Perrins sauce businesses in the U.K. and the Italian pasta producers Panzani, Agnesi and Ponte.

The market forecast for software and services within the process manufacturing sector in France is shown by delivery mode in Exhibit IV-4. Exhibit IV-5 identifies the principal software and services vendors.

EXHIBIT IV-4

Software and Services Market Process Manufacturing, France (FF Millions)

Delivery Mode	1991	'91-'92 AGR (%)	1992	'92-'97 CAGR (%)	1997
Transaction Processing	470	4	490	2	550
Turnkey Systems	1,260	11	1,400	18	3,200
Applications Software					
Products	790	18	930	17	2,000
Professional Services	2,210	13	2,500	10	4,000
Network Services	500	20	600	22	1,600
Systems Operations	690	22	840	19	2,000
Systems Integration	140	21	170	21	450
Industry Sector Total*	6,050	15	6,950	15	13,800

* May not compute due to rounding.

EXHIBIT IV-5

**Leading Software and Services Vendors
Process Manufacturing Sector
France, 1991**

Rank	Vendor	Country of Origin	Estimated Sector Revenues (FF Millions)	Market Share (Percent)
1	CAP Gemini Sogeti	France	335	5.5
2	EDS-GFI	U.S.	280	4.6
3	IBM	U.S.	210	3.5
4	Alcatel TiTN	France	190	3.1
5	AT&T Dataid	France	190	3.1
6	Syseca	France	165	2.7
7	Sema Group	France	150	2.5
8	Sligos	France	140	2.3
9	CISI	France	140	2.3
10	Bull	France	125	2.1
	Total Listed		1,925	31.8
	Total Market		6,050	100.0

The leading vendors in the process manufacturing sector in France are the major professional services vendors such as Sligos and CAP Gemini together with the process manufacturing specialists GFI.

The equipment vendors IBM and Bull also have a significant interest in the process manufacturing sector and can be expected to become a major competitive threat to the professional services vendors over the next few years, as they appear to have more advanced product portfolios for the process manufacturing sector.

D**United Kingdom**

Manufacturing industry in the United Kingdom is currently feeling the severe impact of the recession and, in some subsectors such as petrochemicals, the process manufacturing industry is no exception. For example, ICI has instructed its business units to cut costs and has cut £100 million from the company's 1991 capital expenditure programme as part of a two-year "belt-tightening" period. Similarly, Exxon Chemicals is forecasting slower growth in basic chemicals and halted work on construction of a £235 million ethylene plant in Scotland.

However, the food and drink industry remains strong and is largely regarded as recession-proof, while the United Kingdom is also strong in pharmaceuticals, which has similar characteristics.

So overall, the process manufacturing sector has been less badly affected by the recession than the discrete manufacturing sector, with only the petrochemicals sector showing real signs of distress and food and pharmaceuticals showing some resilience to the recession. Accordingly, a comparatively high annual average growth rate is forecast for the U.K. process manufacturing sector, as shown in the market forecast provided in Exhibit IV-6. The leading vendors in the sector are shown in Exhibit IV-7.

EXHIBIT IV-6

**Software and Services Market
Process Manufacturing, United Kingdom
(PS Millions)**

Delivery Mode	1991	'91-'92 AGR (%)	1992	'92-'97 CAGR (%)	1997
Transaction Processing	25	0	25	3	29
Turnkey Systems	110	9	120	12	215
Applications Software Products	66	14	75	17	165
Professional Services	110	9	120	13	220
Network Services	40	13	45	17	100
Systems Operations	59	19	70	20	177
Systems Integration	33	15	38	19	92
Industry Sector Total	*445	11	495	15	1,000

* May not compute due to rounding.

EXHIBIT IV-7

**Leading Software and Services Vendors
Process Manufacturing Sector
U.K., 1991**

Rank	Vendor	Country of Origin	Sector Revenues (PS Millions)	Estimated Market Share (Percent)
1	EDS-Scicon	U.S.	28	6.3
2	AT&T Istel	U.S.	22	4.9
3	Hoskyns (CGS)	U.K. (F)	20	4.5
4	IBM	U.S.	18	4.0
5	Sema Group	France	13	3.0
6	Logica	U.K.	13	2.9
7	McDonnell Douglas	U.S.	10	2.4
8	Centre-file	U.K.	10	2.2
9	Digital	U.S.	8	1.7
10	Microsoft	U.S.	7	1.6
	Total Listed*		149	33.6
	Total Market		445	100.0

* May not compute due to rounding.

In the United Kingdom, there are a number of professional services vendors that have traditional strengths in the process manufacturing sector, frequently arising from their involvement on projects relating to oil and gas production in the North Sea. Examples include EDS-Scicon and Logica. More recently, AT&T Istel has diversified from its origins in the discrete manufacturing sector and successfully assembled a portfolio of products and services for the process manufacturing sector.

IBM has also been aggressive in the U.K., where it conducted the first European launch of its Process Operations Management System (POMS) during 1990. The system is reported to have received a good reception and the initial implementations are underway.

The United Kingdom tends to be the European testing ground for the U.S. applications software product vendors, and so is ahead of the other major European countries in the acceptance of production management software products specifically designed for the process manufacturing sector.

E**Italy**

During 1990, the Italian chemicals sector was dominated by the controversy over the ownership of Enimont. Enimont is a joint venture between ENI—the state petrochemicals company—and Montedison, and accounts for 35% of output from the Italian chemicals sector.

The bulk of the company's production and sales occur in Italy, at a time when presence in Far Eastern markets is perceived as having growing importance. The company is also heavily dependent on basic chemicals and other low value-added product areas such as bulk plastics and acrylic fibres. Accordingly, the company has a strong need to move its product lines further downstream and to diversify into foreign markets.

Pirelli, the Italian tyres company, is also trying to establish a stronger European position. Recently this included a hostile takeover bid for the Germany company, Continental.

The market forecast for software and services within the process manufacturing sector in Italy is shown by delivery mode in Exhibit IV-8. The leading vendors in the sector are shown in Exhibit IV-9.

The Italian market for software and services in the process manufacturing sector is still relatively underdeveloped and is dominated by the equipment manufacturers: IBM, Olivetti, Bull, and Unisys together with a group of professional services vendors led by Finsiel and CAP Gemini.

Sime is a subsidiary of Enimont and the bulk of its services comprise the provision of information systems to its parent company and fellow subsidiaries.

EXHIBIT IV-8

Software and Services Market Process Manufacturing, Italy (Lira Billions)

Delivery Mode	1991	'91-'92 AGR (%)	1992	'92-'97 CAGR (%)	1997
Transaction Processing	42	5	44	7	62
Turnkey Systems	125	8	135	10	220
Applications Software Products	110	18	130	18	300
Professional Services	200	13	225	13	415
Network Services	42	19	50	23	140
Systems Operations	25	20	30	21	77
Systems Integration	8	25	10	21	26
Industry Sector Total	*550	14	625	15	1,250

* May not compute due to rounding.

EXHIBIT IV-9

Leading Software and Services Vendors Process Manufacturing Sector Italy, 1991

Rank	Vendor	Country of Origin	Estimated Sector Revenues (Lira Billions)	Market Share (Percent)
1	IBM	U.S.	40	7.3
2	Olivetti	Italy	40	7.3
3	Finsiel	Italy	25	4.5
4	Microsoft	U.S.	10	1.8
5	Cerved	Italy	10	1.8
6	Siemens-Nixdorf	Germany	10	1.8
7	Sicit	Italy	10	1.8
8	Syntax	Italy	10	1.8
9	Bull	France	10	1.8
10	Computer Associates	U.S.	10	1.8
	Total Listed*		175	31.8
	Total Market		550	100.0

* May not compute due to rounding.

V

Key Delivery Modes

A

Overview

The process manufacturing sector is forecast to show a comparatively high level of growth between 1992 and 1997. This growth is being fuelled by the sector's sudden recognition of a need for improved production management systems and the resulting purchase of packaged software, and, in the longer term, the desire to integrate these systems with process control applications. This will lead to a levelling out of growth rates between the various delivery modes, as shown in Exhibit V-1, with turnkey systems and applications software products showing an initial burst of activity followed subsequently by increased growth in professional services and systems integration.

Systems operations will also show substantial growth, influenced by increasing cost pressures on companies and by possibly dramatic changes in applications and the technology on which these applications are based.

At the moment, electronic data interchange can be expected to show appreciably lower levels of growth in the process manufacturing sector compared to the discrete manufacturing sector.

B

Software Products

Only revenues from industry-specific applications software products are included in INPUT's forecasts for the process manufacturing sector. Revenues from systems software and cross-industry applications are excluded.

EXHIBIT V-1

**Software and Services Market
Process Manufacturing, Europe
(U.S. Dollars Millions)**

Delivery Mode	1991	'91-'92 AGR (%)	1992	'92-'97 CAGR (%)	1997
Transaction Processing	330	3	340	5	430
Turnkey Systems	1,170	10	1,290	14	2,510
Applications					
Software Products	730	18	860	17	1,920
Professional Services	1,490	13	1,690	14	3,310
Network Services	340	21	410	22	1,120
Systems Operations	380	20	455	21	1,170
Systems Integration	210	19	250	21	645
Industry Sector Total*	4,650	14	5,300	16	11,100

* May not compute due to rounding.

Typical industry-specific applications for the process manufacturing sector include:

- Production management
- Supervisory control and data acquisition (SCADA)
- Shopfloor data capture for manual input and time and attendance recording
- Quality systems
- Maintenance management
- Production supervision and control
- Transport management

These applications are delivered via both turnkey system and applications software product delivery modes, with applications such as SCADA and production supervision and control tending towards the turnkey end of the spectrum.

Exhibits V-2 and V-3 show users' and vendors' perceptions of some of the leading trends in software products. A major overall trend is the significant shift to the use of standard software packages reported by both users and vendors.

This shift is particularly true in the case of production management systems. Until 1990, the majority of production management systems used in the process manufacturing sector were developed in-house by users and few of the software product vendors that served the discrete manufacturing sector had appropriate products for the process manufacturing sector.

The considerable growth taking place in the process manufacturing sector is clear from both the users' perspective shown in Exhibit V-2 and the vendors' viewpoint shown in Exhibit V-3. However, on the vendor side, the level of increasing demand varies quite noticeably by vendor category, as shown in Exhibit V-4, with professional services vendors showing considerably lower levels of expectation than either applications software product vendors or equipment vendors, which suggests that the latter categories may be proving the more successful distribution channels at the present time.

EXHIBIT V-2

Software Product Trends—User Perception Process Manufacturing Sector, Europe

Trend	User Rating Profile				
	1	2	3	4	5
Increasing reliance on packages	-	-	-	2	3
Implementation of production management systems	-	-	-	1	4
Standardised systems across each factory	-	-	2	1	2
UNIX-based systems at production management level	1	1	-	1	1
Distributed production management systems	2	-	-	1	1

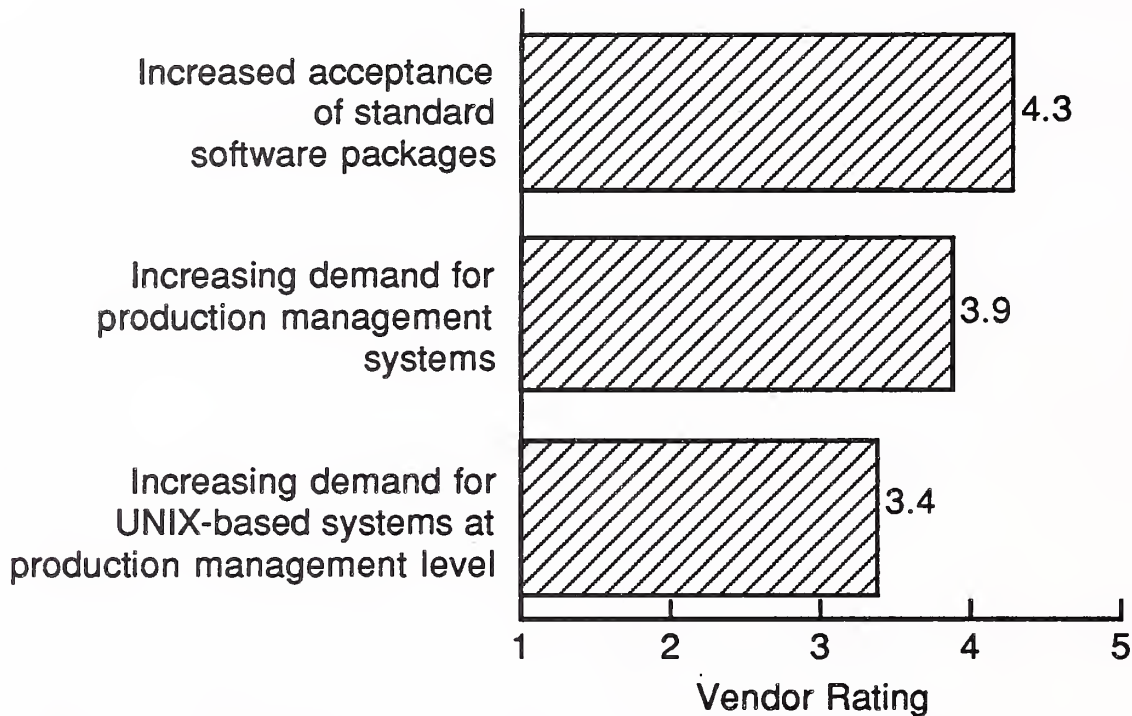
Scale of 1-5: 1 = Not At All Likely, 5 = Very Likely

Likelihood of adoption of trend.

Sample of five process manufacturing companies.

EXHIBIT V-3

Software Product Trends—Vendor Perception Process Manufacturing Sector, Europe



Scale 1-5: 1 = Not at all
5 = Very substantially

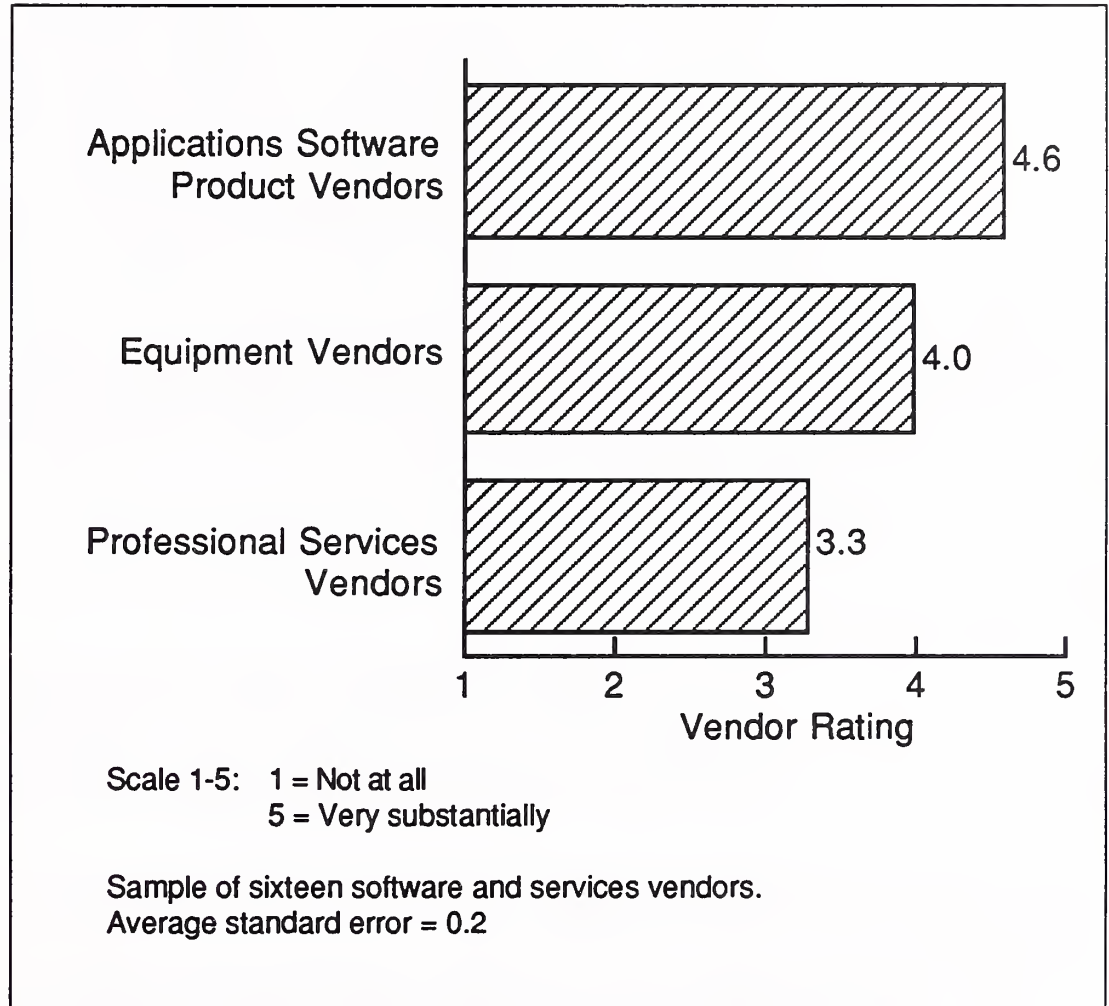
Response to question: "To what extent do you believe the following trends are taking place in the Western European process manufacturing sector?" Sample of sixteen software and services vendors. Average standard error = 0.2

However, a significant number of products launched have been specifically designed for the process manufacturing sector. This is particularly true in the United Kingdom where the leading U.S. production management vendors, such as ASK, have been at the forefront of these announcements. It has also become apparent that the majority of the traditional production management product vendors will endeavour to enter the process manufacturing sector.

This means that the battle for market share has now commenced in earnest. Few products have an established installed base in the process manufacturing sector at the present time.

EXHIBIT V-4

Expectation of Increasing Demand for Production Management Systems by Vendor Category



A further level of complexity is added to the marketing and support of these products since a number of them will be launched under UNIX. There is a high level of support for open systems and UNIX within the process manufacturing sector at the production management level, as shown by Exhibits V-2 and V-3. Within the larger companies in the industry, there appears to be a much stronger drive to UNIX in the medium term than is apparent in the discrete manufacturing sector.

However, while there are exceptions, on the whole, vendors offering AS/400-based production management systems for the process manufacturing sector are not yet moving to offer UNIX-based versions of their products.

At present, many companies are installing production management systems on a centralised basis. However, this will gradually change as distributed

systems become proven products. Many users have a longer term desire to move to a more decentralised approach.

Quality systems are another very important application in the process manufacturing sector because of the need for lot traceability. It is important to be able to identify any product discrepancies and the reasons why these occurred. Accordingly, there is a high level of demand for laboratory information management systems or in-line quality testing. Such systems analyse the quality of both raw materials and finished product and feed the results to both the process operator and the production management system. The logging of process operating parameters such as temperature and pressure for each batch of product is important in ensuring that the process is operating within the preferred range and in improving product yields.

Maintenance management systems, although important for plant efficiency and safety, are extensively used in the process manufacturing sector at present and are not expected to be a significant growth area over the next few years.

C

Turnkey Systems

Supervisory control and data acquisition (SCADA) systems that link directly to the plant process controllers are obviously instrumental in collecting data from the plant. This data can then be fed into mimic displays for plant operators and into higher level applications.

The benefits of SCADA in providing traceability are illustrated by the following quotation from a medium-sized food processing company:

“Phase 2 will be a SCADA system capturing data from the processing equipment to link into the IBM AS/400 database. So if, for example, a bag of crisps is returned with a complaint, we will be able to detect what materials were used; where they came from and when they were delivered and used; what happened to the machinery during the course of production; and where other items from that batch were delivered. This will give us full traceability of every bag of product”.

One recent innovation, introduced by IBM in 1990, is their Process Operations Management System (POMS). This application resides between the SCADA and production management systems. POMS is a production supervision and control product, and its principal purpose is to ensure that best practice is carried out by process operators, leading to the production of consistently high-quality product. The main functions of POMS are:

- Enabling production supervisors to work to a defined production schedule with full knowledge of the plant status at all times

- Providing the process operators with detailed instructions of the process steps to be followed
- Ensuring that process supervision is carried out
- Recording details of the materials used
- Logging details of the plant used and its operating parameters for each batch
- Updating inventory records

IBM POMS is reported to have received a good reception since its European launch. It was first launched in Europe in the United Kingdom in March 1990 with subsequent roll-out to the other major countries six months later. POMS was initially developed by IBM and INCODE in the U.S. utilising a consortium including Campbell's Soup, Johnson & Johnson, Nestlé Foods, Ralston Purina and Smith Kline Beecham. The first installations in the United Kingdom are now underway with the implementation work being carried out by Logica.

CAD also has a role to play in the process manufacturing sector in the design and ongoing maintenance of process plants.

D

Professional Services

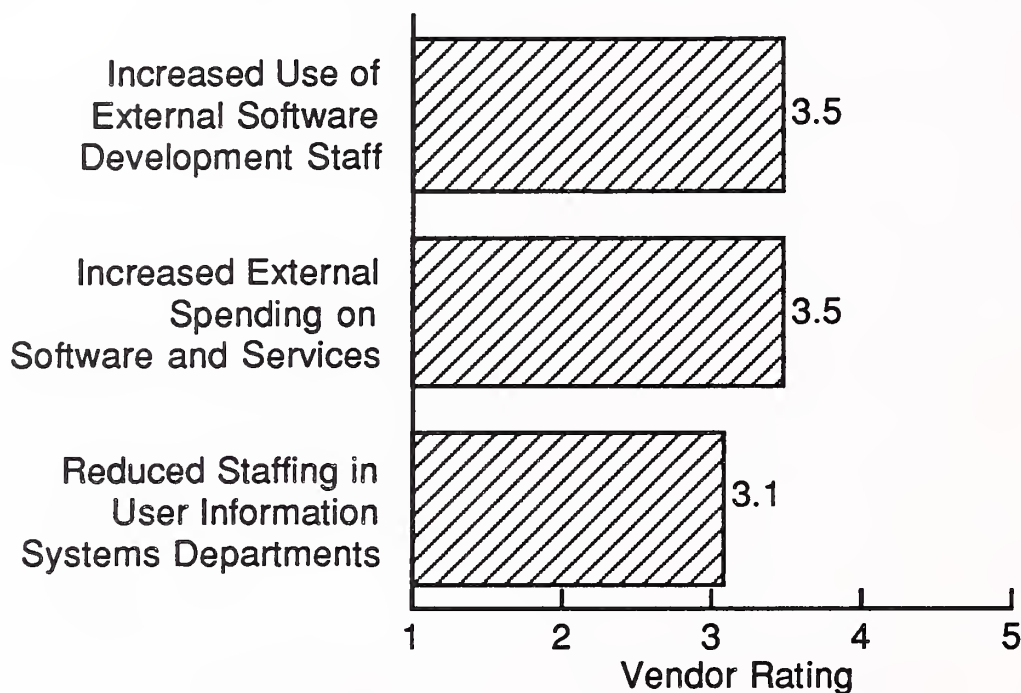
Users within the process manufacturing sector reported increasingly using third parties both for consultancy to help them establish their information systems plans and direction and for implementation and integration of their various applications. At the same time, some users are reporting some reduction in the levels of in-house information systems development staff. On the other hand, some users still felt that any integration should be carried out in-house, since vendors were unlikely to understand the complexity of their plants.

The views of vendors are summarized in Exhibit V-5. Vendors clearly anticipate increased use of their professional services personnel and a degree of reduced staffing in user information systems departments.

However, the largest increases in external spending in the short term are likely to be for applications software products rather than professional services, with the professional services companies again showing a lower rating (3.2) than the other categories of vendors on this criterion.

EXHIBIT V-5

Professional Services Trends—Vendor Perception Process Manufacturing Sector, Europe



Scale 1-5: 1 = Not at all
5 = Very substantially

Response to question: "To what extent to you believe the following trends are taking place in the Western European process manufacturing sector?"

Sample of sixteen software and services vendors.

Average standard error = 0.2

E

Systems Integration

Exhibit V-6 shows the integration plans expressed by users. Users are undoubtedly moving towards greater degrees of integration, and while some users are already integrating their systems, a typical large user in the process manufacturing sector is expecting to link the production management systems to the plant process control within the next one to five years. Correspondingly, users anticipate that their expenditure on the integration of systems will increase over the next few years.

As is the case in the discrete manufacturing sector, much of the integration work carried out will be merely linking together existing components rather than large-scale systems integration projects.

EXHIBIT V-6

User Integration Plans Process Manufacturing Sector, Europe

Area of Integration	User Profile				
	Not at All Likely		Very Likely		
	1	2	3	4	5
Full Computer-Integrated Manufacturing	-	1	-	2	2
Integration of Production Management and SCADA Systems	-	-	1	2	2

Likelihood of adoption of level of integration shown.
Sample of five process manufacturing companies.

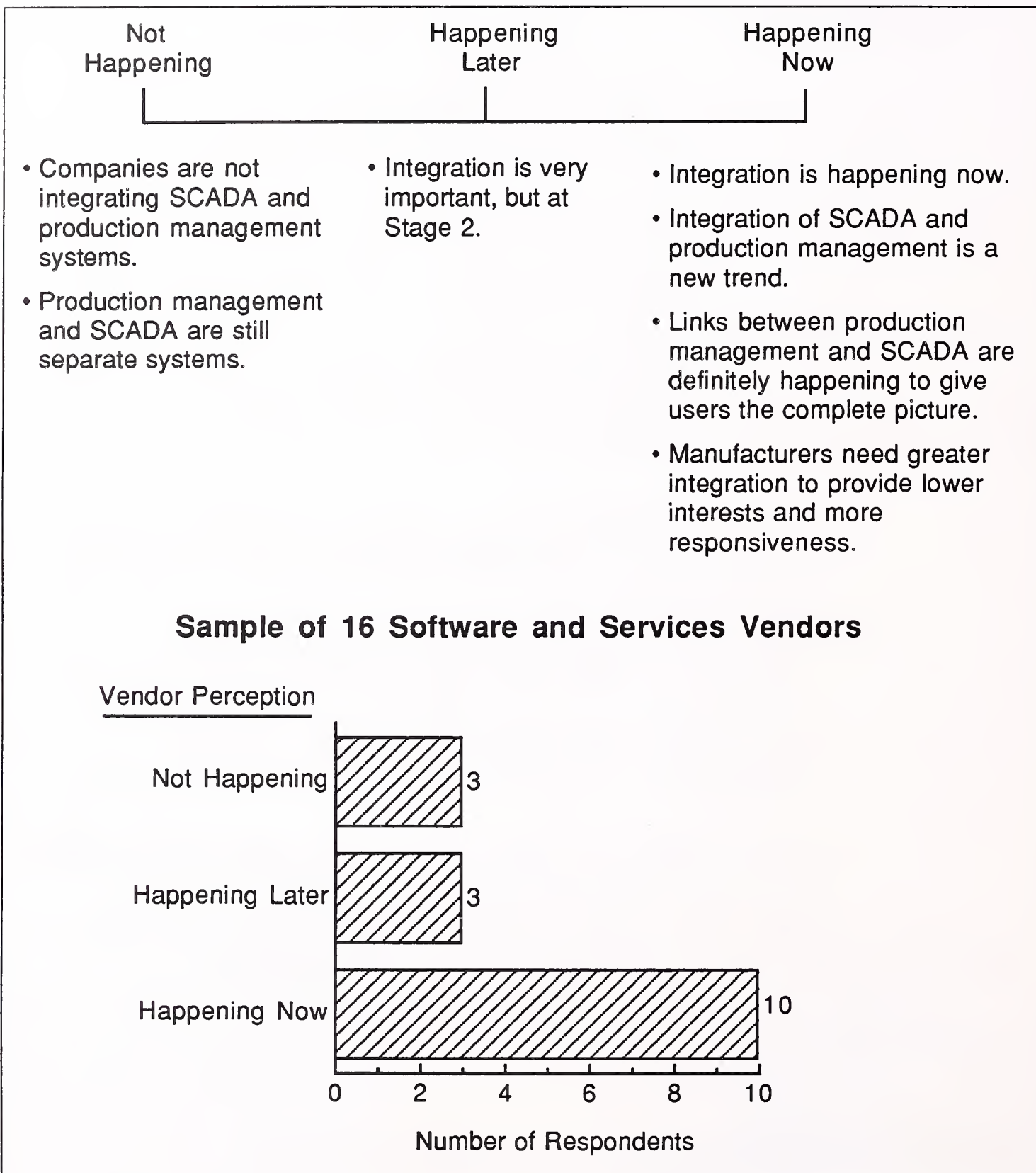
Exhibit V-7 shows that in the contrast to the users that believe integration of SCADA and production management systems will not take place for several years, the majority of vendors believe integration projects are already taking place to a significant extent.

Several vendors stressed the importance of integration in “giving users the complete picture”. Prior to integration, users often plan their production for the following day, but only know if the plan was achieved several days later. Given the demands being placed on the sector for greater responsiveness, this is becoming an inadequate basis on which to manage the business.

One of the challenges for vendors in achieving integration between process control equipment and administrative systems is the variety, and in some instances, the antiquity of existing process control equipment. However, some users are showing an awareness of the need to replace some of their older process control equipment prior to attempting integration.

EXHIBIT V-7

Timing of Integration of SCADA and Production Management Systems—Vendor Perception



One example of a systems integration project in the process manufacturing sector is the factory management and plant control system implemented by Logica for Dunlop at its rubber-mixing mill in Manchester (U.K.). The system is based on a network of Digital minicomputers and comprises capabilities for:

- Production control, including formulation development, capacity planning and production scheduling
- Quality control of raw materials and finished compounds
- Plant performance analysis
- Progress and quality control reporting
- Prompting and monitoring of shopfloor operatives
- Direct control of plant according to schedule

There are high levels of activity by the major equipment vendors such as IBM and Digital in consulting with user management and taking the lead in initiating systems integration projects.

In the U.S., IBM established a joint venture with Coopers & Lybrand specifically to target computer-integrated manufacturing. Subsectors such as pharmaceuticals within the process manufacturing sector are among the initial target markets. This move emphasizes the importance of consulting activities aimed at user top management in generating systems integration projects.

F

Network Services

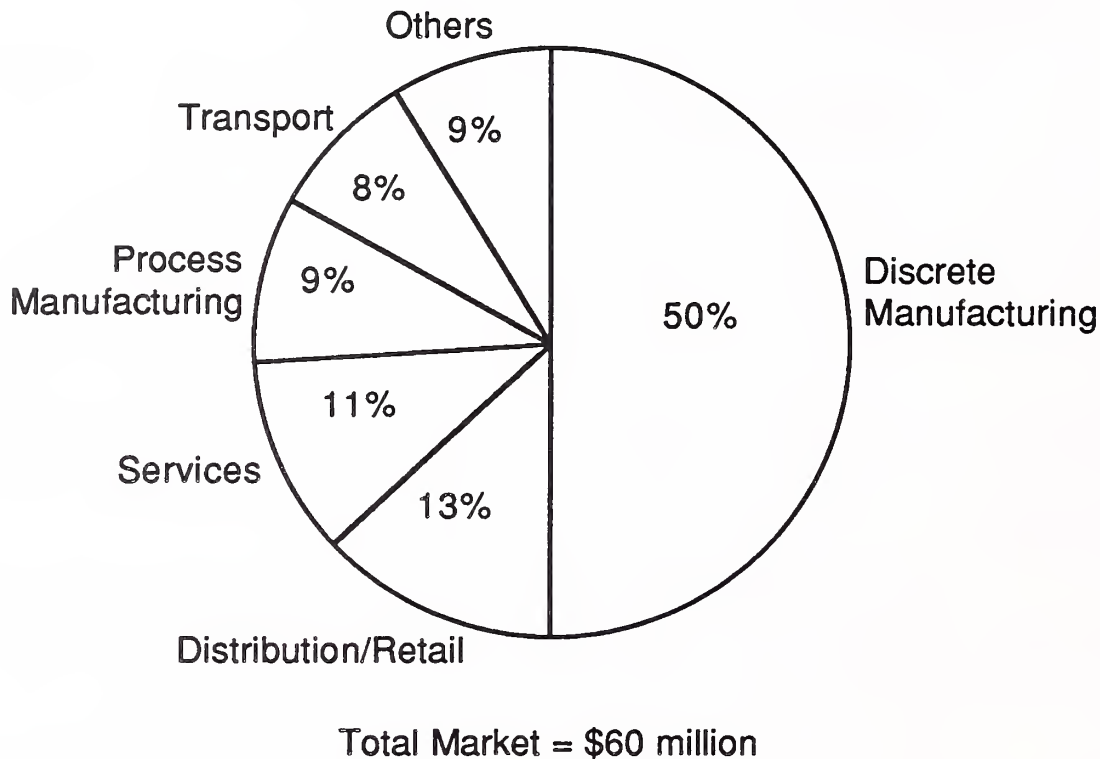
Exhibit V-8 shows the comparatively low levels of take-up of electronic data interchange in the process manufacturing sector compared to the discrete manufacturing sector.

In the discrete manufacturing sector, the use of electronic data interchange is frequently driven by the major manufacturers and their need to establish links with their key suppliers as a prerequisite to the use of just-in-time techniques.

In the process manufacturing sector, this need is not the case. The principal drivers of the use of electronic data interchange are the large retailers, such as the major supermarket chains.

EXHIBIT V-8

European EDI Markets by Vertical Sector, 1991



Indeed, there is a significant divergence between the views of users and those of vendors on the subject of electronic data interchange, as shown in Exhibit V-9.

Vendors attached a significantly higher level of importance to electronic data interchange than did users. Indeed, one user that had implemented EDI links with a number of major supermarket chains commented that even in this instance, usage had not yet grown as expected.

Vendors also believed that links to customers and links to suppliers were approximately equal in importance, while users tended to view links to customers as much more important than links to suppliers.

Taking the users' view, growth of electronic data interchange in the process manufacturing sector is forecast to continue to be much lower than in the discrete manufacturing sector. The key area of opportunity in the process manufacturing sector is forecast to be in establishing links between manufacturers and the major retail chains. Links to suppliers and even wholesalers will be of less importance.

EXHIBIT V-9

Increasing Usage of EDI Process Manufacturing Sector, Europe

EDI Application	Usage of EDI	
	Users	Vendors
Links to customers	Medium	High
Links to suppliers	Low-Medium	High

Sample of 16 software and services vendors and five users in process manufacturing sector

G Systems Operations

The process manufacturing sector, as is the case for the discrete manufacturing sector, is suffering from the recession. The impact of the recession is particularly noticeable in the upstream sectors such as petrochemicals, synthetic fibres, and rubber and plastics processing.

While profitability in sectors such as food and pharmaceuticals remains comparatively high, these sectors cannot afford to be complacent given their own pressures from factors such as own-label goods and the preference of central governments for generic drugs.

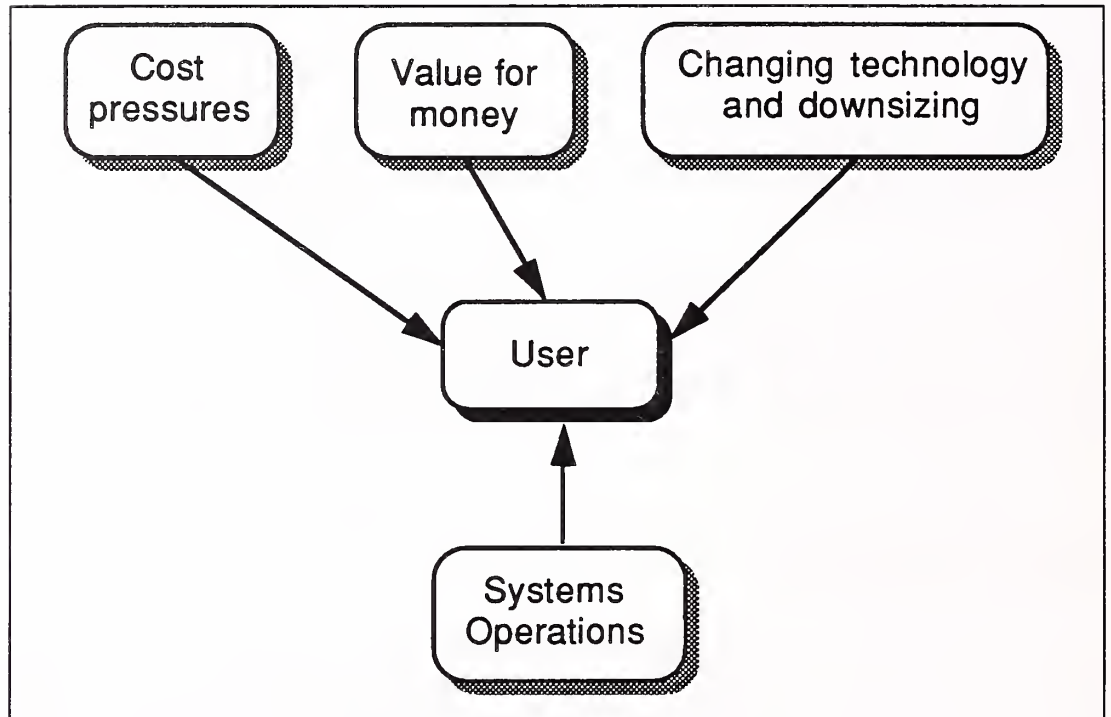
Another factor that will encourage users to adopt systems operations is the high level of redevelopment of systems, often on a changing technology platform, which is now underway in the process manufacturing sector. One option in such cases is for a systems operations vendor to manage the existing system while user personnel carry out the redevelopment. Of course, another option is to transfer the whole operation to a systems operations vendor.

Overall, it is probable that the subsectors showing the most significant trend to systems operations will be the upstream sectors such as petrochemicals and synthetic fibres.

The overall pressures in the process manufacturing sector to adopt systems operations are shown in Exhibit V-10.

EXHIBIT V-10

Increasing Usage of Systems Operations Process Manufacturing Sector, Europe



VI

Vendor Issues and Strategies

A

Vendor Issues

1. Overview

The major challenges facing vendors targeting the European process manufacturing sector are shown in Exhibit VI-1.

The process manufacturing sector has been under-exploited by software and services vendors in the past. A very high proportion of the systems installed, particularly for production administration, have been developed in-house with comparatively little involvement from the software products and professional services vendors. This situation is now changing rapidly. The process manufacturing sector is increasingly using vendors for consultancy, is much more inclined to adopt packaged solutions, and will continue to use professional services vendors to integrate application areas.

Hence, the initial challenge facing many vendors is to establish their credibility in the market-place by showing an understanding of companies' businesses and problems. This particularly applies to applications software product vendors, many of which will be seen as experts in discrete manufacturing, but with little experience in the process manufacturing sector.

A related challenge is the need to build market share quickly. At present, few vendors are truly established in the process manufacturing sector, and the next few years will be crucial in determining the market leaders.

Although these issues are very challenging in their own right, two added complications are the need for vendors to acquire a pan-European presence that mirrors the operations of their potential clients, and the changes in equipment platform that are taking place. Users are starting to move away from mainframes and in the medium term are showing a significant degree of enthusiasm for open systems and UNIX-based systems.

EXHIBIT VI-1

Vendor Challenges Process Manufacturing Sector, Europe

- Speaking clients' language
- Marketing challenge of new products and services
- Expanding European coverage
- Links to process control equipment
- User downsizing

2. Acceptance of UNIX

In contrast to the discrete manufacturing sector, where UNIX is forecast to have greater initial impact at the shopfloor system level, in the process manufacturing sector, UNIX is forecast to make the greater impact at the production administration level. This view is shared by both users and vendors. At the SCADA level, users felt that UNIX could be less relevant given the need to interface with proprietary process automation hardware.

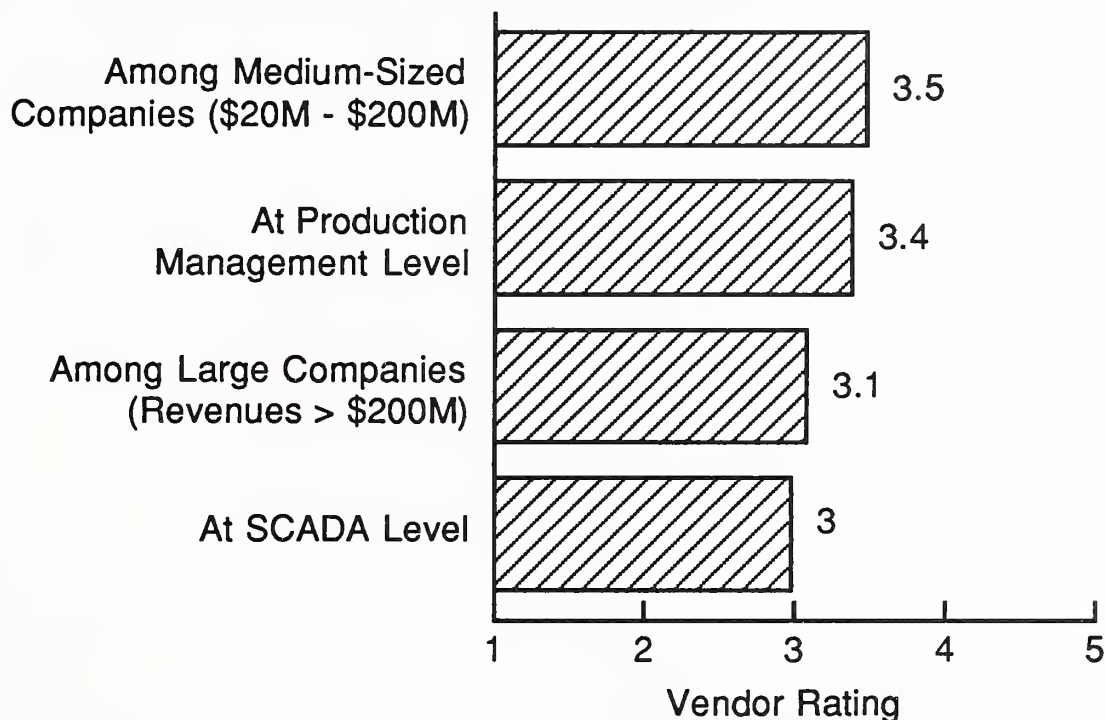
The vendor survey, the results of which are summarised in Exhibit VI-2, again indicated a faster acceptance of UNIX-based systems by medium-sized companies. However, the user survey indicated an acceptance of UNIX by large companies in the process manufacturing sector at very much higher levels than that in the discrete manufacturing sector. Some of the leading companies in the process manufacturing sector have a clear policy of moving to open systems and UNIX in the short or medium term.

3. Suitability of Product/Service Portfolio

Exhibit VI-3 shows how software and service vendors rate the "completeness of their offerings" for the process manufacturing sector. All of the vendors in this sample are already active in the sector.

EXHIBIT VI-2

Increasing Demand for UNIX-Based Systems Vendor Perception



Scale 1-5: 1 = Not at all
5 = Very substantially

Sample of sixteen software and services vendors. Standard error= 0.2
Response to question: "To what extent do you believe there is an increasing demand for UNIX-based systems in the Western European process manufacturing sector?"

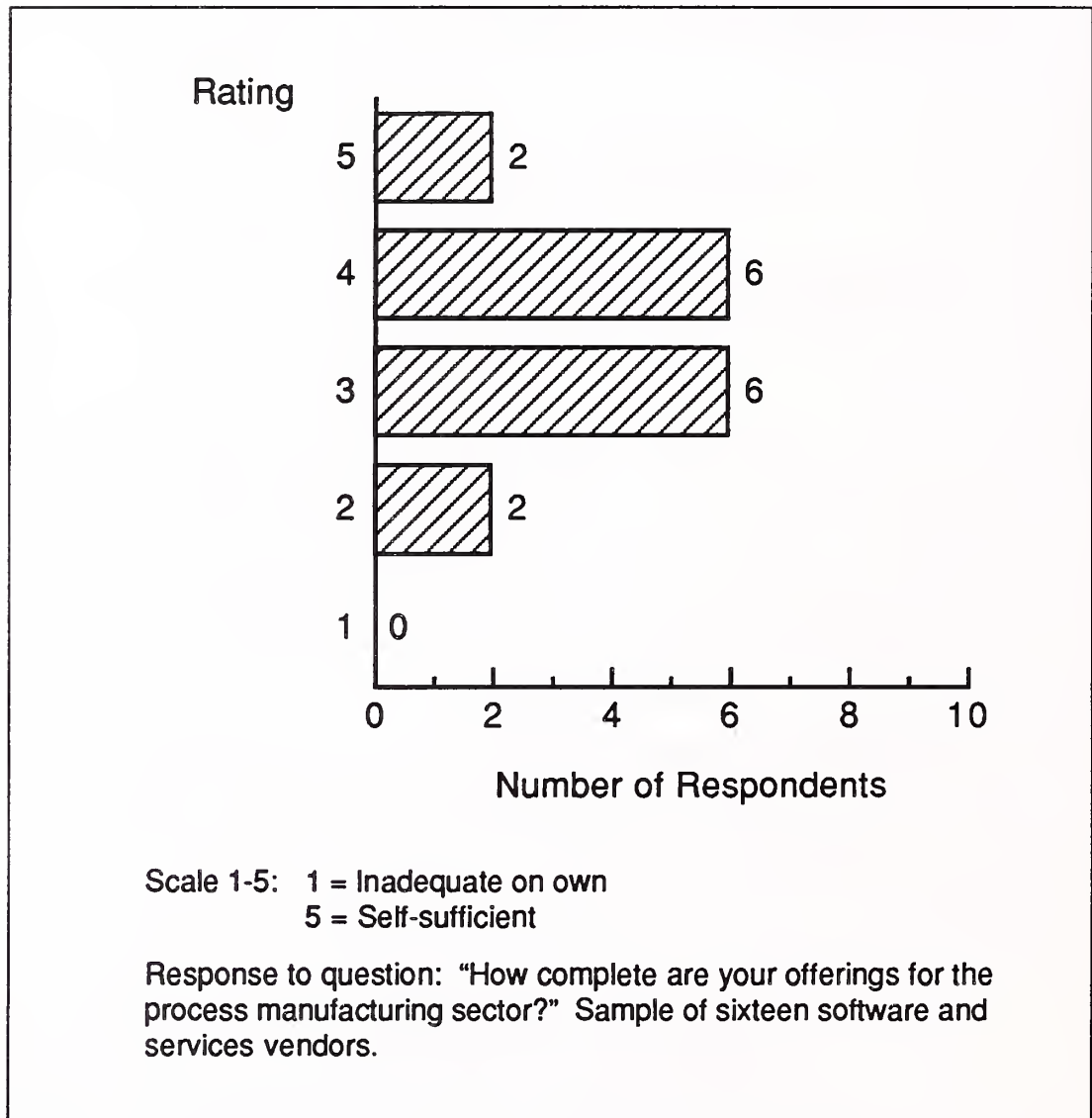
The aggregate position shown in Exhibit VI-3 shows a medium to high level of satisfaction with their offerings by vendors. However, if this satisfaction level is broken down into the various categories of vendors, then the following picture emerges. Firstly, taking into account their current partnerships and relationships, the major equipment vendors rate themselves as very highly self-sufficient already. Secondly, the applications software product vendors are only slightly less confident of their present product offerings. However, the professional services vendors and the second tier of equipment vendors only rate their current offerings as moderately complete.

This implies that in the newly emerging process manufacturing market, the major equipment vendors have been quick to position themselves and to develop relationships with applications software product vendors and professional services vendors. Professional services vendors and the

second tier of equipment manufacturers have been comparatively slow in developing their product/service portfolios.

EXHIBIT VI-3

Completeness of Offerings for the Process Manufacturing Sector, Europe



Exhibits VI-4 and VI-5 show the level of need for applications software products exhibited by vendors together with the means by which they intend to fill the gaps in their product portfolios.

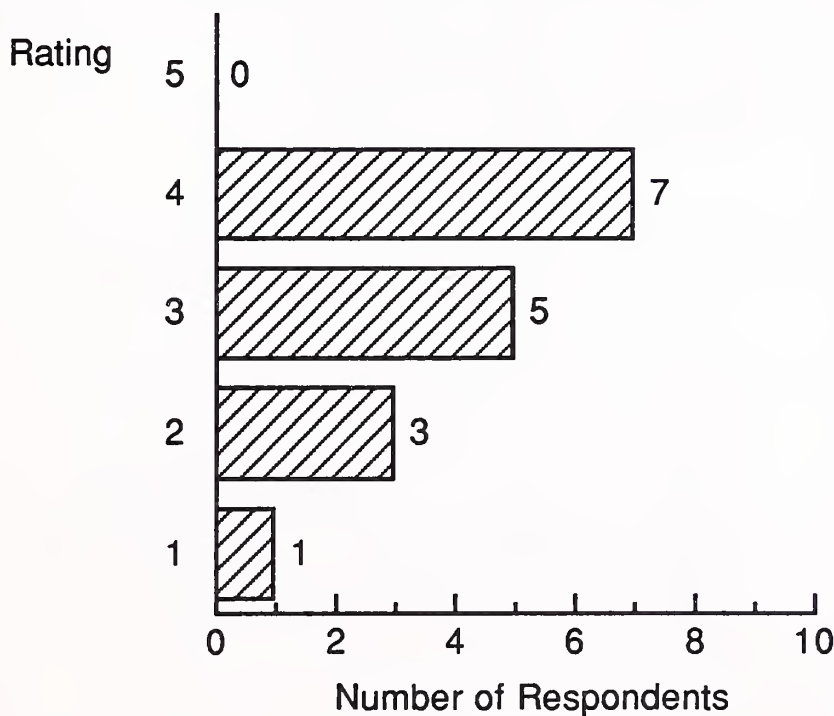
EXHIBIT VI-4

Need to Extend Offerings for Process Manufacturing Sector Applications Software Products, Europe

1	2	3	4	5
Not at all				Essential
We take an independent stance.	We have just launched a production management package.	We need complementary packages. We need a finite scheduling package. We are looking for a forecasting package.		There is a shortage of good quality assurance and process operations management systems.

Sample Attitude Profile

Sample of 16 Software and Services Vendors

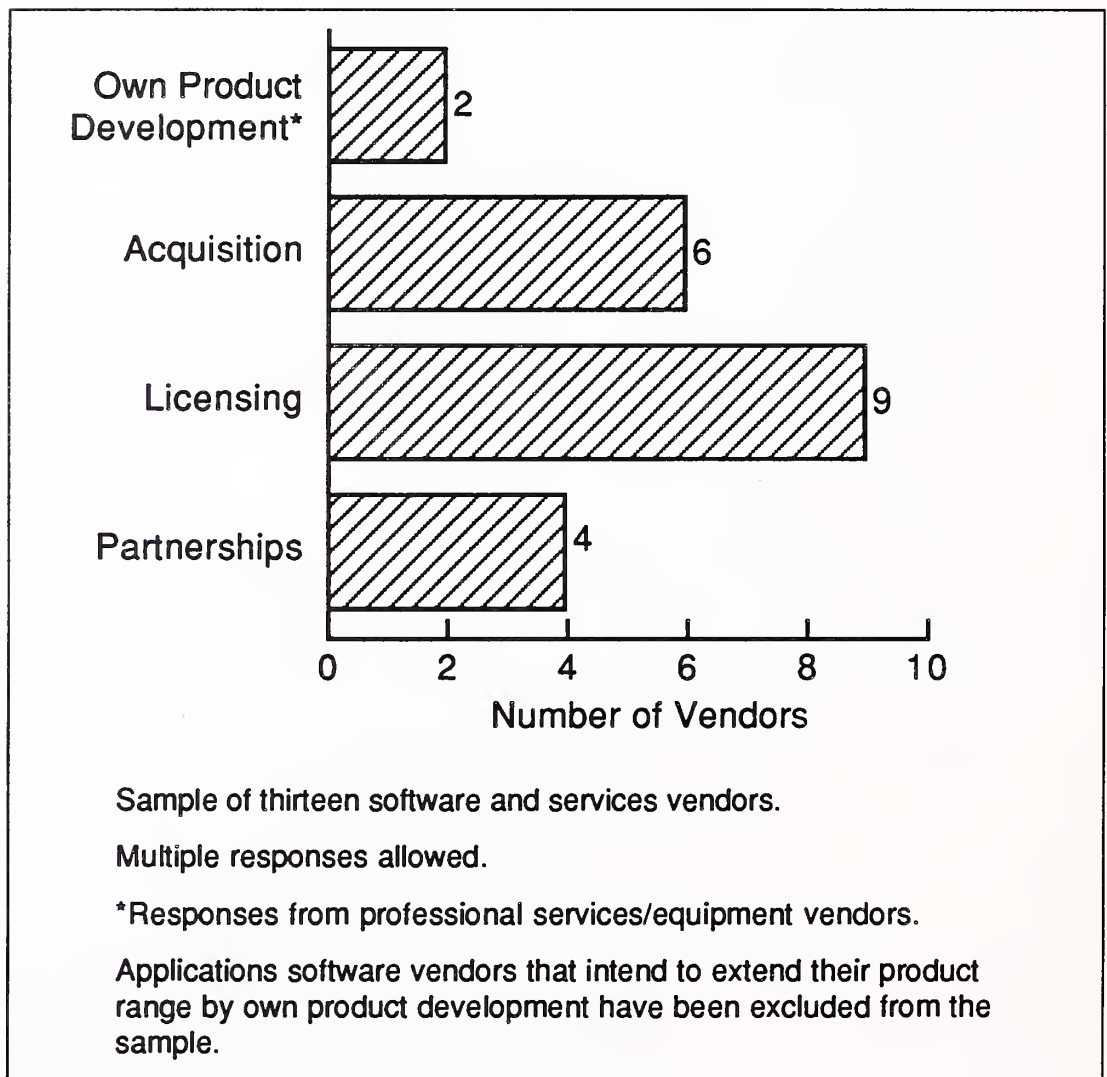


Scale: 1-5
1 = Not at all, 5 = Essential

Although the major equipment vendors have typically already assembled sound product portfolios for the process manufacturing sector, they still have a strong need for further applications software products to provide in some instances an aura of choice for their clients and to extend the scope of applications covered. Equipment vendors tend to favour licensing and partnerships rather than own-product development, though there is a trend towards increasing use of minority stakes and acquisition, principally as a means of influencing partners in their marketing strategies, and making the relationship a more exclusive one.

EXHIBIT VI-5

How Gaps in Applications Software Products Portfolio Will Be Filled



On average, the professional services vendors appear to have been slower in developing their product portfolios for the process manufacturing sector, though there are notable exceptions such as AT&T Istel. This delay means that there are undoubtedly still some major professional services vendors

that have yet to license basic applications software products such as production management systems for the process manufacturing sector. Accordingly, a significant proportion of professional services vendors exhibit a high requirement for applications software products. The favoured mechanisms for product acquisition are again licensing and partnerships, though some company acquisition is indicated.

Exhibit VI-6 shows the level of vendors' perceived need to extend their professional services offerings.

The equipment vendors are keen to become more involved in professional services. For the major vendors, much of the early emphasis will be in the consultancy area, helping users to identify their critical success factors and how information systems can contribute to these areas. Much of the ensuing implementation and integration activity will then typically be subcontracted to professional services vendors. However, it is likely that the major equipment vendors will increasingly move into these areas themselves in the longer term.

Some of the applications software product vendors are also enthusiastic about developing into professional services via partnership arrangements. The obvious example of this is ASK's establishment of links with EDS.

EXHIBIT VI-6

**Need To Extend Offerings for
Process Manufacturing Sector
Professional Services, Europe**

Vendor Type	Level of Need
Major equipment vendors	High
Applications software product vendors	Medium
Professional services vendors	Low

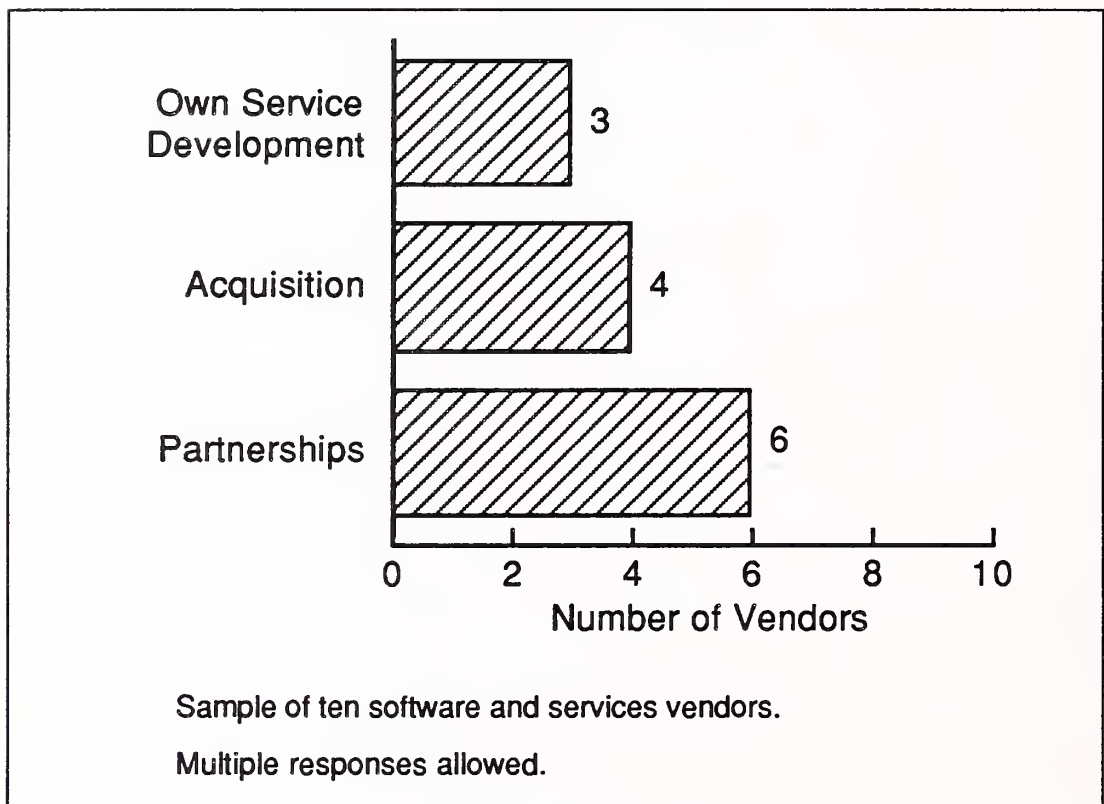
Systems integration is an important area for development by the major equipment vendors, since it is perceived as one of the keys to control of the major accounts. Systems integration enables vendors to establish a consultative relationship with clients while steering them to choose offerings from within their own framework or architecture. Hence, a framework of enablers and a wide choice of applications software products are needed by

the vendors. The detailed work required to implement and integrate the applications selected is usually subcontracted to professional services vendors at present. While partnerships are still the favoured means of extending vendors' systems integration capability, as shown in Exhibit VI-7, there is again a trend towards company acquisition.

Applications software product vendors are keen to have their products adopted by the major systems integration vendors and so are developing relationships with these companies.

EXHIBIT VI-7

How Gaps in Systems Integration Portfolio Will Be Filled



B

Vendor Strategies

1. Equipment Vendors

The approach being taken by the major equipment vendors is shown in Exhibit VI-8. The major equipment vendors are well positioned to tackle the process manufacturing sector. Each vendor typically has an architecture and a range of enablers pointing the way to computer-integrated processing, a good portfolio of applications software products, established partnerships with professional services vendors, and industry consultants to drive their

account management. These equipment vendors are targeting overall systems integration in the major accounts.

However, at present they are very dependent on applications software product vendors and professional services vendors.

Many of the second-tier equipment vendors are already offering UNIX-based products to medium-sized process manufacturing companies, and INPUT's research shows that a number of the major equipment vendors recognise the importance of UNIX to large companies in the process manufacturing sector. As yet, there is little sign of their product offerings reflecting this trend, but this may change in the short to medium term. ASK has announced that its Manman/Process system, developed in conjunction with Digital, will be converted for open systems in 1993 or 1994. This conversion may lag behind market requirements.

EXHIBIT VI-8

Strategy: Equipment Vendors Process Manufacturing Sector, Europe

- Account management
 - Industry consultants
 - Management workshops
- Overall systems integration
- Extensive partnerships with third-party vendors
- Major move to open systems

2. Professional Services Vendors

Many of the professional services vendors seem to have been caught temporarily off-guard by the changes taking place in the process manufacturing sector. While their targeting is similar to that of the major equipment vendors, they have typically been slower in this sector in licensing products and setting up the partnerships to develop their product portfolios. Accordingly, some vendors are still putting together their basic portfolios for the process manufacturing sector.

Industry-specific consultancy is very important for professional services companies in building up their credibility within the sector, as is access to a range of "best of breed" applications software products, as illustrated in Exhibit VI-9.

EXHIBIT VI-9

Strategy: Professional Services Vendors Process Manufacturing Sector, Europe

- Developing systems integration capabilities
- Consultancy capabilities important
- Licensing “best of breed”

3. Applications Software Product Vendors

Applications such as accounting and maintenance management have been purchased by the process manufacturing sector for some time, whereas production management systems developed specifically for the process manufacturing sector are a comparatively recent development. Many of the major production management systems vendors, such as ASK, announced products during 1990, and it is likely that many more announcements will take place.

Accordingly, the fight for market share in this sector will be tough. As shown in Exhibit VI-10, the first priority of the applications software product vendors is to establish their credibility as organisations that understand the pharmaceuticals industry, food and drink manufacturers, etc. Many of the potential vendors have core businesses that supply the discrete manufacturing sector, and this may be a handicap in terms of image.

Partnerships can be a key factor. Backing from one of the equipment vendors is obviously beneficial, as can be a relationship with one of the major professional services vendors.

Many of the larger companies in the process manufacturing sector have European, if not global, site coverage, and so the capability to sell and support on a pan-European basis is a prerequisite for targeting these users.

An additional complicating factor is the comparatively high level of interest being shown in open systems and UNIX by companies in the process manufacturing sector, which may necessitate companies developing UNIX-based versions of their products in the short to medium term.

EXHIBIT VI-10**Strategy: Applications Software Product Vendors
Process Manufacturing Sector, Europe**

- Process manufacturing products are recent/imminent development
- Need to project credibility in coming battle for market share
- Partnerships vital
- Development of European coverage
- New technology

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VII User Issues

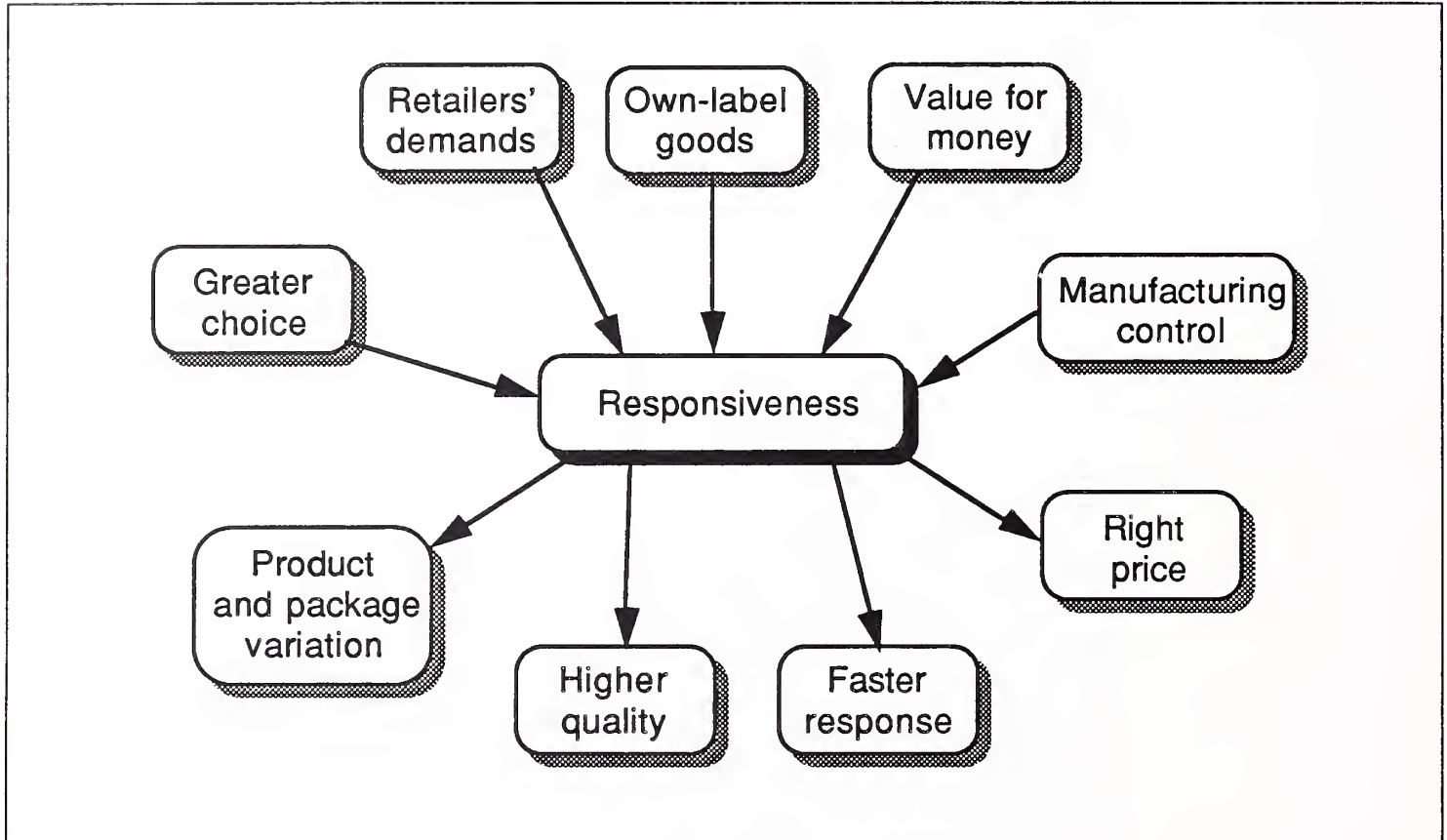
A User Pressures

As Exhibit VII-1 shows, the main pressures on the process manufacturing sector are not cost pressures—though cost pressures brought about by an excess of supply over demand frequently operate in some of the low value-added subsectors such as basic chemicals. On the whole, companies in both the chemicals and the food sectors are moving to high value-added products such as pharmaceuticals and ready-made meals. This move is leading to a greater variety of products being produced and consequently the need to provide the right goods at the right time. This need, in turn, necessitates a greater degree of manufacturing control by the manufacturer together with improved scheduling capability. For example, a manufacturer may be required to repackage an item for a retailer's in-store promotion; to do so successfully requires the manufacturer to schedule a shorter production run than usual and timely delivery is critical.

Also, as manufacturers move to higher value-added products, quality becomes even more important. Hence, lot traceability is frequently necessary within the process manufacturing sector, and there is an increasing tendency to integrate quality within the production function leading to developments such as in-line quality monitoring.

EXHIBIT VII-1

User Pressures Process Manufacturing Sector, Europe



B**Key Trends**

Exhibit VII-2 shows the key trends identified by the user poll.

EXHIBIT VII-2

**Key User Trends
Process Manufacturing Sector, Europe**

Trend	User Profile*				
	Not at All Likely				Very Likely
	1	2	3	4	5
Increasing reliance on packages	-	-	-	2	3
Implementation of production management systems	-	-	-	1	4
Standardised systems across each factory	-	-	2	1	2
Adoption of relational databases	-	1	-	2	2
Move to full computer-integrated manufacturing systems	-	1	-	2	2
Integration of production management systems with SCADA systems	-	-	1	2	2

* Likelihood of users adopting trend.

Sample of five process manufacturing companies.

Traditionally, production management systems used by the process manufacturing sector have been written in-house. There have been two main reasons for this. Firstly, conventional production management packages were seen as having been written to meet the needs of discrete manufacturing companies and so were not considered appropriate. Secondly, production management was previously seen as a comparatively simple task in the process manufacturing sector, since the product was highly standardized and was produced in large batch sizes, in some cases taking weeks or even years to produce.

This is now changing with the arrival of smaller batches, more variability, tighter delivery schedules, and the growing need for sophisticated lot

traceability. These changes have resulted in a huge increase in demand for production management packages written specifically for the process manufacturing sector, along with a marked increase in the acceptability of standard applications software packages.

There is also, as observed in the discrete manufacturing sector, a move to standardise the production management systems used across factories and subsidiaries. Major companies, such as Unilever, have up to 200 factories across Europe.

Once the production management system has been implemented, typically over the next two to three years, users intend to commence integrating these systems with their supervisory control and data acquisition (SCADA) systems to give full links to the process automation equipment. Given the high level of adoption of sophisticated process control equipment within the process manufacturing sector, and the comparative difficulty of automating shopfloor processes in the discrete manufacturing sector, the process manufacturing sector will probably achieve computer-integrated processing ahead of the discrete manufacturing sector.

Companies in the process manufacturing sector are quite forward-looking in their use of technology. Exhibit VII-3 shows a high level of adoption of relational databases, and a commitment to move to distributed production management systems once these are available. This commitment is accompanied by a significant trend to downsizing of equipment as mainframes become increasingly out of favour.

EXHIBIT VII-3

Major Technological Trends: User Perception Process Manufacturing Sector, Europe

Trend	User Profile*				
	Not at All Likely	2	3	4	Very Likely
	1	2	3	4	5
Standardised system across each factory	-	-	2	1	2
Adoption of relational databases	-	1	-	2	2
Downsizing of equipment	2	-	1	1	1
Adoption of distributed production management systems	2	-	-	1	1

* Likelihood of users adopting trend.

Sample of five process manufacturing companies.

As indicated in Exhibit VII-4, users in the process manufacturing sector are also moving comparatively strongly in favour of UNIX. One example of this is the Petrotechnical Open Software Corporation—a group of oil companies clearly strongly committed to open systems and UNIX. There are also leading consumer goods companies, for example Unilever, that have declared policies of moving to open systems and UNIX for all their key applications.

EXHIBIT VII-4

User Adoption of UNIX Process Manufacturing Sector, Europe

Area of Adoption	Likelihood of Users Adopting UNIX
Widespread use of UNIX	Medium
UNIX-based systems	
- For production management	Medium
- For SCADA	Low

Sample of five process manufacturing companies.

In contrast to the discrete manufacturing sector, where UNIX is expected to develop most strongly at the shopfloor (SFDCC) level, in the process manufacturing sector, UNIX is viewed as an important technology at the production management level. UNIX is perceived as being less important at the supervisory control and data acquisition level on the basis that open systems are less meaningful where there is a requirement to link into a wide range of proprietary equipment supplied by the traditional process control manufacturers.

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VIII

Logistics

A

Introduction

The term “logistics” is used to define the complete supply chain of a company from the purchase of raw materials through to the receipt of finished goods by the customer. However, this total logistics operation is conventionally divided into two components:

- Manufacturing logistics, which is the management of raw materials within the manufacturing process itself, including stocks of finished goods held at the manufacturing site
- Distribution logistics, which is the management of finished goods in the distribution network of the manufacturer, up until the point goods are accepted by a wholesaler, retailer or customer.

This report is primarily concerned with distribution logistics and the interface between manufacturing and distribution systems.

B

Driving Forces

The business pressures that are driving process manufacturing companies to examine their logistics systems are listed in Exhibit VIII-1.

EXHIBIT VIII-1

Business Pressures—Logistics Process Manufacturing Sector, Europe

- Single European market
- Customer service is paramount
- Cost pressure

Firstly there is the impact of “1992”, which has encouraged companies to re-evaluate their presence in each of the national markets of the Economic Community. It has led to a significant number of acquisitions by organisations such as BSN, Nestlé, and Unilever as they seek to dominate their chosen market sectors on a pan-European basis. As these national markets become increasingly homogeneous in terms of regulations and buying characteristics, it encourages organisations such as Nestlé to review the siting of their manufacturing and warehousing activities. In theory at least, the impact of “1992” should encourage manufacturers to rationalise their activities and concentrate production and distribution at fewer, more efficient sites.

Customer service is especially important in the food and drinks sector, where manufacturers are facing considerable pressure from the major retail chains for just-in-time deliveries aimed at specific time windows. There are also pressures for greater product and packaging variability.

Finally, having taken steps to reduce their manufacturing costs in recent years, manufacturers are now finding that their distribution networks are a major source of cost.

The key challenges that process manufacturing companies face in controlling their logistics operations are shown in Exhibit VIII-2.

EXHIBIT VIII-2

Key Logistics Challenges Process Manufacturing, Europe

- Forecasting/capturing demand
- Monitoring stock across the whole chain
- Optimising total logistic costs
- Generating performance indicators

One of the foremost logistical problems is in gaining an accurate picture of demand that can be fed into the manufacturing process, and in identifying potential shortages early. Traditional forecasting models tend to smooth forecast demand, and so it is important that any data relating to known orders is fed into the system as early as possible. Two trends taking place in forecasting software at present include:

- The use of knowledge-based systems as forecasting tools to allow most of the major factors that affect demand to be taken into account;
- Forecasting across multiple factory sites and across the whole of the distribution network

There is also a need to monitor stock across the whole of the distribution network and to source accordingly. At present, it is often difficult for one warehouse to identify stockholding of an item at other points in the distribution network.

Optimising total logistic costs is another issue. At present, there is a danger that the production management system and the distribution management system work in isolation with each seeking to minimize the costs within its own domain. However, this isolation may not lead to the best level of efficiency across the whole of the supply chain.

Another significant challenge is the provision of management information on the logistics operation to management with details of:

- Customer service levels achieved
- Actual costs of servicing each customer
- Stockholding of items across the chain
- Wastage

C

Subsector Trends

1. Overall Demand

The overall levels of interest in logistics systems within the key subsectors of the process manufacturing sector are identified in Exhibit VIII-3.

EXHIBIT VIII-3

Level of Demand for Logistics Systems Process Manufacturing Sector, Europe

Subsector	Level of Demand
Food and drink	Medium
Pharmaceuticals	Low-Medium
Petrochemicals	Low

The food and drink subsector is the area of highest demand since it faces the greatest pressures from its key customers—the major retail chains. Overall, distribution logistics is an area that has received comparatively little attention from users in the past, but is now due to be an area of increasing focus.

2. Food and Drink

There are three ways in which food and drink companies handle their distribution logistics:

- Outsourcing of entire distribution operation
- Direct plant shipments from factory
- Own-account distribution operations

Overall, the trend is towards a reduction in the proportion of companies using own-account distribution operations. Historically food and drinks manufacturers sited their depots adjacent to the major centres of population to maintain proximity to the small retail outlets served. However, the food and drink subsector is increasingly dominated—with the notable exception of Italy—by the major retail multiples that expect distribution to their own major distribution depots. This expectation has removed the need for many manufacturers to maintain their secondary distribution networks. Indeed, some companies in the food and drink subsector are evaluating the possibility of moving entirely to direct plant shipments.

However, other companies see their distribution network as a source of competitive advantage and are reviewing their logistics capability accordingly.

In many cases, the major retail multiples are forcing their suppliers to adopt EDI and are moving to greater frequency of deliveries within clearly defined time slots.

3. Pharmaceuticals

At present, logistics is not an area of prime concern to pharmaceutical companies, though this situation may change in the medium term. At present, many pharmaceutical companies are encouraged by national governments to set up manufacturing operations in a country as a by-product of the drug licensing process. This has led to an excess of capacity in many countries and has discouraged the establishment of cohesive, pan-European distribution networks by the pharmaceutical companies.

An additional factor is that the major expense in the pharmaceuticals sector is incurred in R&D and licensing rather than in the production process. Accordingly, margins are comparatively high and the cost of excessive stockholding is less critical than in other subsectors that retain the product diversity of the pharmaceuticals sector but where production costs constitute a much higher proportion of the value added.

D

Opportunities

The major opportunities for software and services vendors within the logistics function of process manufacturing companies are identified in Exhibit VIII-4.

EXHIBIT VIII-4

Major Opportunities in Logistics Process Manufacturing Sector, Europe

- Long-term planning system
- Warehouse management/automation
- Integration of major applications
- Provision of performance indicators

The first major opportunity area is in forecasting/scheduling software for both long-term planning—a month ahead—and short-term planning. The major impact on stock-holding costs of finished goods lies in correctly predicting customer demand. A number of software products that assist planning across multiple manufacturing and distribution sites are now available, and some manufacturers use knowledge-based software to take into account local factors influencing demand.

There are also opportunities for suppliers of warehouse management systems, and automated warehousing is being adopted for distribution-centre-to-distribution-centre operations. To improve warehouse operative efficiency, many systems now incorporate radio transmission of picking lists to hand-held units. Other systems enable multiple orders to be picked simultaneously to reduce operative movement around the warehouse and thus increase efficiency.

In the past, many information systems supporting logistics operations, such as:

- forecasting and planning
- warehousing
- transport management
- customer service management

have existed as “islands by automation”. There is now a need to integrate these islands and to measure the performance of the logistics operation as a whole.

E

Case Study

This case study illustrates some of the issues facing process manufacturing companies that retain their own account distribution operations.

The company described is a food processing company serving three types of customer:

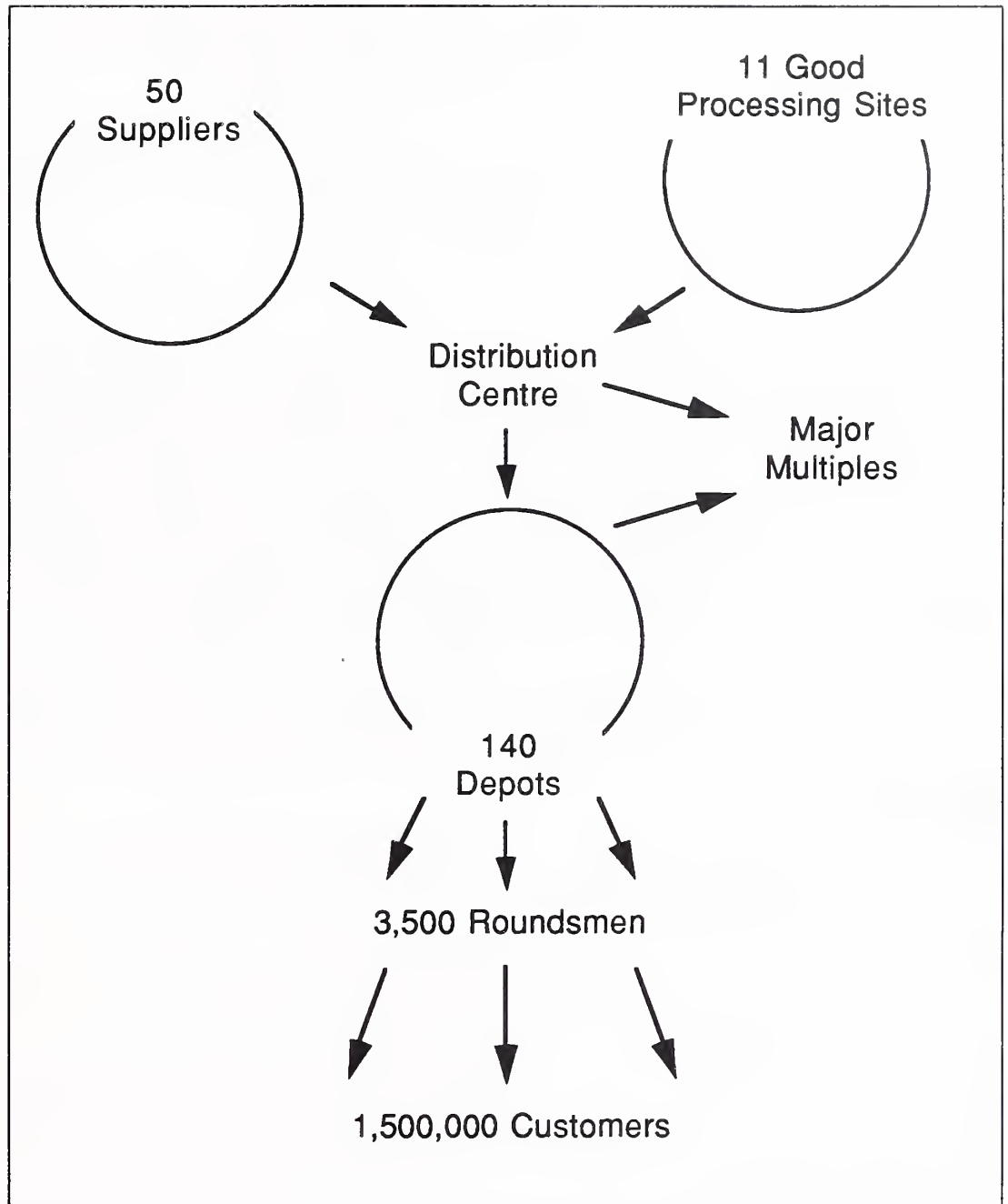
- doorstep clients
- corner shops
- major retail multiples

The company had decided to take advantage of its strengths in doorstep and corner shop deliveries by offering this service to other suppliers for which it would have been extremely costly to set up own-account operations to service these segments.

The resulting distribution network is shown in Exhibit VIII-5.

EXHIBIT VIII-5

The Distribution Network Case Study



The pressures affecting the different types of business are quite varied. The business pressures from the major multiples are listed in Exhibit VIII-6.

EXHIBIT VIII-6

Major Multiples—Issues

- Delivery locations often switched
- Very tight “time windows”
- “Drop drive” policy leads to retrospective invoice adjustments

The major multiples now insist on bulk deliveries within very tight “time windows”, typically a 90-minute slot. These deliveries are often carried out on a “drop drive” basis; that is to unmanned locations, which means that orders and delivery notes cannot be reconciled on delivery and many adjustments to the invoice are subsequently received from the customer. Finally, although the multiples are prepared to commit to known volumes in advance, they have a tendency to switch locations. This poses particular problems for a regional producer of perishable goods, keen to avoid long haulage because of the impact on delivery costs.

The issues facing the distribution channel servicing the doorstep deliveries and corner shops are shown in Exhibit VIII-7.

EXHIBIT VIII-7

Doorstep Deliveries—Issues

- Price changes
- Leakage
- Customer care leads to alternative sourcing

High levels of customer care can disrupt the sales pattern since the roundsmen are likely to use alternative sources, such as supermarkets, if a particular item is unavailable. Also, since the business is “cash-in-hand” and the timing of price changes is difficult to enforce with a manual system, there was extensive scope for leakage.

At the numerous small depots, the prevention of leakage was seen as a major problem, as indicated in Exhibit VIII-8.

EXHIBIT VIII-8

Depots—Issues

- Wide stockholding/low volumes
- Poor stock ordering
- Updating of price lists
- Preventing leakage

Other critical issues included the comparatively high levels of stock held in the distribution chain. These high stock levels are obviously a major problem, with 140 small depots each holding stocks of around 2,500 items. The vagaries of the roundsmen's sourcing together with the low skill level of the employees also led to a low standard of stock reordering. This situation was further compounded by the low priority other suppliers attached to this operation. If any of these suppliers were having difficulties in meeting orders for the major multiples, then supplies for the corner shops and doorstep deliveries would suffer.

This left the user with a requirement to introduce information systems to meet the objectives shown in Exhibit VIII-9.

EXHIBIT VIII-9

User Objectives—Case Study

- Reduce depot stock holdings
- Provide accurate forecasts to suppliers
- Reduce wastage in chain

These objectives were met by introducing a stand-alone stock control system into each depot, which also catered for invoicing from the depots to each corner shop, helping to reduce leakage, especially since price changes could now be effectively implemented. At the end of each week, each depot is dialled from a central information system to collect the week's accounts and to update product and price lists.

The user believes that in time this system will assist in reducing depot stock levels significantly, and will enable better modelling of demand so that other suppliers can be provided with more accurate sales forecasts.

IX

Opportunities

The principal opportunities for software and services in the European process manufacturing sector are shown in Exhibit IX-1. The major opportunity in the short term in the process manufacturing sector is undoubtedly the market for production management software. There has recently been very considerable growth in this market with the result that the majority of the production management package vendors have recently launched, or are currently in the process of developing, products designed specifically for the process manufacturing sector.

EXHIBIT IX-1

Principal Opportunities Process Manufacturing Sector, Europe

- Production administration software
- Professional services/consultancy
- Integration of production management and process control systems
- Improved logistics systems
- Open systems

Consequently, the next twelve months will be crucial in establishing the industry leaders. It will also be important to be on the right technology platform. For IBM, the majority of sales will be of AS/400-based systems, though the RS/6000 may become a significant platform in the medium term. On other equipment platforms, UNIX will become important in the short to medium term.

Unlike the discrete manufacturing sector, where production management systems were initially installed in isolation with no thought given to their long-term integration with other applications, in the process manufacturing sector there is currently a strong awareness of the desirability of moving to computer-integrated processing and of the need to plan towards this end. Accordingly, there is a greater commitment to open systems and extensive use of consultants for planning the organisations' overall information systems approach.

In the medium term, the integration of production management and process control systems will itself become a major opportunity, though this development is happening already in some of the leading manufacturers. This form of integration provides considerable benefits to users, principally by way of providing up-to-date information on production status and by providing sophisticated facilities for lot traceability and quality assurance.

Another emerging opportunity is the need for more comprehensive and better-integrated logistics support. Once the production function is under tight control, the next area for improvement in terms of increased customer responsiveness and greater efficiency is the distribution logistics function.

The principal opportunities within applications software products, in addition to production management systems, are shown in Exhibit IX-2.

EXHIBIT IX-2

Principal Opportunities Applications Software Products Process Manufacturing Sector, Europe

- Production management
- Quality systems
- Process operations management
- Supervisory control and data acquisition
- Decision support

There is a strong need for in-line quality systems that measure the composition of both raw materials and final products, and feed the results of these analyses, in real time, to the control room or process operator and to the production management system.

To establish the link between production management systems and the manufacturing process, supervisory control and data acquisition (SCADA) systems and production supervision and control products—for example, IBM Process Operations Management Systems (POMS)—will be in demand. The IBM POMS product is already reported to have had a good reception in Europe and the first installations are being implemented.

As more and more information becomes available from the shopfloor, there will also be demand for decision support systems to prevent management information overload.

The growth prospects for the key subsectors are summarized in Exhibit IX-3.

EXHIBIT IX-3

Key Industrial Sectors—Vendor Perspective Process Manufacturing Sector, Europe

Sector	Growth Prospects
Pharmaceuticals	Very good
Food and drink	Good
Other chemical, oil and gas, paper and pulp	Average

Pharmaceuticals was viewed as being the most promising subsector by all categories of vendors. Certainly, given the current demographic trends within Europe, the demand for pharmaceutical products is expected to show appreciable growth. However, this same trend is causing concern to central governments worried by the trend in health care spending, leading to cost reduction pressures on the pharmaceutical companies. This subsector has a tradition of high investment, particularly R&D expenditure.

The food and beverages subsector was seen as another area that is relatively immune to recessionary pressures. Overall, the food processing sector is moving towards a greater variety of high quality products and so needs to substantially improve the degree of manufacturing control achieved.

As shown in Exhibit IX-4, the main challenge for many vendors will be in establishing themselves within the process manufacturing sector. Traditionally, this sector has developed most of its own production administration systems in-house, and is very suspicious of vendors perceived as traditional suppliers to the discrete manufacturing sector.

Hence, vendors need to be able to demonstrate both their business understanding of the sector and their systems capability in this context. At the moment, there is a window of opportunity in the market for production management packages, and the next twelve months will be crucial in determining the market leaders.

EXHIBIT IX-4

Issues for Vendors Process Manufacturing Sector, Europe

- Industry credibility
- Marketing new products and services
- High acceptability of UNIX
- European coverage
- Assembling product/service portfolio

There is a high level of acceptance of open systems and UNIX in the process manufacturing sector. This acceptance poses the question for vendors of when to move to UNIX-based rather than proprietary products.

Pan-European coverage is again important for vendors targeting the leading process manufacturing companies. Process manufacturing companies typically have large numbers of plants spread throughout Europe.

At the present time, many equipment vendors and professional services vendors have still to assemble full product/service portfolios for the process manufacturing sector. It is important that such vendors are in a position to offer both sector-specific consultancy services and access for their clients to “best of breed” applications software products.

A

Forecast Database

EXHIBIT A-1

Software and Services Market Process Manufacturing, Europe

Region	Currency	1991	'91-'92 AGR (%)	1992	'92-'97 CAGR (%)	1997	(\$) Exch Rate
France	FFM	6,050	15	6,950	15	13,800	5.18
Germany	DMM	1,600	14	1,820	17	4,000	1.52
U.K.	PSM	445	11	495	15	1,000	0.532
Italy	ILB	550	14	625	15	1,250	1.15
Rest of Europe	\$M	1,100	15	1,270	16	2,700	1.00
Total Europe	\$M	4,650	14	5,300	16	11,100	1.00

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B Forecast Reconciliation

The 5% increase in overall 1991 industry sector total shown in Exhibit B-1 hides a real 1% fall. Changes in exchange rates between the 1991 and 1992 studies resulted in a 6% rise in all European figures when calculated country by country. Systems operations and integration had both been previously underestimated.

The forecast CAGR remains among the highest for any industry sector, compared to an average 11% for the total European software and services market.

Exhibit B-1

Process Manufacturing Sector Reconciliation of Market Forecast, Europe

Industry Specific Delivery Modes	1991 Market			1996 Market			'91-'96 CAGR	
	1991 Study (\$M)	1992 Study (\$M)	Variance (%)	1991 Study (\$M)	1992 Study (\$M)	Variance (%)	1991 Study (%)	1992 Study (%)
Transaction Processing	330	330	0	400	410	3	10	5
Turnkey Systems	1,070	1,170	9	2,480	2,200	-11	18	14
Applications Software Products	705	730	4	1,880	1,650	-12	17	17
Professional Services	1,440	1,490	3	3,350	2,900	-13	18	14
Network Services	350	340	-3	845	900	7	21	22
Systems Operations	325	380	17	820	950	16	19	21
Systems Integration	170	210	24	425	535	26	24	21
Industry Sector Total*	4,440	4,650	5	10,200	9,550	14	17	16

* May not compute due to rounding.

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C

Exchange Rates

1. European Exchange Rates

The following table, Exhibit C-1, shows the standard exchange rates used throughout the 1992 programme to consolidate country market data for overall European forecasts and vendor market shares.

EXHIBIT C-1

U.S. Dollar and ECU Exchange Rates, 1992

Country	Currency	U.S. Dollar	ECU
France	FF	5.18	6.96
Germany	DM	1.52	2.04
United Kingdom	£	0.532	0.715
Italy	Lira	1,150	1,544
Sweden	Sek	5.54	7.45
Denmark	DK	5.89	7.93
Norway	NK	5.98	8.03
Finland	FM	4.15	5.51
Netherlands	Dfl	1.71	2.29
Belgium	BF	31.26	41.94
Switzerland	SF	1.35	1.81
Austria	Sch	10.63	14.33
Spain	Ptas	96.2	129.6
Portugal	Esc	134.9	181.0
Greece	Dra	174.0	234.8
Ireland	IR£	0.57	0.765
	\$	1	1.34

Source: *Financial Times*, 30 December 1991

2. European Inflation Rates

Exhibit C-2 shows the average five-year inflation assumptions for each reported country and the changes from those used in reports produced in the previous year. All INPUT forecasts include the effects of inflation as well as natural market growth rates. For consistency, the same inflation rates are used throughout all the different market sectors research and analysis during a calendar year, unless specified otherwise.

EXHIBIT C-2

Inflation Assumptions, 1991 and 1992

Country	Assumption 1991-1996	Assumption 1992-1997	Change
France	3.0	2.7	-0.3
Germany	2.7	3.9	+1.2
United Kingdom	4.8	3.7	-1.1
Italy	4.4	5.2	+0.8
Sweden	6.3	4.0	-2.3
Denmark	2.7	2.4	-0.3
Norway	4.9	3.4	-1.5
Finland	5.0	1.4	-3.6
Netherlands	2.4	3.3	+0.9
Belgium	3.3	3.2	-0.1
Switzerland	3.3	3.5	+0.2
Austria	2.6	3.2	+0.6
Spain	4.7	5.0	+0.3
Portugal	8.0	12.5	+4.5
Greece	12.0	11.0	-1.0
Ireland	3.0	3.0	0.0
European Average	4.0	4.2	+0.2

Source: OECD Forecasts, Q4 1991

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D Related INPUT Reports

- *The Challenge of the Single European Market—1992 and Beyond*
- *The Western European Market for Computer Software and Services, 1990-1995*
- *European Software and Services Market, 1991-1996—Insurance Sector*
- *European Software and Services Market, 1991-1996—Banking and Finance Sector*
- *European Software and Services Market, 1991-1996—Distribution Sector*
- *European Software and Services Market, 1991-1996—Discrete Manufacturing Sector*

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