THE FUTURE OF CASE: 1991-1995

INPUT

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THE FUTURE OF CASE
1991-1996

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The Future of CASE: 1991-1996

Abstract

This report provides an in-depth assessment of the U.S. CASE technology market with a projection of developments and growth over the next five years. CASE technology exploded on the market in the late 1980s and since has faced continual challenges in achieving the level of success and acceptance that early response suggested.

INPUT, in its second assessment of this important market, positions the CASE market within the U.S. information services industry, provides an analysis of the impact of IBM's AD/Cycle, describes the current perspectives on CASE in the information systems function, sizes the U.S. market, and analyzes the forces driving and inhibiting success. CASE continues to offer significant opportunity to strengthen the information services industry through improvements in productivity, systems quality, and systems longevity. This analysis provides valuable insights to both vendor and information systems executives as they strive to achieve the benefits successful CASE implementation offers.

This report contains 106 pages and 82 exhibits.

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Exhibits

Exhibits (Continued)

Exhibits (Continued)

I

Introduction

I

Introduction

This report and the related research was performed as part of INPUT's Information Systems Program. This program serves the management of leading vendors in the information services industry and the information systems function of large organizations.

Throughout this report, IS refers to the information systems functions of corporations.

A

Scope

This report examines developments in CASE (computer-assisted systems engineering) which involve the development of business systems. The main focus is on two interrelated issues:

• IS departments' requirements and plans

• Technology issues affecting the increased use and effectiveness of CASE

Based on INPUT's analysis of requirements and technology, INPUT has developed several scenarios on CASE growth for the 1991-1996 period. INPUT's forecast is for the size of the CASE product market. It is currently not feasible to measure the separate impact of CASE on other areas. In professional services, for example, the amount of pure CASE services is relatively modest; the extent to which CASE permeates other services is significant, but resistant to quantification. However, INPUT believes that the rate of market growth, and especially the development of its alternate growth scenarios, represent a good surrogate for the growth of overall CASE use.

Section C of this chapter, Definitions, defines in more detail the areas included and excluded in this report.

B
Objectives

This report will address the following issues:

- How effective within corporations has CASE been to date?

- How will applications development change from 1991 to 1996?

- What is the current and planned use of CASE?

- What are the most serious barriers to wider CASE use?

- How important are technical issues generally for CASE acceptance?

- What impact will developments in re-engineering have on CASE technology and CASE use?

- What are the "stages" of CASE?

- How important is distributed applications development?

- What are the "soft" CASE implementation issues? How important are they?

- How large is the CASE product market likely to be by 1996? Under what circumstances will it be larger or smaller?

- How dominant will AD/Cycle be? What effect will AD/Cycle have on users and other vendors?

- What impacts will CASE have on application software companies?

- What options do professional services firms and systems integrators have in responding to CASE developments?

C
Definitions

1. Terms Addressed in this Report

This report focuses on CASE as used to develop business applications. CASE, in this context, includes:

- Forward engineering
- Re-engineering
- Repository technology

Exhibit I-1 lays out the major components of CASE and their relationships.

Forward engineering has traditionally been divided into:

- Front-end tools for performing requirements, analysis, and design work
- Back-end tools, or code generators

EXHIBIT I-1   I-3

CASE Components

Front End   **Back End**

Forward
Engineering

```
Requirements,          Code
Analysis, Design Tools Generators        Application

                       Repository

Re-engineering                    Re-use         Reverse
                                                 Engineering

                       Generator
```
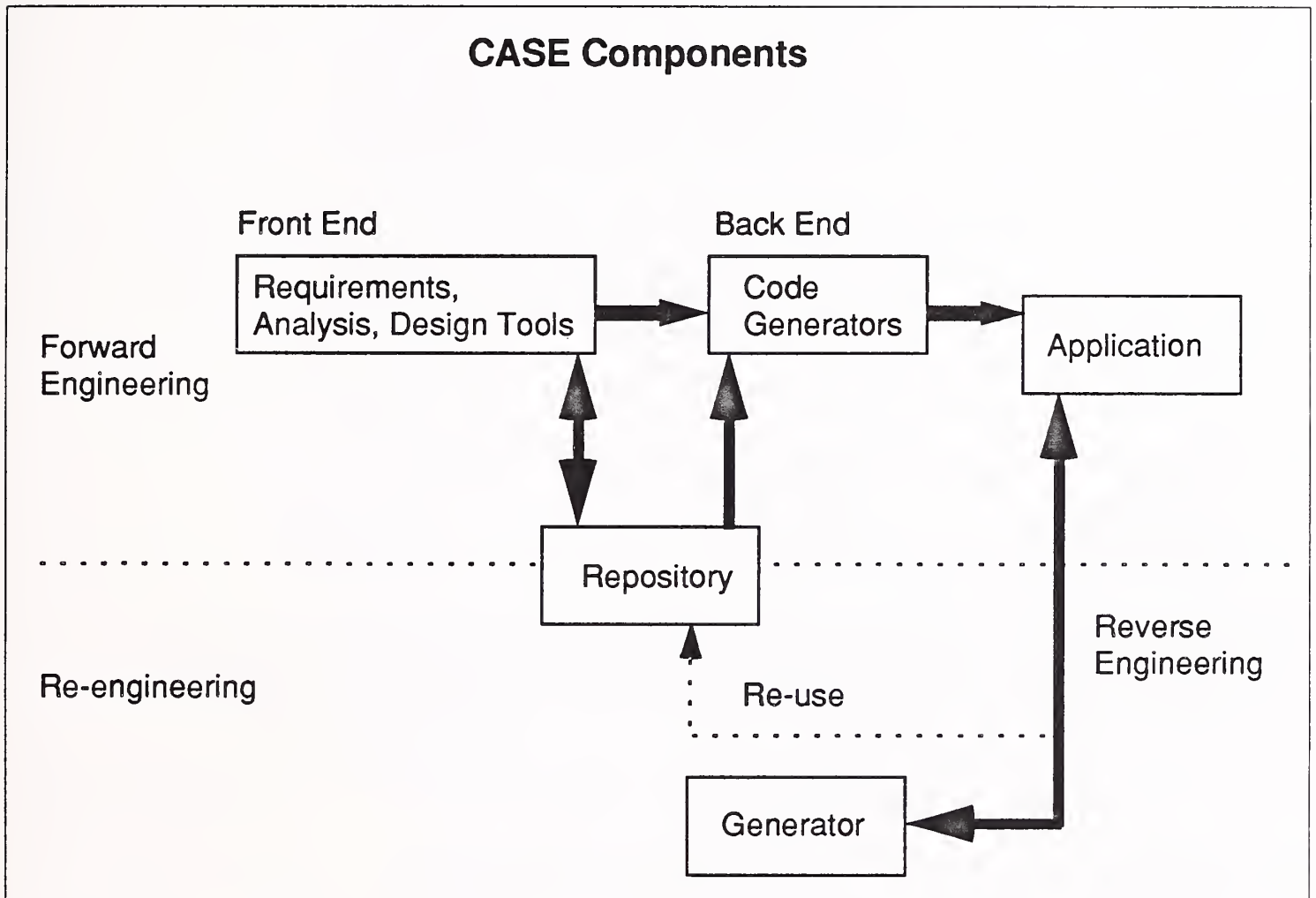
In the 1980s front-end and back-end tools were generally separate. With the advent of repository technology, this has begun to change quickly.

- A repository (or encyclopedia) is used to capture requirements and design on a centralized basis.

- The repository can maintain changes and serve as the input point for code generation.

Chapter IV discusses these issues in more depth.

In this report re-engineering is used to describe the entire process for taking an existing application and either re-using the logic or reverse-engineering the code. These differences are shown in Exhibit I-2.

EXHIBIT I-2

Re-engineering Options

Options (One/Both)	Reverse- Engineered Application	Re-used Application
Objectives (Some/all may be involved	• Stabilize application • "Re-write" • One-time/multiple changes • Short/long life expectancy	• Learn data/process logic • Help populate repository • Form base case for forward engineering
Attributes (Some/all may be involved)	• Restructured code • Logic tracing • Created modules • Graphical manipulation	• Entities • Relationships • Data base structures • Objects

2. Exclusions from this Report

This report covers business-related CASE. It does not include CASE tools/methodologies that focus on:

• Microprocessor design
• Real-time systems
• Embedded systems
• Scientific/engineering applications

In addition, this report does not include:

- Traditional compilers and debuggers
- Fourth-generation languages (4GL)
- Data base access languages (e.g., SQL and related tools)
- Data base tools
- Project management systems

These areas are analyzed in INPUT's report, *U.S. Systems Software Products, 1990-1995*.

D
Methodology

The following sources were used for this report:

- A written questionnaire, completed by 92 CIOs (Appendix A)

- Telephone interviews with 14 senior IS executives (Appendix B)

- Telephone interviews with 20 application development managers (Appendix C)

- Telephone interviews with 13 leading CASE vendors (Appendix D)

In addition, INPUT staff held in-depth meetings with senior staff of over 20 CASE vendors and other information services vendors, to gain insights into the direction of CASE and related services.

E
Report Structure

The remaining chapters of this report are organized as follows:

- Chapter II, Executive overview, provides a summary of the contents of the report

- Chapter III, User Requirements, reports on INPUT's research and analysis in the following areas:

  - CASE in the overall IS context
  - CASE problems and issues
  - CASE planning

- Chapter IV, the Impact of Technical Issues, examines three key issues affecting CASE progress: integration, re-engineering, and distributed applications development.

- Chapter V, Market Forecasts, provides scenarios affecting CASE growth and quantifies the size of the CASE product market from 1991-1996 under different sets of assumptions.

- Chapter VI, Competitive Environment, analyzes the following issues:

  - AD/Cycle
  - Leading CASE product vendors
  - CASE strategies of selected vendors
  - The impact of CASE on professional services/systems integration firms

- Chapter VII, Conclusions and Recommendations, summarizes INPUT's findings and proposes short- and longer-term actions for both users and vendors.

- Appendixes include:

  - Appendix A - IS Management Questionnaire (mail questionnaire)

  - Appendix B - IS Management Questionnaire (telephone question-naire)

  - Appendix C - Application Development Manager Questionnaire

  - Appendix D - CASE Vendor Questionnaire

F

Related Reports

Please refer to the following related INPUT reports:

Managing Information Technology in the 1990s

Developments in End-User Computing

Data Base Systems Development

U.S. Systems Software Products, 1990-1995

U.S. Professional Services Market, 1990-1995

II

Executive Overview
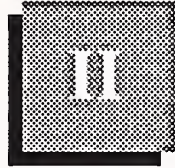
Executive Overview

CASE (computer-aided systems engineering) has held out the promise since the mid-1980s of making a significant impact on the applications development process. CASE proponents see opportunities for significant improvements in

- The elapsed time it takes to develop applications
- Application quality
- IS staff productivity

CASE could potentially have an even broader impact on the information services industry and corporations in general.

This promise has so far been largely delayed, for reasons described in this report. INPUT's research has identified several critical variables that have affected CASE progress. This report analyzes and quantifies these variables and forecasts CASE growth under several conditions.

A

CASE Stages

Based on INPUT's research and analysis, INPUT has divided CASE into four stages of development (Exhibit II-1).

- The first two stages focused on individual tools and how they could be used together.

- The third stage, repository-based tools, became the dominant mode in 1990 with the announcement of AD/Cycle. (Texas Instruments and KnowledgeWare each had earlier repository-based products.)

The third stage represents a definite break with the past. The transition from Stage 3 to Stage 4 will be more gradual.

EXHIBIT II-1

II-2

CASE Stages

Key

○ Stage

—————— Dominant Period

— — — — Secondary Period

Note: Does not include R&D period for any stage
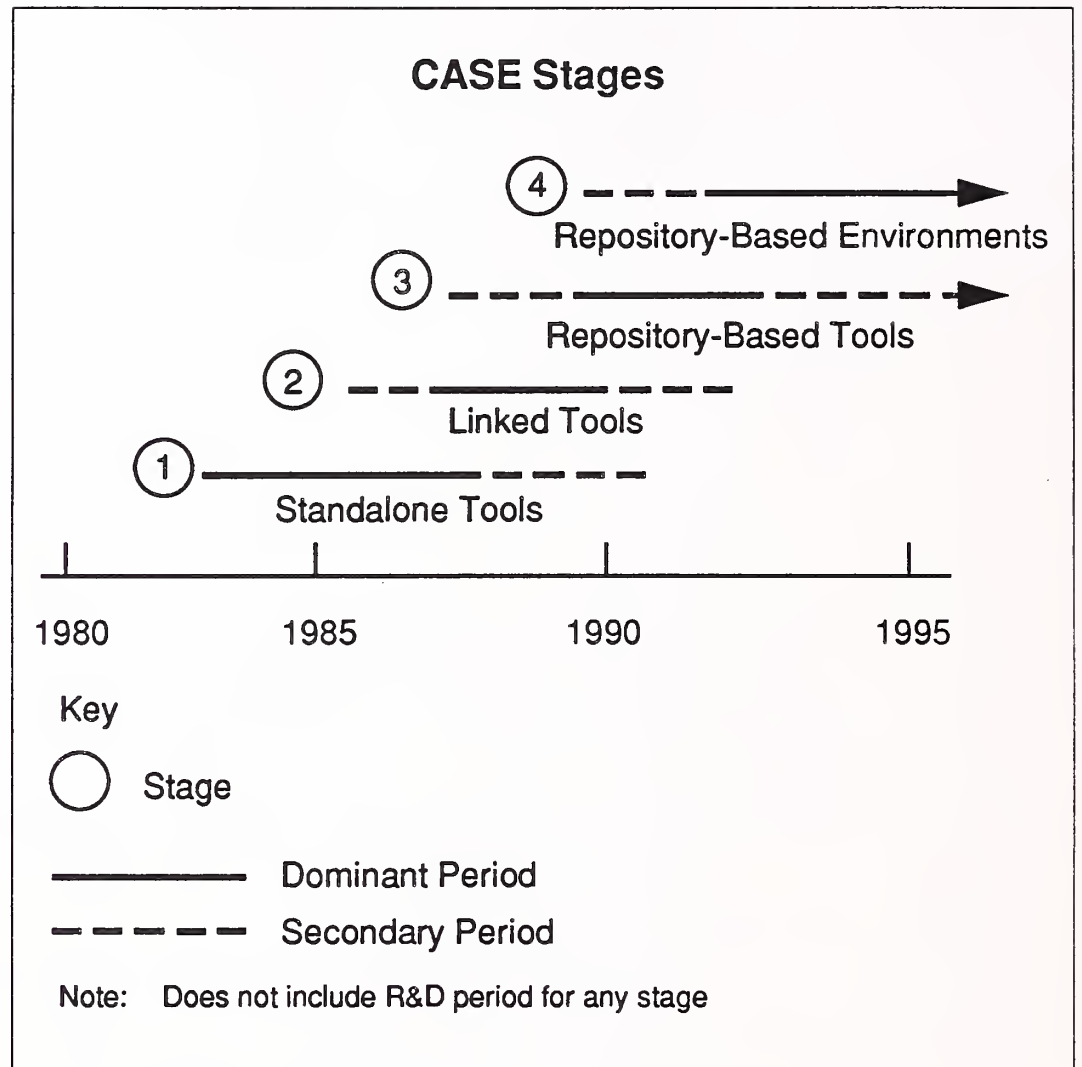
A CASE repository-based environment (Exhibit II-2) will provide:

• A suite of tools

• A common repository for information exchange and tool coordination

• Forward engineering facilities (Stage 3)

• Re-engineering facilities (Stage 4)

EXHIBIT II-2

Repository-Based CASE (Schematic)

Forward-Engineered

(Stage 3)

Repository → Application

Re-engineering
(Stage 4)

——————— Tight linkage

• • • • • • Intravendor linkage

Note: Letters within symbols refer to individual vendors

☐ Project management systems

⬡ Methodologies

△ Analysis/design tools

◯ Generators
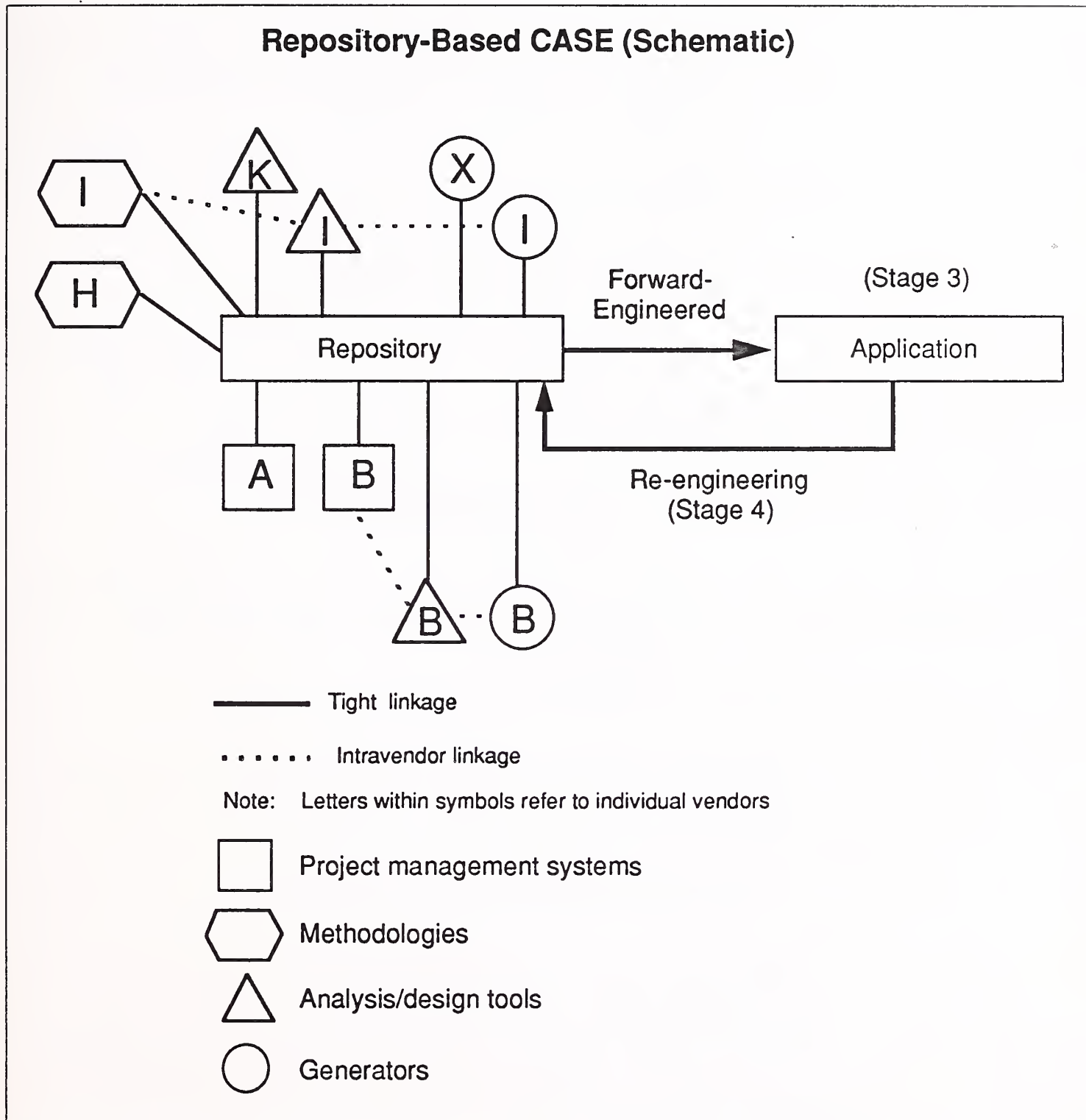
B

CASE Growth

The most likely growth scenario for CASE products in the 1990s is indicated in Exhibit II-3.

EXHIBIT II-3

CASE Product Growth Scenarios: Summary

Source: Exhibit V-9
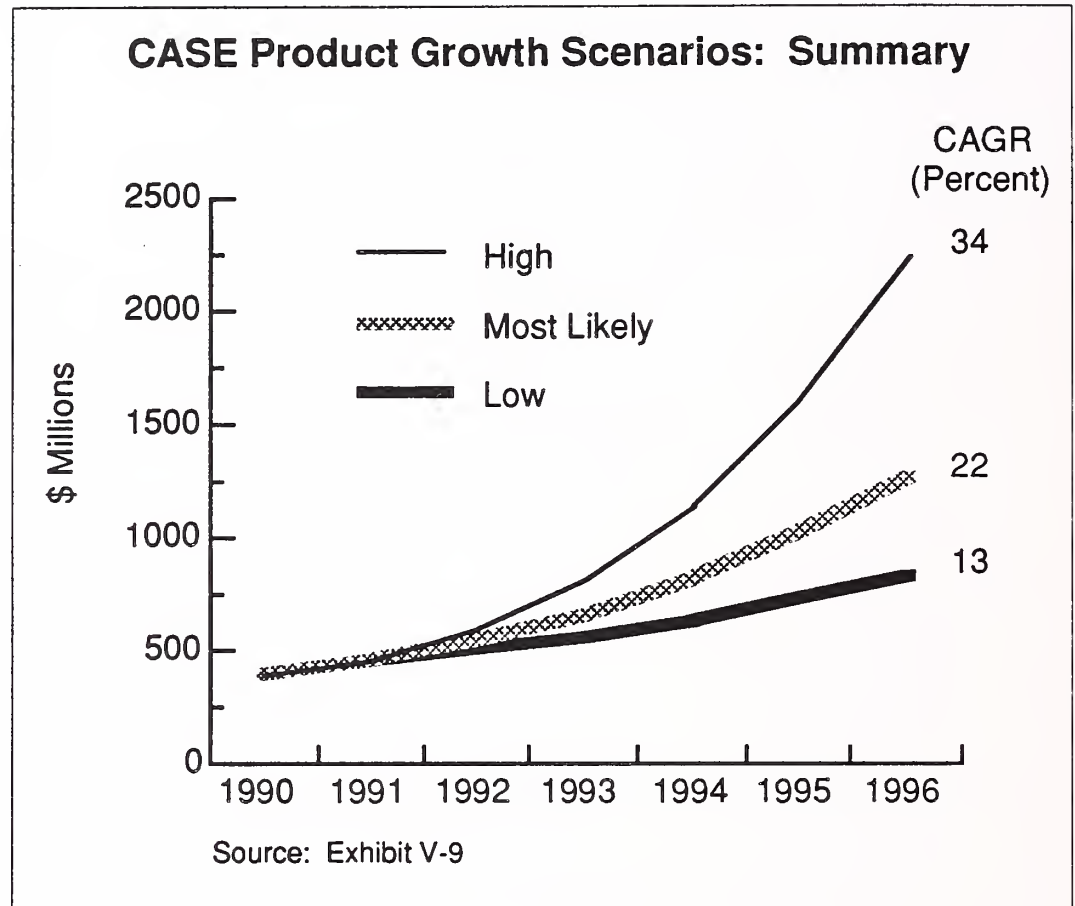
- This represents an increase from about $450 million in 1991 to over $1.2 billion in 1996, a 22% compound average annual growth rate.

- INPUT expects that the growth rate will increase from 15% in the 1990-1991 period to 25% in the 1995-1996 period.

The growth shown here is for CASE software products, since this is currently the only part of the CASE market it is feasible to measure. While CASE may have significant effects on hardware sales and will heavily influence the professional services market, it is not possible at this time to isolate the effects of CASE alone. INPUT believes that the growth rates shown here are a good indicator for overall CASE use within corporations.

CASE product revenues could be as little as $800 million in 1996 or as much as $2.2 billion.

- INPUT estimates there is approximately a 25% probability of the low-growth scenario occurring.

• INPUT gives a 25% probability for the high-growth scenario occurring.

Based on its research, INPUT has identified two principal variables that will impact CASE growth:

• A group of "soft" issues that denote an organization's readiness to absorb and use CASE technology

• The extent to which re-engineering technology develops and is put to use

These issues are analyzed in the next two sections.

C

CASE Readiness

Part of INPUT's research included probing for the issues and problems facing corporations in making CASE work. These issues were classified and then categorized as being either technology-related or "soft" issues (e.g., methodology, knowledge, training, organization/culture, etc.).

• Eighty percent of respondents cited at least one "soft" issue as being a key problem (Exhibit II-4).

EXHIBIT II-4

Technology vs. "Soft" CASE Problems

Technology Only

No Problems Cited 10%

10%

Technology and "Soft"

40%

"Soft" Only

40%

Percentage of respondents citing problem types
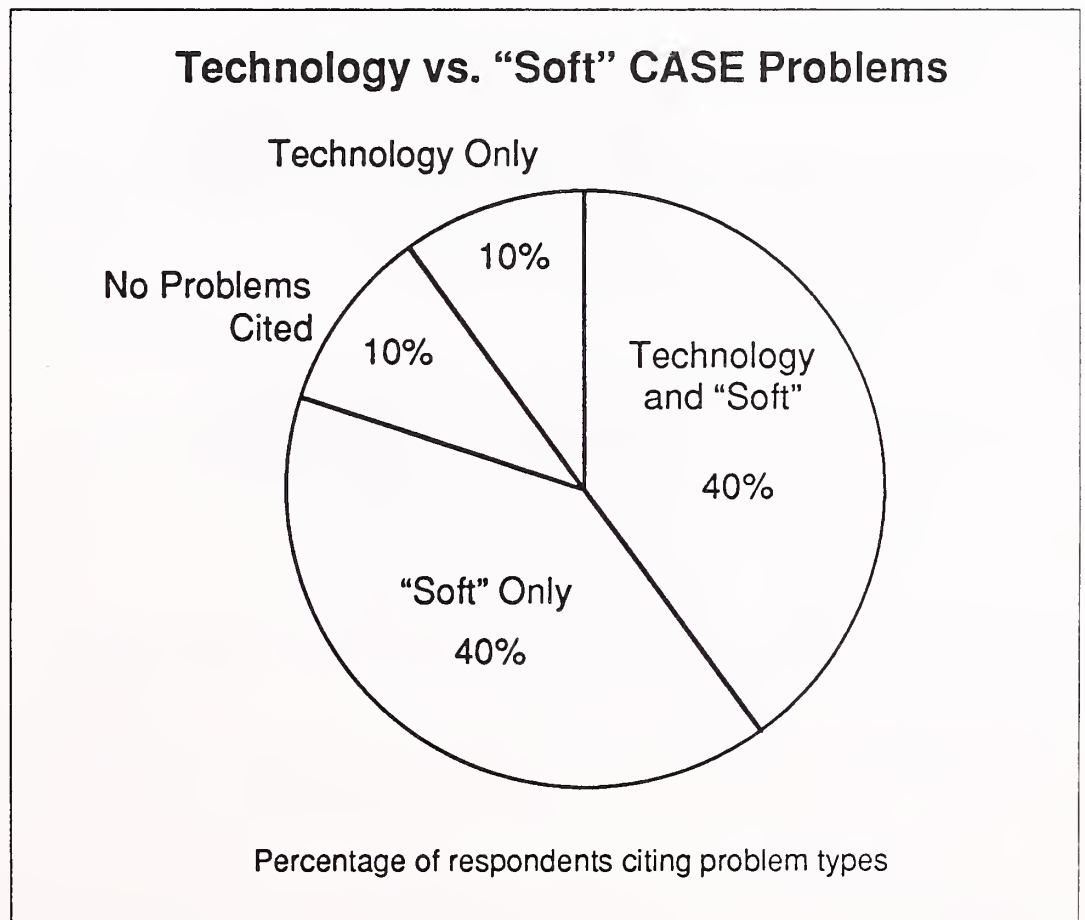
- Forty percent cited only soft issues as being important (as opposed to 10% who cited only technology issues).

These findings indicated that CASE users are not looking for and do not expect a "silver bullet" in the form of a plug-in package. Rather, they appreciate that CASE is a process, almost a way of life. Technology is a precondition for, but not a guarantee of, success.

A critical associated finding is that both vendors and IS departments place high importance on understanding the reasons for CASE success (Exhibit II-5). However, there is a significant gap between this importance and how much knowledge either vendors or IS departments now have. Filling this gap should be a critical near-term goal for most organizations.

EXHIBIT II-5

Understanding Reasons for CASE Success: Importance and Current Knowledge of Vendors and IS Departments

Vendors
- Importance: 4.3
- Knowledge: 2.6

IS Departments
- Importance: 3.8
- Knowledge: 2.8

Legend:
- Importance
- Knowledge

Scale: 0 (Low) 1 2 3 4 5 (High)
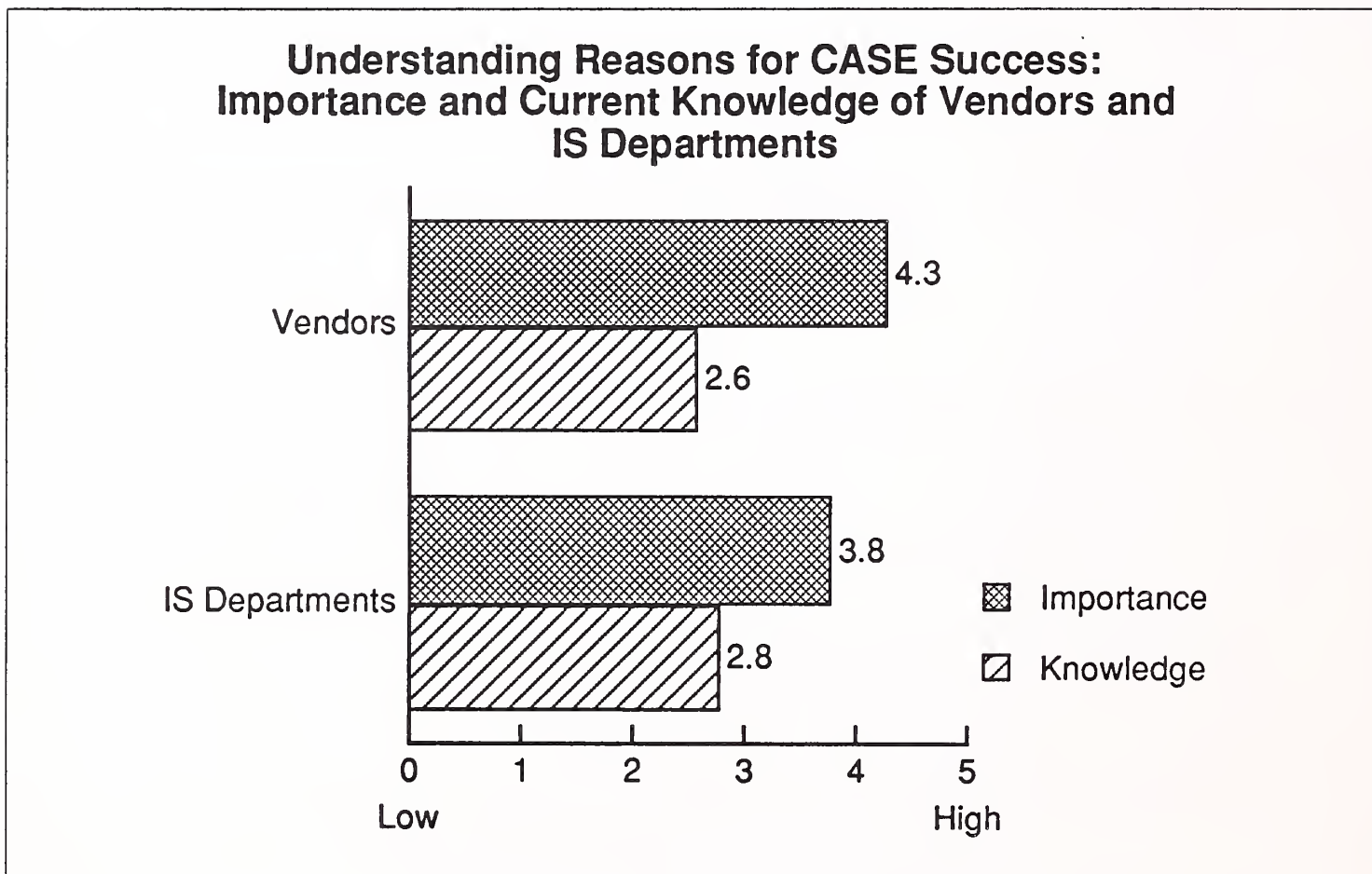
D

Re-engineering

Re-engineering, as INPUT defines it, encompasses:

- Reverse engineering (i.e., stabilizing an application for CASE-led maintenance)

- Re-used applications (i.e., where a repository is populated by the logic of an old application to which forward-engineering technology is then applied.)

Currently, CASE technology and methodology is largely forward engineering oriented.

- In 1991 this limits CASE to roughly one-third of the potential applications development market. (This market includes maintenance and modifications activities.)

- By 1996, INPUT estimates that almost half the applications development market could make use of re-engineering technology. Little more than 10% could utilize forward engineering technology, as now defined.

Consequently, the development of re-engineering technology is very important for CASE take-off in the 1990s. INPUT has assessed the technical probability of re-engineering meeting the needs of stage 4 CASE.

- There is a very high probability that back-end CASE logic can be used to populate repositories within a forward-engineering environment.

- There is almost as good a chance that a back-end to front-end link can be established within reverse engineering.

E

CASE Impact

Currently, the impact of CASE techniques and technologies within the typical corporation is quite low.

- INPUT's research shows a low level of perceived effectiveness.

- The great majority of organizations are using only a partial set of CASE tools, generally within only a part of the organization.

The result is a vicious circle (Exhibit II-6). The set of "soft" problems does not make the situation any easier to resolve.

On the other hand, a successful CASE take-off may take people by surprise, since the planning lead time for developing a CASE strategy can be lengthy. As Exhibit II-7 shows, many groups would be affected if CASE assumed a high profile.

EXHIBIT II-6

CASE's Vicious Circle and Its Effects

Secondary
Management
Emphasis

Lack of
Demonstrated
CASE
Effectiveness

Partial
CASE Use

Open Issues/
Problems
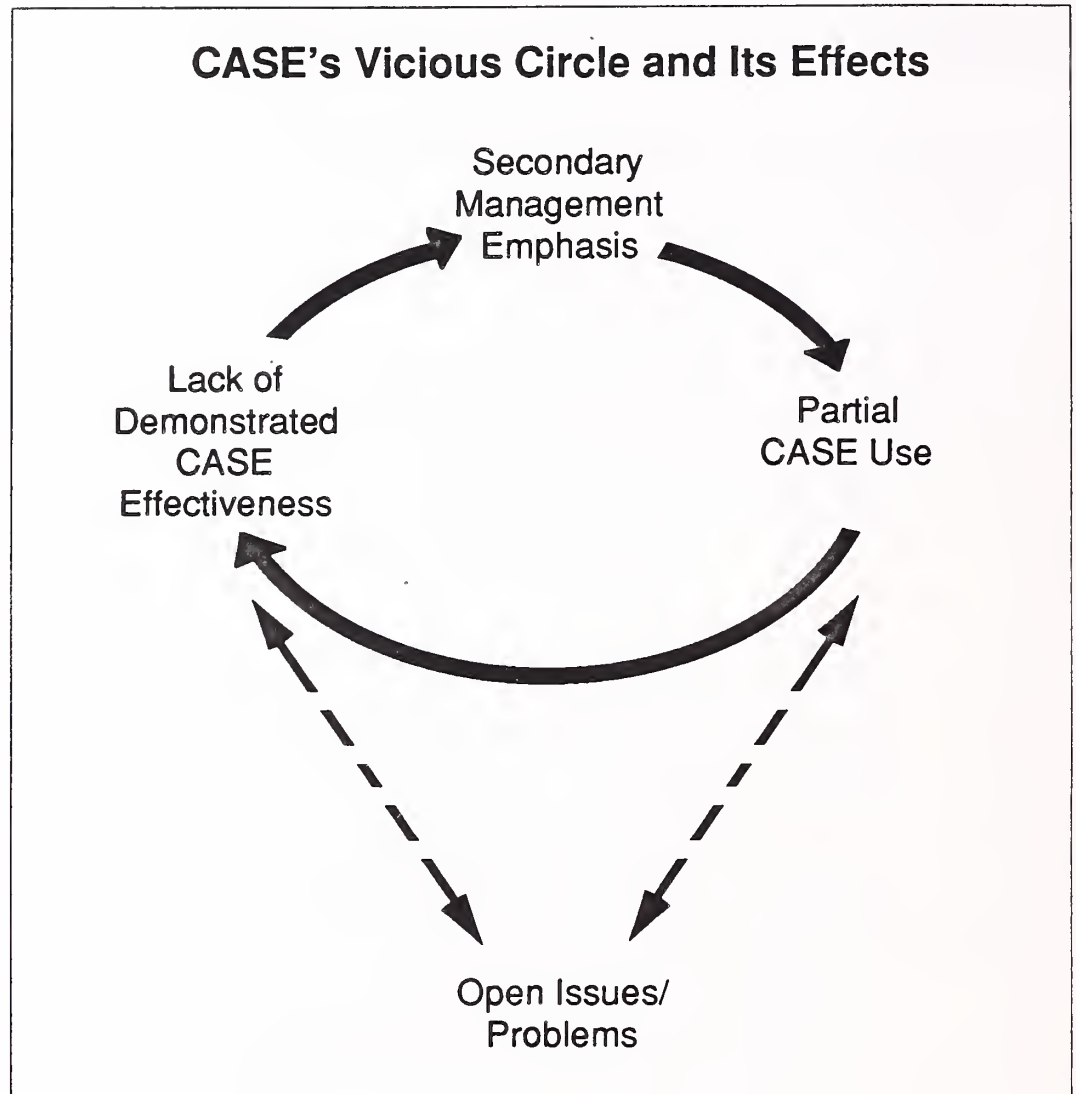
- CASE would affect how work would be conducted, which would have a significant impact on application developers, user departments, and professional services/systems integration firms. (Besides, of course, CASE product vendors themselves.)

- The roles of application developers, application software vendors, and professional services/systems integration firms would change significantly.

- Business strategies would (or certainly should) undergo very significant changes as both IS and non-IS groups worked out the implications of successful CASE (that is "faster-better-cheaper").

EXHIBIT II-7

Impact of CASE Take-Off

Potential Impact On	Corporations			Software Products Vendors			
	Planners	Appl. Dev.	User Depts.	CASE Products	Other Sys. SW	Appl. SW	Prof. Svc./ Sys. Int.
Manner in which work is conducted (tactics)		✓✓	✓✓	✓✓	✓	✓	✓✓
Organizational structure	✓	✓✓	✓✓				✓
Future role of organization	✓	✓✓	✓	✓✓	✓	✓✓	✓✓
Business strategy	✓✓		✓✓	✓✓	✓✓	✓✓	✓✓

✓ = Important Impact
✓✓ = Very Important Impact

F

AD/Cycle

AD/Cycle has revolutionized the CASE environment since it was announced in September 1989.

- It meets the market's expectations for an integrated, repository-based product.

- The equity investment strategy means that IBM can credibly offer other vendors' products as an integral part of AD/Cycle.

- Both customers and other vendors have generally welcomed the concept of a de facto CASE standard on the IBM platform.

The market acceptance of AD/Cycle is shown in Exhibit II-8, where AD/Cycle (not KnowledgeWare, etc.) is generally the planned CASE product of choice.

IBM's strategy is to use CASE to sell more, possibly much more, IBM hardware by greatly improving applications quality, timeliness, and development costs (Exhibit II-9). For IBM this is too important to leave to third-party CASE product vendors: Andersen and Texas Instruments have recently concluded agreements with DEC to move their tools from the IBM platform to the DEC platform. This shows that there are few significant impediments to redirecting a CASE tools output from one hardware/software platform to another.

EXHIBIT II-8

AD/Cycle's Market Share

Current CASE Products

IBM and Close Vendor Partners — 75

All Other Vendors — 40

Percent of Sites
(0, 20, 40, 60, 80, 100)

Planned CASE Products

AD/Cycle — 25

All Other Products — 5

Percent of Sites
(0, 20, 40, 60, 80, 100)

EXHIBIT II-9

IBM's Intermediate and Final CASE Objectives

| Rapid Development | De Facto CASE Standard | CASE Product Options | Third-Party CASE Co-option | CASE-Based Applications |

↓ ↓ ↓ ↓ ↓

Improved Application Implementation

↓

Additional Hardware Sales

By controlling AD/Cycle, IBM will offer rapid development in a context that will ensure IBM's general control of the process through:

* Maintaining a de facto standard

* Offering CASE product options within AD/Cycle (e.g., KnowledgeWare versus Index versus IBM)

* Co-opting many potential third-party competitors

* Encouraging AD/Cycle-based application software products

Nothing like AD/Cycle is yet on the horizon in the non-IBM world

G

Other Vendors

CASE product vendors and professional services/systems integration firms have important near-term decisions to make.

CASE product vendors have several options in dealing with AD/Cycle, as shown in Exhibit II-10.

EXHIBIT II-10

AD/Cycle CASE Vendor Options

Bridge

Product A

AD/Cycle

Niche

Product B
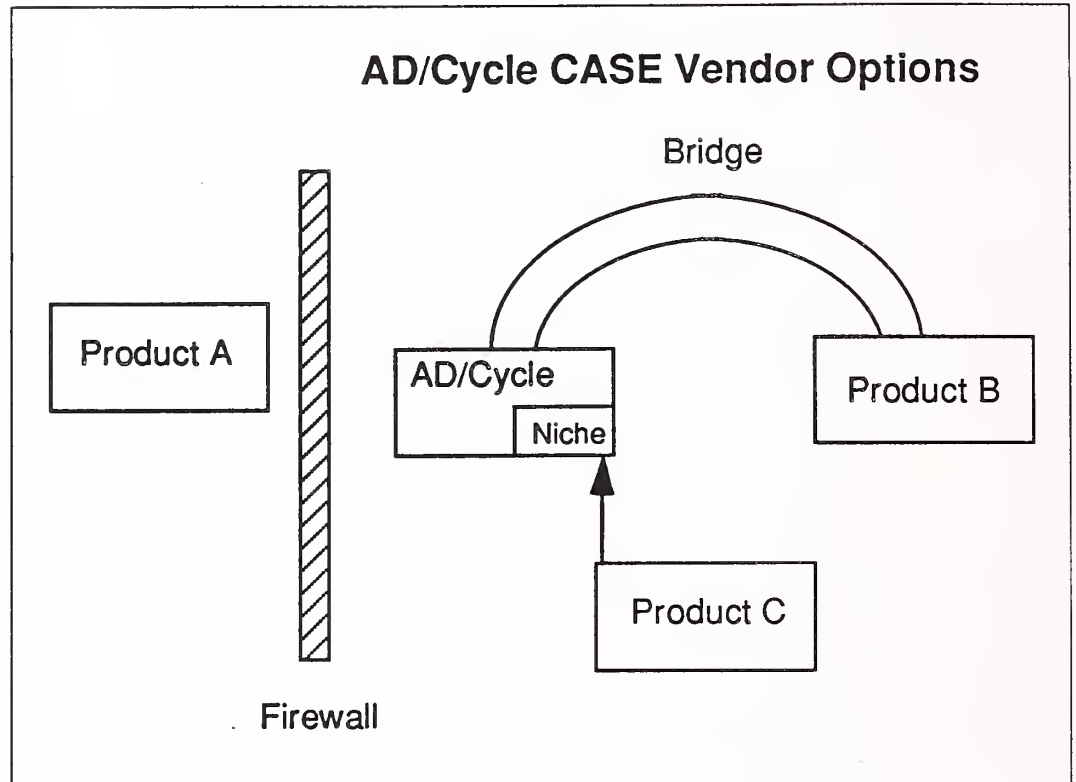
Product C

Firewall

- They can build a firewall between themselves and AD/Cycle by offering:

  - Totally separate products on non-IBM platforms with few connections to AD/Cycle. Today, fewer vendors are taking this route compared to a year ago.

  - An alternate approach is to develop products for (or ports to) non-IBM platforms, as Andersen and Texas Instruments are now doing with DEC.

- More common is the "bridge" approach, where a vendor promises to remain compatible with AD/Cycle. The long-term feasibility of this approach is difficult to evaluate now, given the unfinished aspects of AD/Cycle.

- The niche alternative within AD/Cycle is one that is only beginning to emerge. The best example of this is the Bachman Information Systems data base design and migration tools.

Professional services/systems integration firms have the most options to choose from now (see Exhibit II-11). These are very important choices since a large portion of the business of these firms is application development.

EXHIBIT II-11

Professional Services/Systems Integration Firms
CASE Alternatives
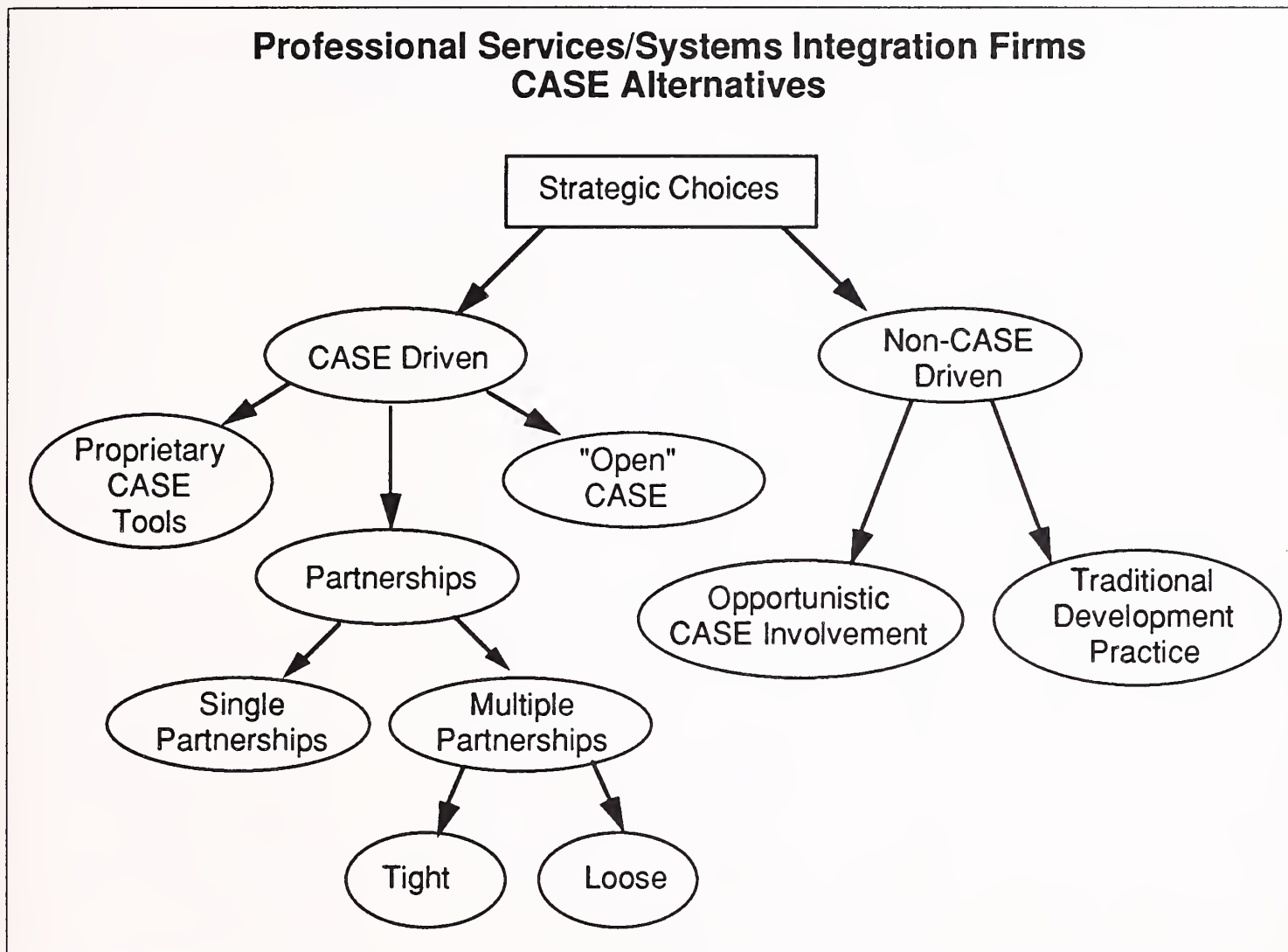
- Retaining conventional application development approaches is the easiest, but would leave such firms far behind if and when CASE does become critical.

- A CASE-driven strategy may only utilize a firm's own tools or, at the other extreme, be less selective on the specific CASE tools utilized.

  - Using proprietary tools can lead to the development of internal skills and therefore help maintain account control; this assumes that proprietary tools are competitive in the long and short run.

  - An "open" CASE approach can mean selecting the best set of tools; however, staff may not attain a critical mass of knowledge.

- There can be a great range of closeness and exclusivity in partnerships. The basic trade-off is influence on the other party versus dependency on an outside organization.

Of any group involved with CASE, professional services firms and systems integrators have the most complex and important decisions to make.

III

User Requirements

III
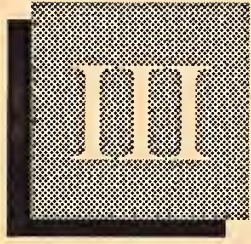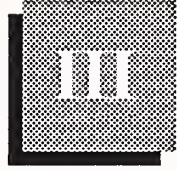
User Requirements

This chapter examines user requirements and plans. Issues analyzed include:

- The effectiveness of CASE within the broader IS context
- The current status of CASE, i.e., the extent to which it is now used
- CASE problems and related issues
- Planning for CASE

A

CASE in the IS Context

At the end of 1990, INPUT asked IS executives to rate the relative importance of the following technical and non-technical applications development-related issues:

- End-user development
- Vendor assistance
- IS funding
- IS personnel availability
- Workstation-based development
- Maintenance and re-engineering
- Distributed DBMS
- Relational DBMS
- CASE

The most important issues by far were those involving resource constraints, as shown in Exhibit III-1. They are:

- Funding
- Maintenance
- Personnel availability

EXHIBIT III-1

IS Management Ratings of Most Important Issues Connected with Systems Development

Maintenance 20%

Funding 21%

Personnel Availability 18%

16% Four Other Issues

13%

12%

End-User Development

Relational DBMS

▨ Resource constraint issues
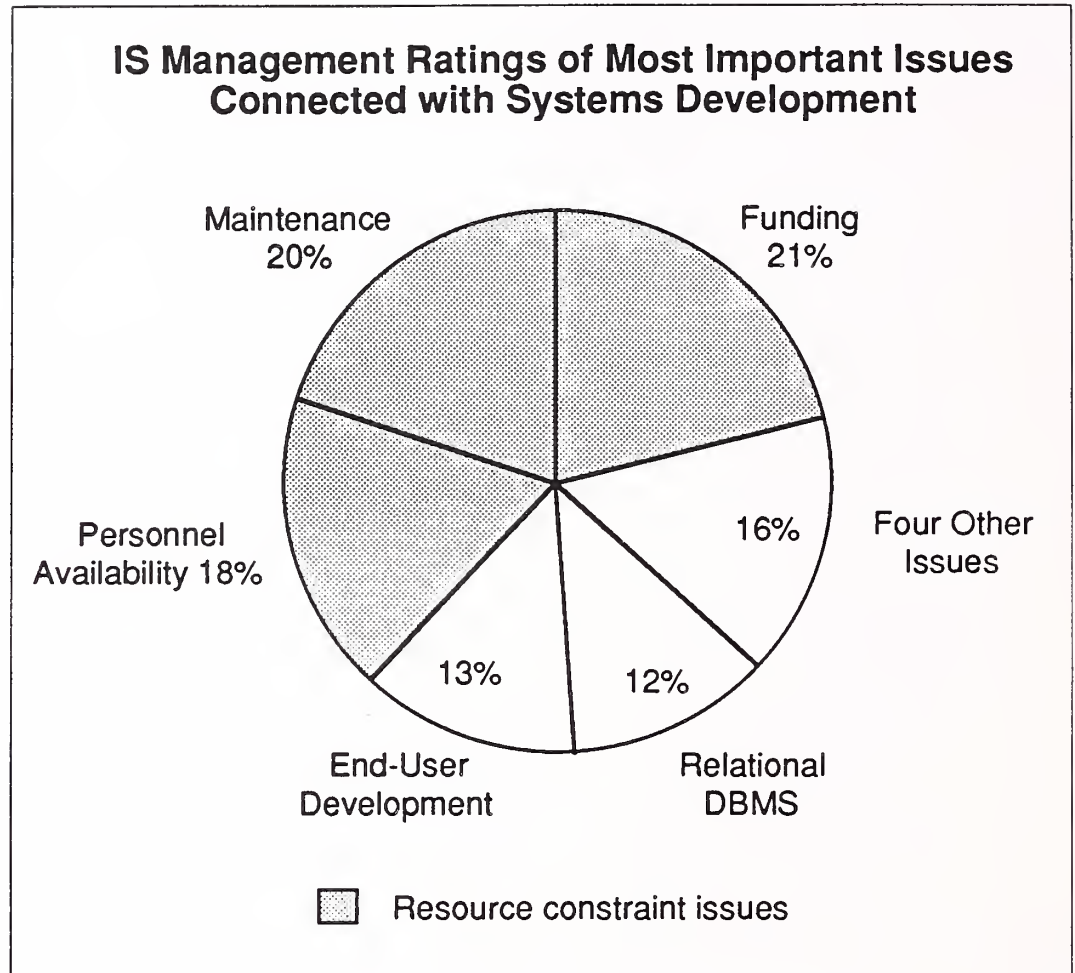
Given the realities of most IS departments, these findings should not be a surprise. What may be a surprise at first is that only 2% of the IS executives interviewed considered CASE their most important issue (Exhibit III-2); however, a majority did include CASE among their top five issues. On closer examination, not having jumped aboard the CASE bandwagon has up to this point made sound business sense:

• CASE is, in most respects, just out of its infancy. (See Chapter IV.)

• While AD/Cycle may have put a powerful "blessing" on CASE, many IS organizations spent 1990 reflecting on just what this meant.

• Most importantly, the real users of CASE, the systems development departments, have yet to see significant results themselves. Exhibit III-3 shows a rating of CASE effectiveness by IS executives. The average rating of 2.6 on a scale of 5 is not at all impressive; over 50% rated CASE progress as less than satisfactory.

This analysis is not intended to present a gloomy picture of CASE's future or technical attractiveness. Rather, it emphasizes the fact that CASE users, especially CASE decision makers, have to balance CASE issues among many other issues.

EXHIBIT III-2

Importance of CASE to IS Management

Issue	Percent
Most Important Issue	2
Second Most Important Issue	15
Third Most Important Issue	12
Fourth Most Important Issue	17
Fifth Most Important Issue	9

Percent of Respondents

EXHIBIT III-3

Effectiveness of CASE

Rating	Percentage
5-very effective	5
4	10
3	33
2	48
1-not effective	4

Percentage of Responses
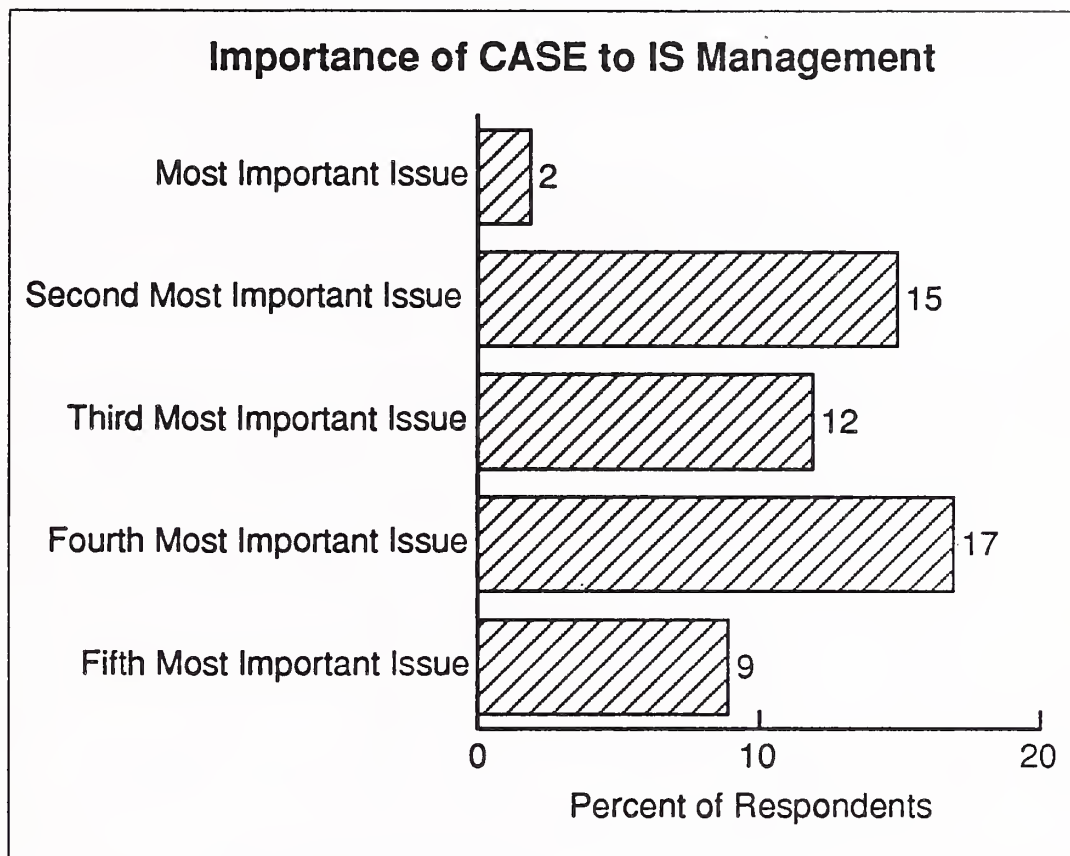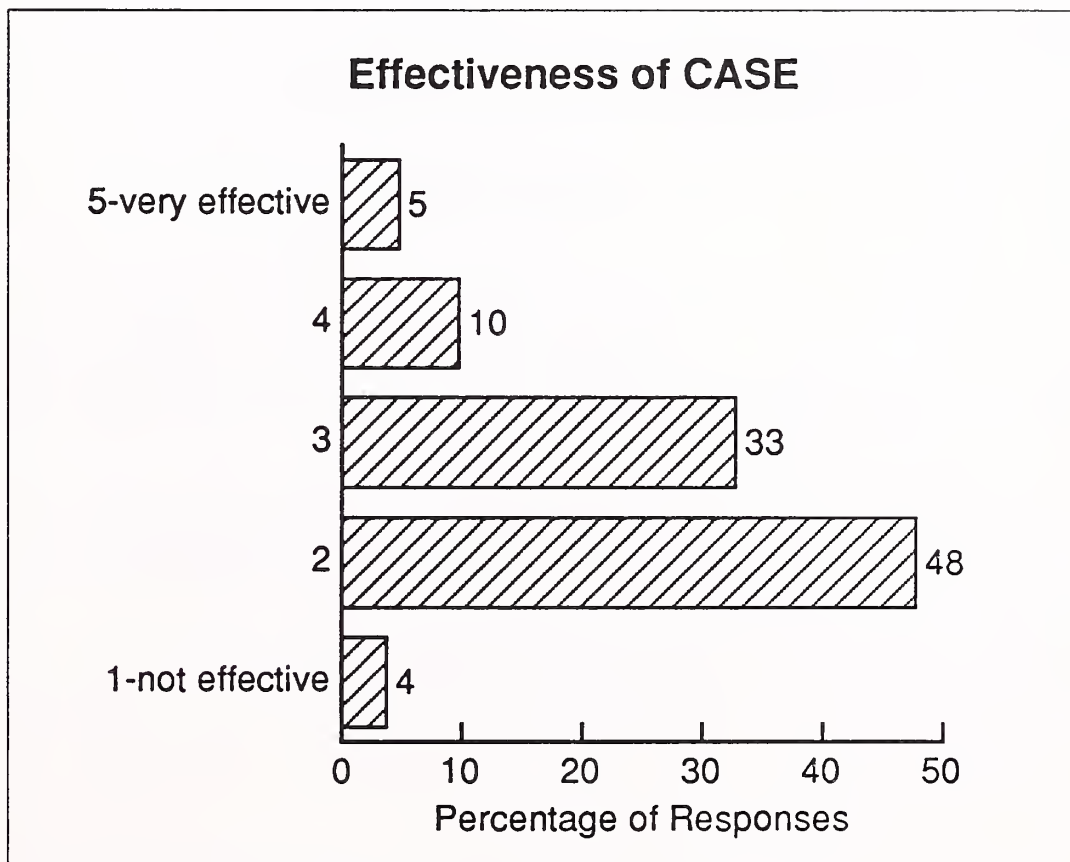
B

CASE Status

As noted in the prior section, most IS executives rate CASE effectiveness relatively low (Exhibit III-3). These low ratings of effectiveness are not a result of IS executives being unfamiliar with CASE:

- Three-quarters of large corporations interviewed by INPUT are using CASE at least partially (Exhibit III-4). Partial use can mean either using only some CASE functions for limited projects, or using limited CASE tools on a few projects.

EXHIBIT III-4

1991 CASE Use

R&D 10%

Selection 15%

Full Use 15%

Partial Use 60%
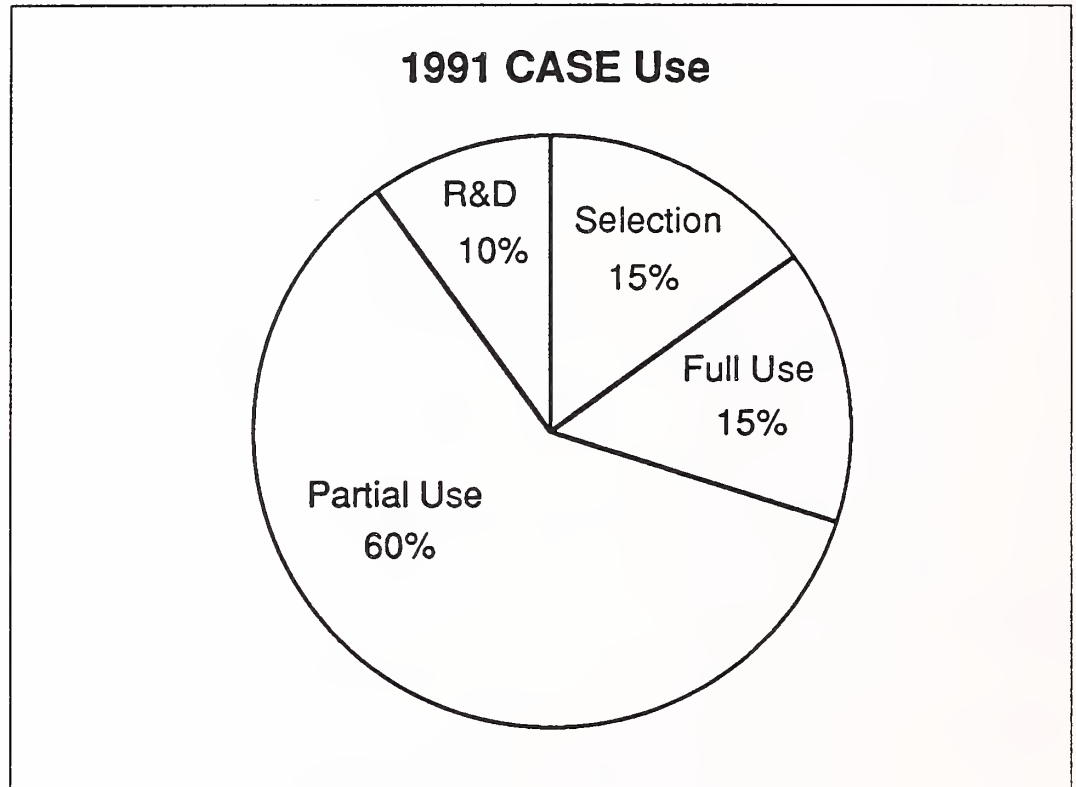
- There is still a great deal of anecdotal evidence concerning CASE "shelfware", i.e., CASE tools bought but used to a very limited extent. One large bank, for example, is said to have over 100 packages of CASE workstation software sitting unopened.

A majority of corporations interviewed are using a CASE tool (Exhibit III-5) for at least one of the three major functions of forward engineering—requirement analysis, system design, or code generation.

However, most users are still using CASE tools in an unintegrated manner (Exhibit III-6). Consequently, the situation is one where some kind of CASE tool has been acquired by most organizations. However, full use and penetration is still quite modest.

Given this environment, it is quite logical that IS executives do not yet give CASE their full attention (Exhibit III-2) nor see signs of CASE effectiveness (Exhibit III-3).

EXHIBIT III-5

1991 CASE Use, by Function

Function

EXHIBIT III-6

Degree of CASE Tool Integration

Note: Organizations in R&D or
selection phase are omitted
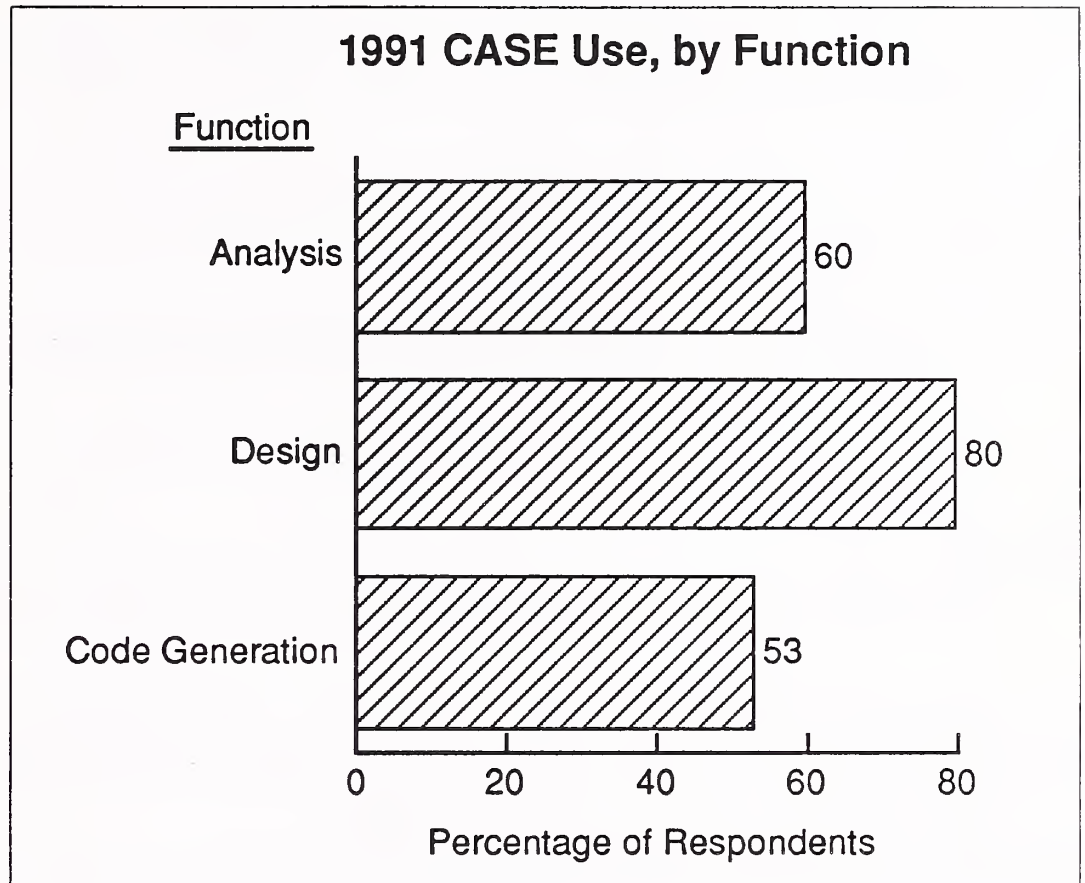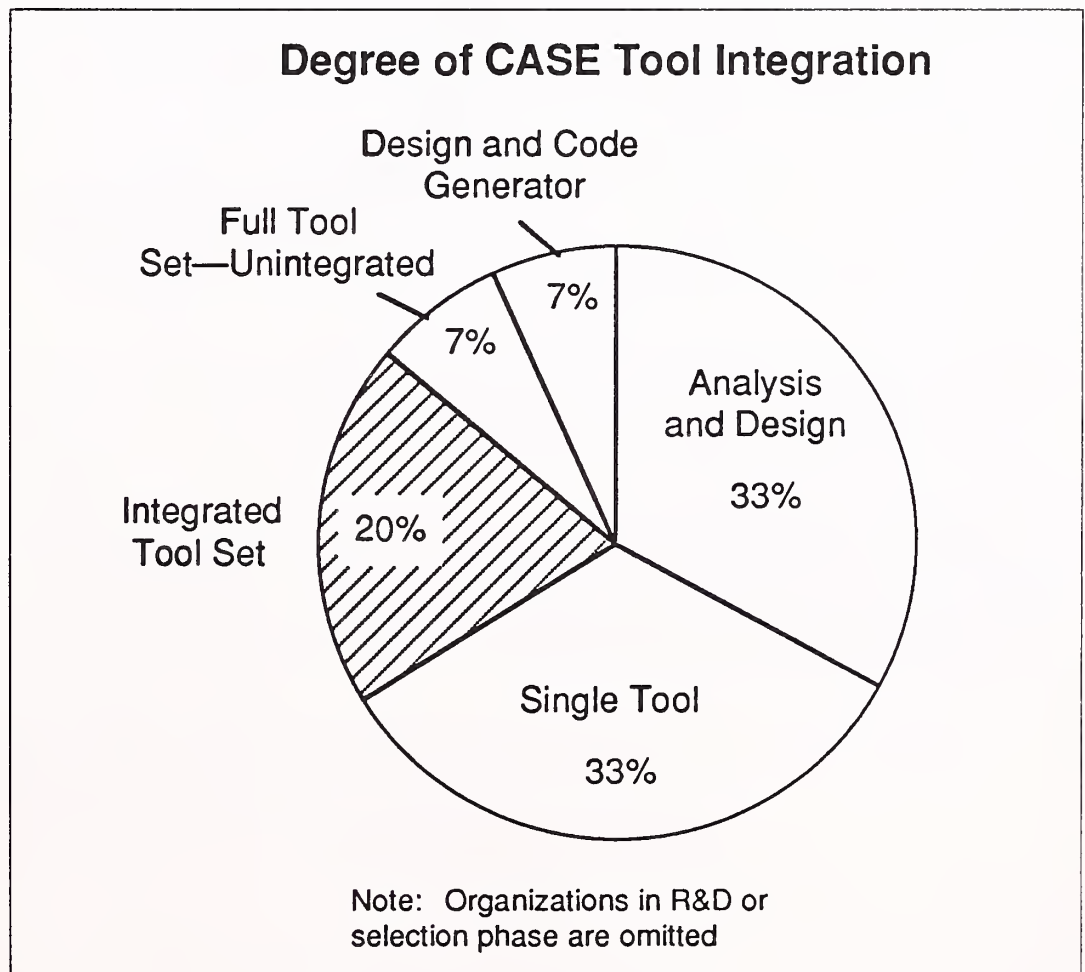
C

CASE Problems and Issues

The preceding sections of this chapter, noted the relationship between partial CASE use, lack of demonstrated CASE effectiveness, and the placement of secondary emphasis by IS management on CASE issues.

- This is often circular; when IS management attaches less importance to CASE, this can influence only partial CASE use, which in turn can create a vicious circle of low use and low expectations.

- Partial CASE use and limited CASE effectiveness are causes as well as effects of perceived CASE problems among CASE users.

Exhibit III-7 illustrates these relationships.

EXHIBIT III-7

CASE's Vicious Circle and Its Effects

Secondary Management Emphasis

Lack of Demonstrated CASE Effectiveness

Partial CASE Use

Open Issues/ Problems
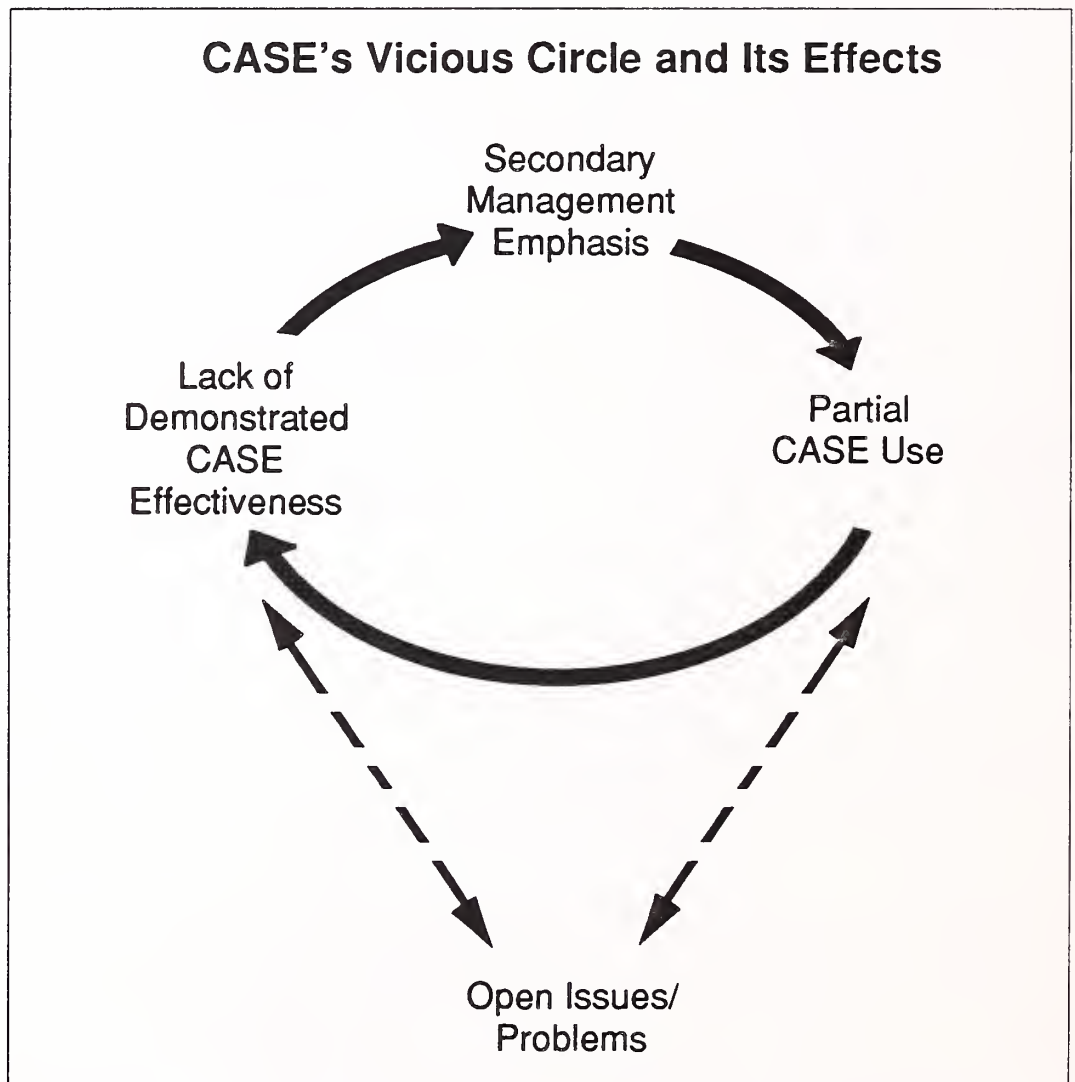
As part of INPUT's research, INPUT asked those knowledgeable in their company's CASE operations to discuss their problems and other open issues they see relating to CASE. The responses were then classified into the following categories:

- Integration of tools, processes, and methodologies

- The acceptance of CASE by the existing organizational structure and culture

- Establishing or choosing an appropriate methodology for the organization, while at the same time receiving the benefits of common standards

- Identifying appropriate levels of CASE knowledge for the organization and providing effective training

- Establishing the true costs and benefits of CASE

- Maintenance and re-engineering

- Deciding the appropriate relationship between using CASE to build applications and using software packages.

The percentage of respondents that cited each issue/problem group is shown in Exhibit III-8. The interesting thing about these issues/problems is how they can be divided into technology issues (integration, re-engineering and, to a large degree, packages versus CASE) and the "soft" issues (organization/culture, knowledge/training, methodology/standards, and cost/benefit).

- Only 10% of respondents saw their problems as involving *only* technology issues. (Exhibit III-9)

- In contrast, 40% cited no technology issues but only "soft" issues. (Only 10% cited no problems at all.)

- While half cited at least one technology issue, 80% cited at least one "soft" issue.

A very important conclusion from this is that CASE is *not* perceived as being primarily a technology question. In general it is more important to deal with the context in which CASE will succeed (or fail).

- The "soft" issues revolve around the organization/culture question (Exhibit III-10). Methodology and training must relate to the specific corporate context if CASE is going to succeed. Cost/benefit and other issues are also tied to the organization/culture question, although not always as tightly.

EXHIBIT III-8

CASE Problems and Unresolved Issues

Bar chart titled "CASE Problems and Unresolved Issues" showing Percentage of Respondents:

Category	Percentage
Integration	40
Organization/Culture	35
Methodology/Standards	30
Knowledge/Training	30
Cost/Benefits	25
Re-engineering/Maintenance	15
Packaged Applications	10
Other	15

Percentage of Respondents

Note: Total of percents is more than 100% due to multiple responses

EXHIBIT III-9

Technology vs. "Soft" CASE Problems

Technology Only

No Problems Cited

10%

10%

Technology and "Soft"

40%

"Soft" Only

40%

Percentage of respondents citing problem types

- Similarly, integration is the key issue in technology (Exhibit III-11). It was perceptive that so many respondents identified the general issue (integration) rather than one of its near-term manifestations (repositories) as being the issue.

One of the critical issues for corporations is to understand the precise reasons for CASE success and failure.

- IS departments state that understanding the concrete reasons for CASE success and failure is very important to them (Exhibits III-12 and III-13). However, IS departments are not nearly as satisfied that they are receiving the kind of information that will allow them to understand the constituents of success and how to apply them.

EXHIBIT III-10

"Soft" Issues—Relationships

Methodology/ ⟷ Knowledge/
Standards (30%)   Training (30%)

Organization/Culture (35%)

Cost/Benefit   Other [Strategy,
(25%)   Applications] (10%)

⟷ Tight Linkage

⟵ - - ➤ Loose Linkage

Note: Percents refer to proportion of respondents citing issue

EXHIBIT III-11

Technology Issues—Relationships

Integration
(40%)

Re-engineering
(15%)

Packaged
Applications
(10%)

Other (Repository)
(5%)

◄━━━━► Tight Linkage

◄- - -► Loose Linkage

Note: Percents refer to proportion of
respondents citing issue

EXHIBIT III-12

**Understanding Reasons for CASE Success:
Importance and Current Knowledge of Vendors and
IS Departments**

Vendors — 4.3 / 2.6

IS Departments — 3.8 / 2.8

0 1 2 3 4 5
Low   High

Importance
Knowledge

- This gap is even wider regarding the need to understand the causes of CASE failure.

- CASE users and prospects are cautious concerning vendor-sponsored illustrations of CASE success. However, such illustrations are better than no information at all.

- Analyses of CASE failure (absolute or relative) are much harder to come by than stories of success; no vendors and few corporations have any incentive to disclose their problems, even if others will benefit from their mistakes.

• The importance and knowledge ratings supplied by vendors closely mirror those of IS departments, showing among other things, that:

- Vendors also recognize that there is a problem that is not being addressed.

- Vendors have no secret store of knowledge being withheld for competitive reasons.

EXHIBIT III-13

Information on CASE Failures: Importance and Current Knowledge of Vendors and IS Departments
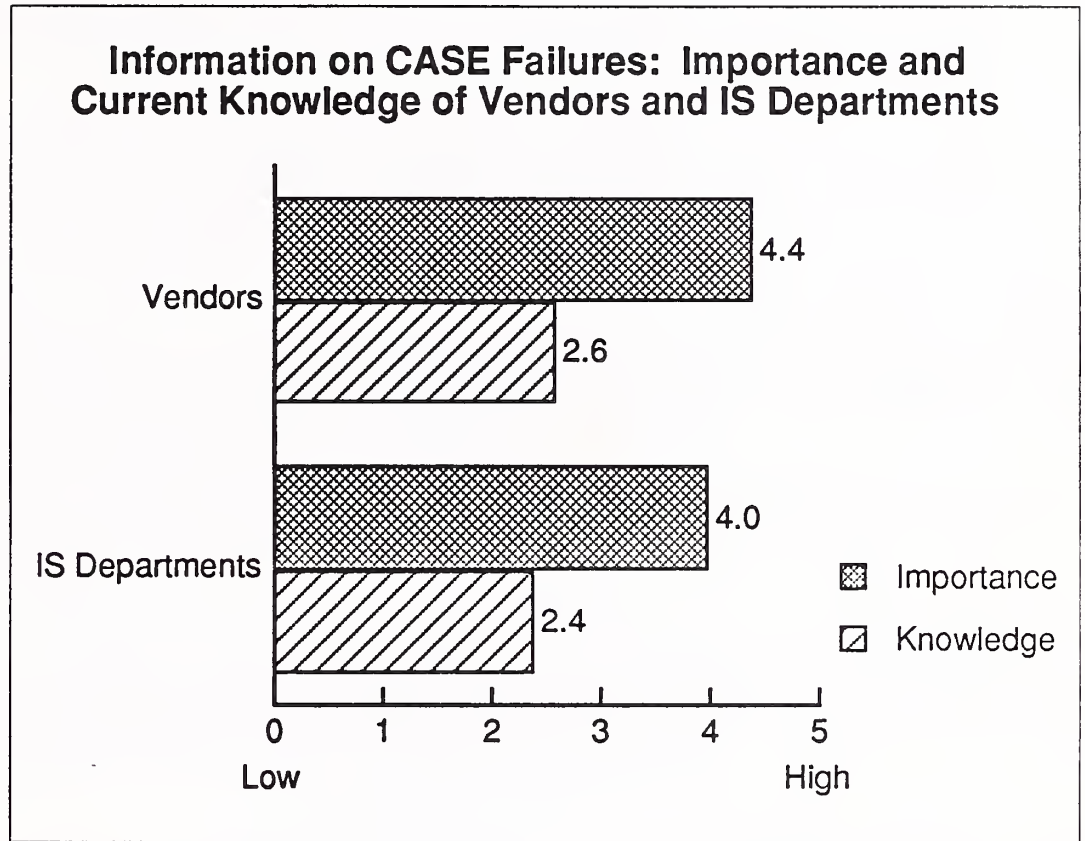
The more abstract "critical CASE success factors" (Exhibit III-14) track fairly closely to the need for success/failure analysis.

EXHIBIT III-14

Information on Critical CASE Success Factors: Importance and Current Knowledge of Vendors and IS Departments
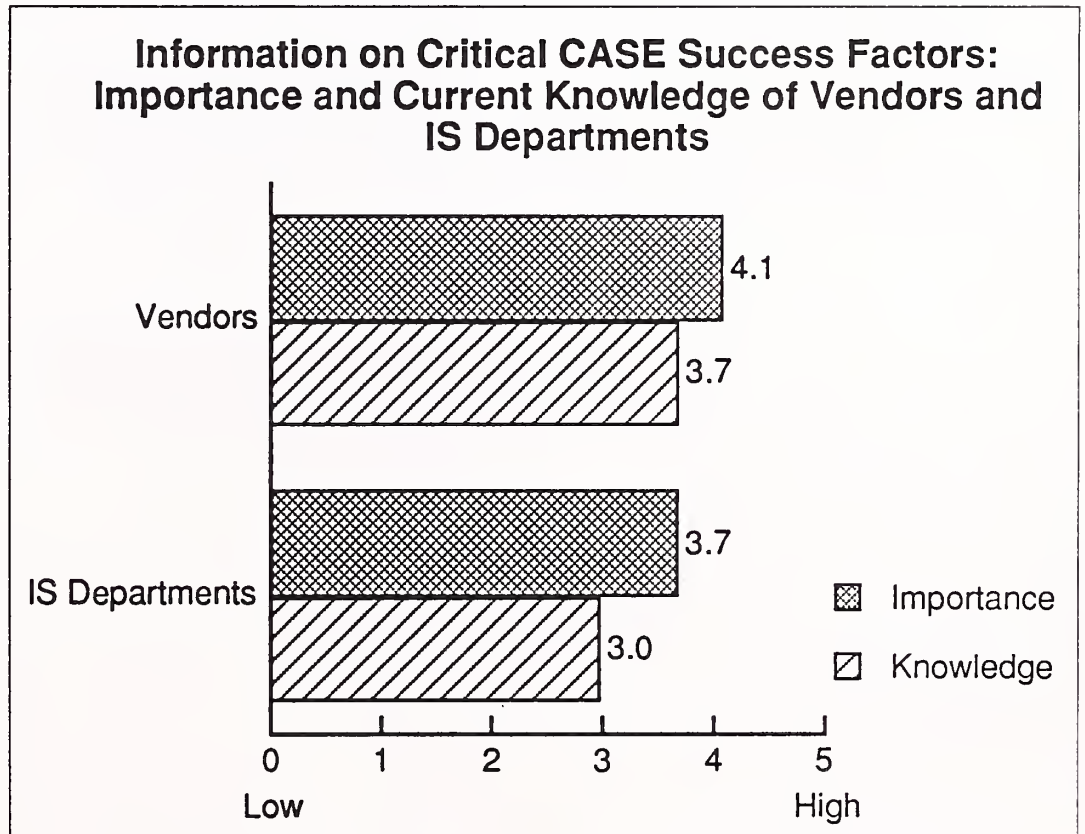
- The gap among IS departments between importance and knowledge is a little less pronounced.

- However, vendors profess to be more satisfied with the information they have available. Vendors may in fact know more than the typical CASE client; however, it is likely that vendors know *general* success factors and not necessarily those applicable to a specific user organization.

D

CASE Planning

IS departments are at a crossroads in their CASE efforts. Even though CASE activities have not produced many results so far, IS departments are quite aware of the potentially favorable impact of CASE on productivity, system quality, applications design, and end-user involvement. This section will report on some of these expectations as well as highlight the gaps in knowledge that impede progress.

Both vendors and IS departments see CASE technology as having a fairly significant impact on the applications design process generally, although both are not too satisfied that they understand the exact form this will take (Exhibit III-15).

EXHIBIT III-15

Impact of CASE Technology on Applications Design: Importance and Current Knowledge of Vendors and IS Departments
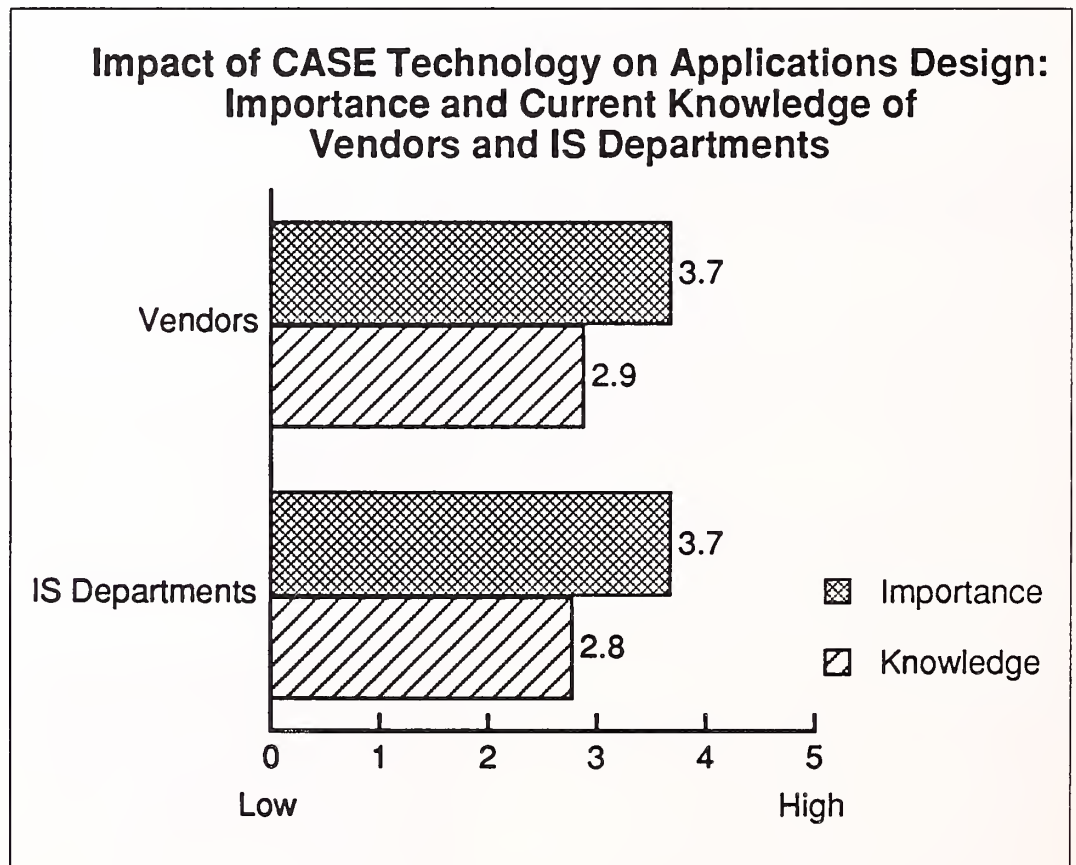
- In large part this is because the relationship of applications design methodology to the underlying CASE technology is still not clear. CASE vendors profess to be "methodology-neutral."

- This causes many IS organizations to, at best, re-invent the wheel. In reality most of the wheels invented are of different shapes and sizes.

IS departments see the potential impact on end users as being even more important than the impact on the applications design process (Exhibit III-16). However, the gap between the perceived importance and their understanding of how this will come about is very wide.

- Anyone who has seen a business analyst and a systems analyst sit side-by-side at a workstation while working through applications logic can understand the enormous promise.

- However, making this a day-to-day reality is difficult. Even more difficult is the task of incorporating organizational, methodological, and training changes needed to provide successful CASE implementations consistently.

- There are practically no "how-to's" in even a crude form to assist corporations in making extensive end-user involvement a reality.

Vendors place considerably less importance on end-user involvement than IS departments (Exhibit III-16). In INPUT's view this reflects the technology/tool focus of most vendors and the inability of today's products to treat the business analyst user as part of the design process.

EXHIBIT III-16

**CASE Impact on End-User Departments:
Importance and Current Understanding of Vendors
and IS Departments**

Vendors
- 3.3
- 2.3

IS Departments
- 3.9
- 2.4

⊠ Importance
☑ Understanding

0   1   2   3   4   5
Low   High
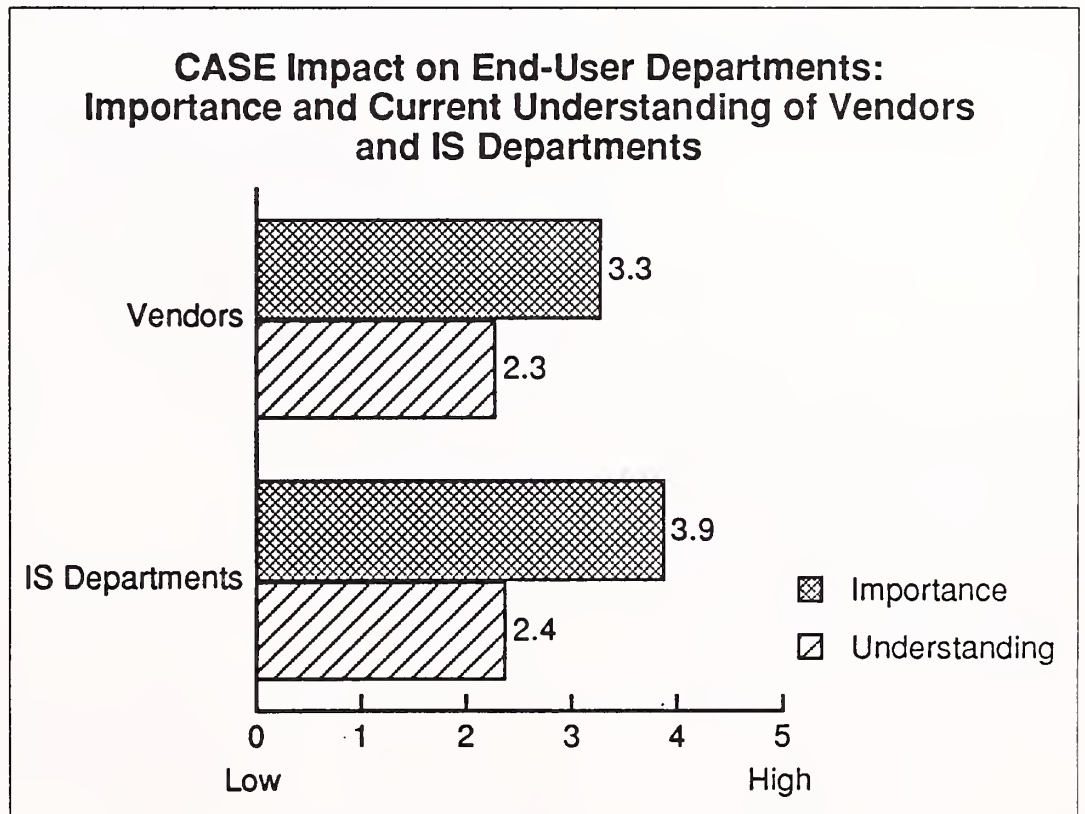
E

Interim Conclusions

It is fair to say that much of CASE planning has been provisional up to now, as firms attempt to:

• Understand the technology

• Fit CASE technology into their own systems objectives

• Adjust CASE-related objectives to the broader corporate environment and goals.

Part of the difficulty in adjusting to CASE may be a result of the decentralization of many IS functions in the last decade. Organizational decentralization and CASE integration may be at least partially in conflict. This subject needs more study.

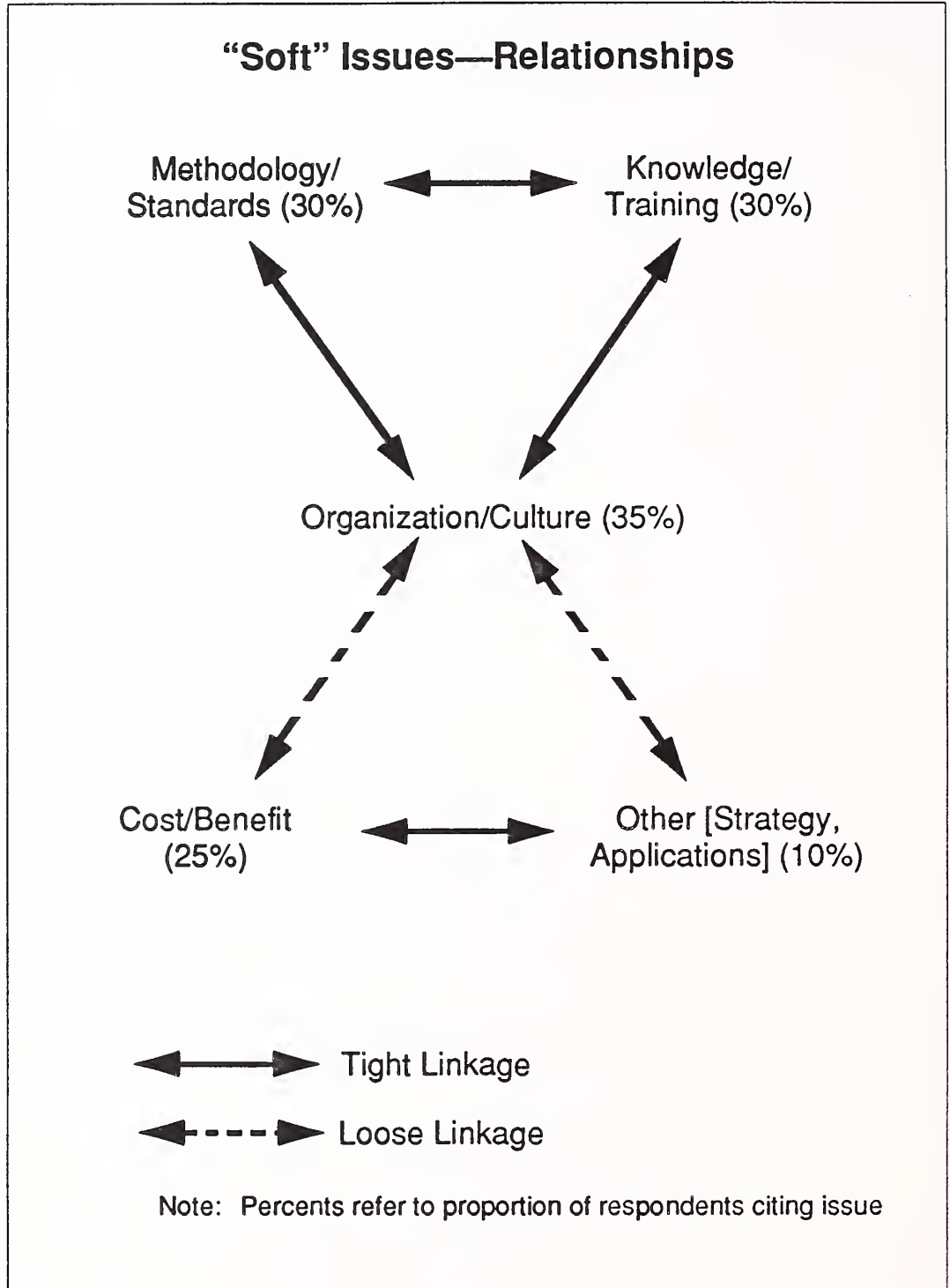According to INPUT's research, only one-third of firms feel comfortable with the CASE-related plans they have already made (Exhibit III-17).

EXHIBIT III-17

Corporate Expectation of Making Changes to CASE Plans

Not Sure, Don't Know 25%

No Changes Expected 35%

Changes Expected (40%)

Other Technical Changes [Non-Vendor-Specific] (20%)

Adopting AD/Cycle (20%)
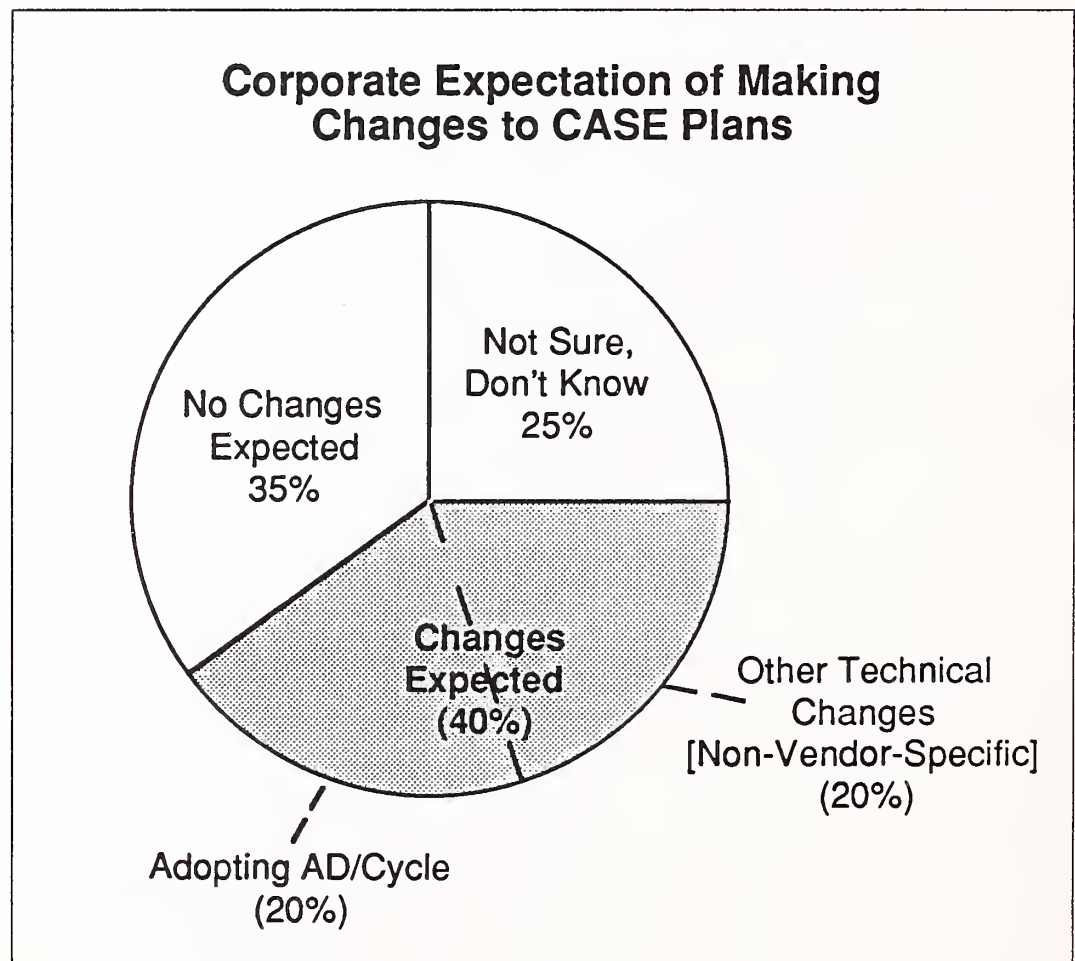
- One-quarter are not sure of their position.

- Forty percent expect to make changes; half of this group (20% of all respondents) have already decided to adopt AD/Cycle.

This last finding certainly indicates the power of IBM's marketing efforts, but it shows considerably more:

- AD/Cycle embodies the integration important to so many IS organizations.

- The repository concept is very powerful and finds immediate appeal.

- AD/Cycle shows IBM's enormous commitment to CASE concepts; there is no question of AD/Cycle's staying power.

The CASE community had for some time before the AD/Cycle announcement been looking for some entity to bring order to the overall CASE environment. As the impact of AD/Cycle began to become clear in the course of 1990, INPUT had dialogs with major vendors about their response to AD/Cycle; the reactions were virtually identical:
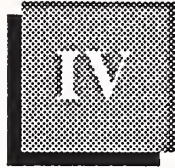
- This was the announcement that the CASE community had been waiting for to bring order to the CASE marketplace.

- Even firms most damaged by AD/Cycle stated that the introduction of AD/Cycle was an absolutely necessary and desirable event.

The next chapter, which analyzes CASE technical issues, provides more background on why AD/Cycle has been received so positively.

IV

The Impact of Technical Issues

IV

The Impact of Technical Issues

Systems engineering, and its manifestation as CASE, can sometimes
appear to be an end in itself. Academics and researchers (as well as self-
interested vendors) discuss at length their positions on such issues as
methodologies, data and process representation, the place for object-
oriented design, information modeling alternatives, etc. These are all
important issues. However, the ultimate justification for CASE is how
useful it is to application developers.

INPUT has found that three straightforward questions serve as a good test
for judging CASE technical issues against the demands of the real world;
these questions are shown in Exhibit IV-1.

EXHIBIT IV-1

CASE Technology Assessment Criteria

- Will the particular technology solve important, real
  problems?

- How adaptable is the technology to current
  environments? Are there many overhead or
  migration resources required to take advantage of
  the technology?

- How much investment—in people, dollars and
  time—is required before significant benefits can be
  expected?

This chapter will examine three issues that relate to CASE technical issues:

- Integration
- Re-engineering
- Distributed applications development

Each of these technical issues will be judged, implicitly and explicitly in terms of the three questions in Exhibit IV-1.

A

Stages of Integration

Integration has been a key CASE issue from the beginning. Dealing with integration—or, more usually, inadequacy in dealing with it—has been an important determinant of CASE progress and acceptance.

INPUT's analysis categorizes CASE into four stages, as shown in Exhibit IV-2:

EXHIBIT IV-2

CASE Stages

④ — — — →
Repository-Based Environments

③ — — — — — →
Repository-Based Tools

② — — — — — —
Linked Tools

① ————— — — — —
Standalone Tools

| | | | |
1980   1985   1990   1995

Key

◯ Stage

——— Dominant Period

— — — Secondary Period

Note: Does not include R&D period for any stage
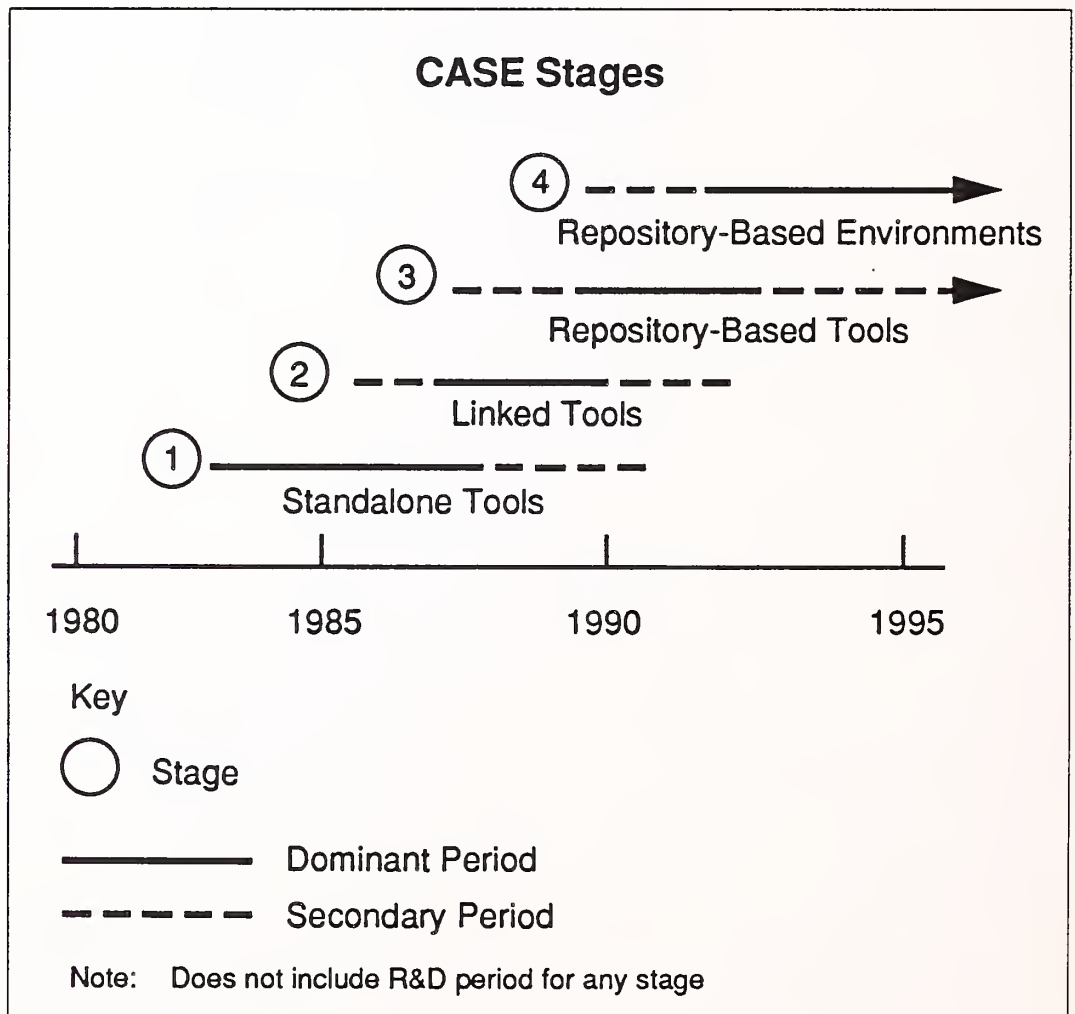
- Each stage has a beginning and, at least for the first two stages, an end.

- Each stage has a period during which it is dominant, as well as secondary period(s), that represent that stage's ascent or decline.

Stage 1: Standalone CASE Tools

This is by now CASE's pre-history, but it is still important for an understanding of overall CASE trends. Both front-end and back-end CASE tools were important in Stage 1 (see Chapter 1 for definitions of CASE tools). However, front-end tools became especially prominent due to the following interrelated developments.

- Graphics-oriented workstations for representing data and process relationships became increasingly capable and inexpensive; originally, specialized graphics workstations were used, but soon standard PCs were acceptable.

- Information modeling methodologies became increasingly sophisticated as well as more practical.

- While it cannot be proved conclusively, it seems apparent in retrospect that the technological and conceptual developments were mutually reinforcing.

Stage 1 front-end technology could soon produce analysis and designs that were:

- Graphical

- Self-documenting

- Most importantly, sharable with non-technicians (e.g., business analysts)

Back-end technology during Stage 1 did not represent the potential breakthrough that Stage 1 front-end technology did. Back-end technology represented iterative improvements to traditional coding, but was still:

- Character based

- Procedural (in concept)

- Code oriented

- Inaccessible to non-technicians

- Most importantly, the output of traditional code could be (and often was) independently maintained.

If the generated code could be maintained independently, then there could not be ironclad assurance that the application-as-documented (i.e., the generator input) would be the same as the application-as-modified (i.e., the working code). This represents the continuation of the age-old "patch" problem, where important changes are not kept track of coherently. Library control is a fall-back position but is primarily an audit function rather than an assistance in development.

The largest problem with Stage 1 tools is that each was isolated from the other, as shown in Exhibit IV-3:

EXHIBIT IV-3

Stage 1 (Mid-1980s) Standalone CASE Tools (Schematic)

F   K   X

G   L   Y

H   M   Z

N

Note: Letters within symbols refer to individual vendors

Methodologies

Analysis/design tools

Generators
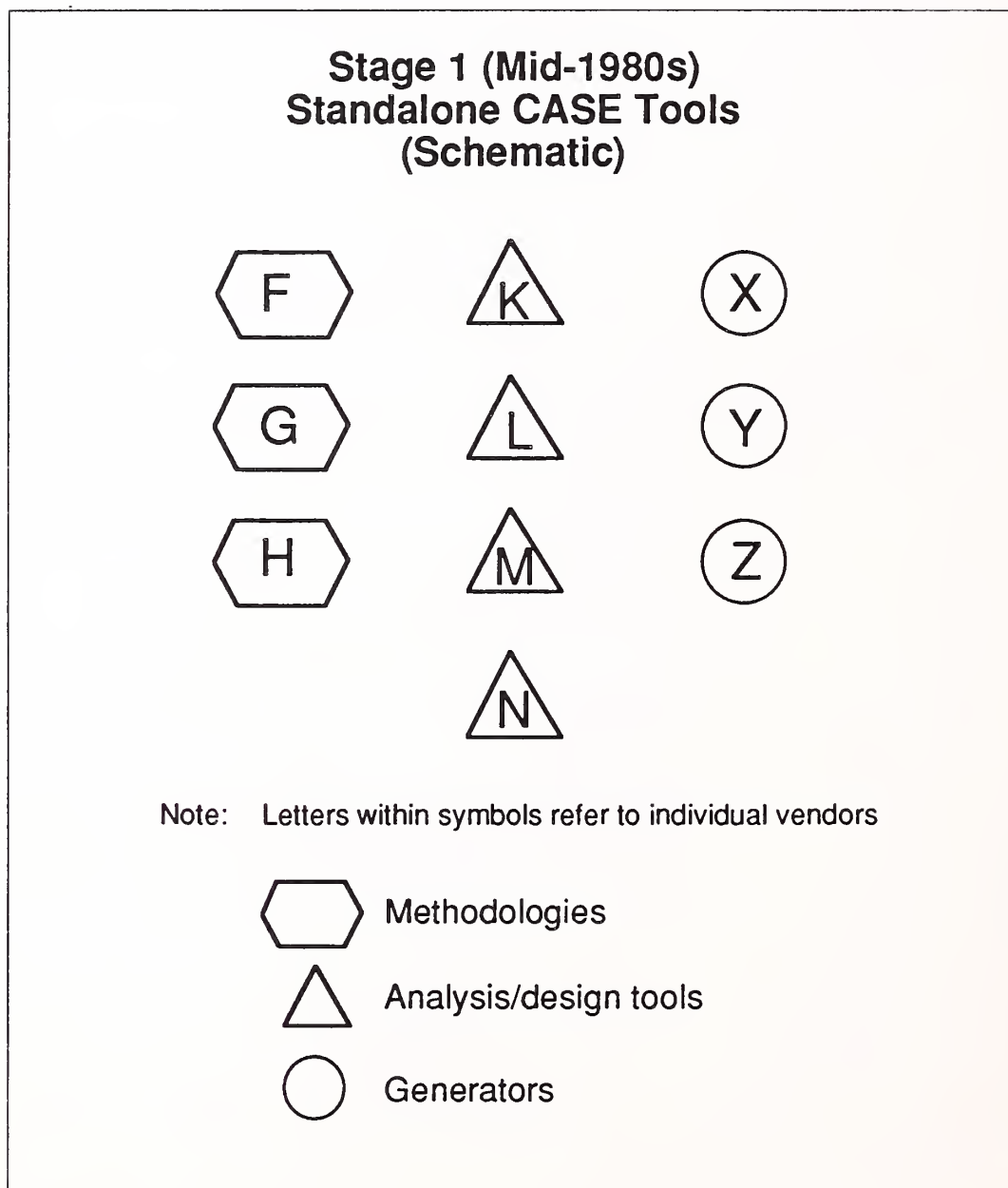
- It was up to the customer, with varying degrees of assistance from vendors, to tie tools together. Even if it were feasible for a customer to do so (and for all but the largest IS organizations it would not be), this would rarely be a worthwhile use of resources.

- Consequently, during this period, CASE tools were almost always merely adjuncts to business as usual—perhaps producing pretty-looking documentation, but documentation just as likely to become instantly obsolete as traditional documentation.

- Stage 1 was the Golden Age of CASE shelfware, as customers found that making CASE useful was far more difficult than they had led themselves to believe.

Stage 2: Linked Tools

As Stage 1 developed, the defects inherent in having islands of CASE automation became clear to theorists, vendors, and customers (or potential customers). The most straightforward solution was to have the tool vendors take over the responsibility for developing links between tools for exchanging information needed for application development. In the mid/late 1980s there was a burst of announcements from tool vendors that they would support interfaces between one another. This was very desirable in that it enabled customers to focus on applications development rather than development of CASE linkages.

However, after a short time it became clear that announcing, or even initially developing an interface, was not a complete answer:

- There were no vendor-neutral information interchange standards.

- Information often had to be simplified (and value lost) in being translated from one dissimilar architecture to another.

These technical issues were serious and would make progress difficult at best. However, business-related factors were even larger stumbling blocks:

- The biggest problem was the sheer number of CASE tool vendors. At one point INPUT counted over 140 vendors offering at least twice that number of products. Exhibit IV-4 is a greatly simplified schematic of the virtually impossible challenges facing vendors attempting to form linkages with each other:

  - How does one keep up with new versions?

  - How should a partner be picked—on technical merit or market strength?

EXHIBIT IV-4

**Stage 2 (Late 1980s)
Linked CASE Tools (Schematic)**

——————— Ad hoc, vendor-supplied linkage

• • • • • • Intravendor linkage
(e.g., acquisition)

Note: Letters within symbols refer to individual vendors

☐ Project management systems

⬡ Methodologies

△ Analysis/design tools

◯ Generators
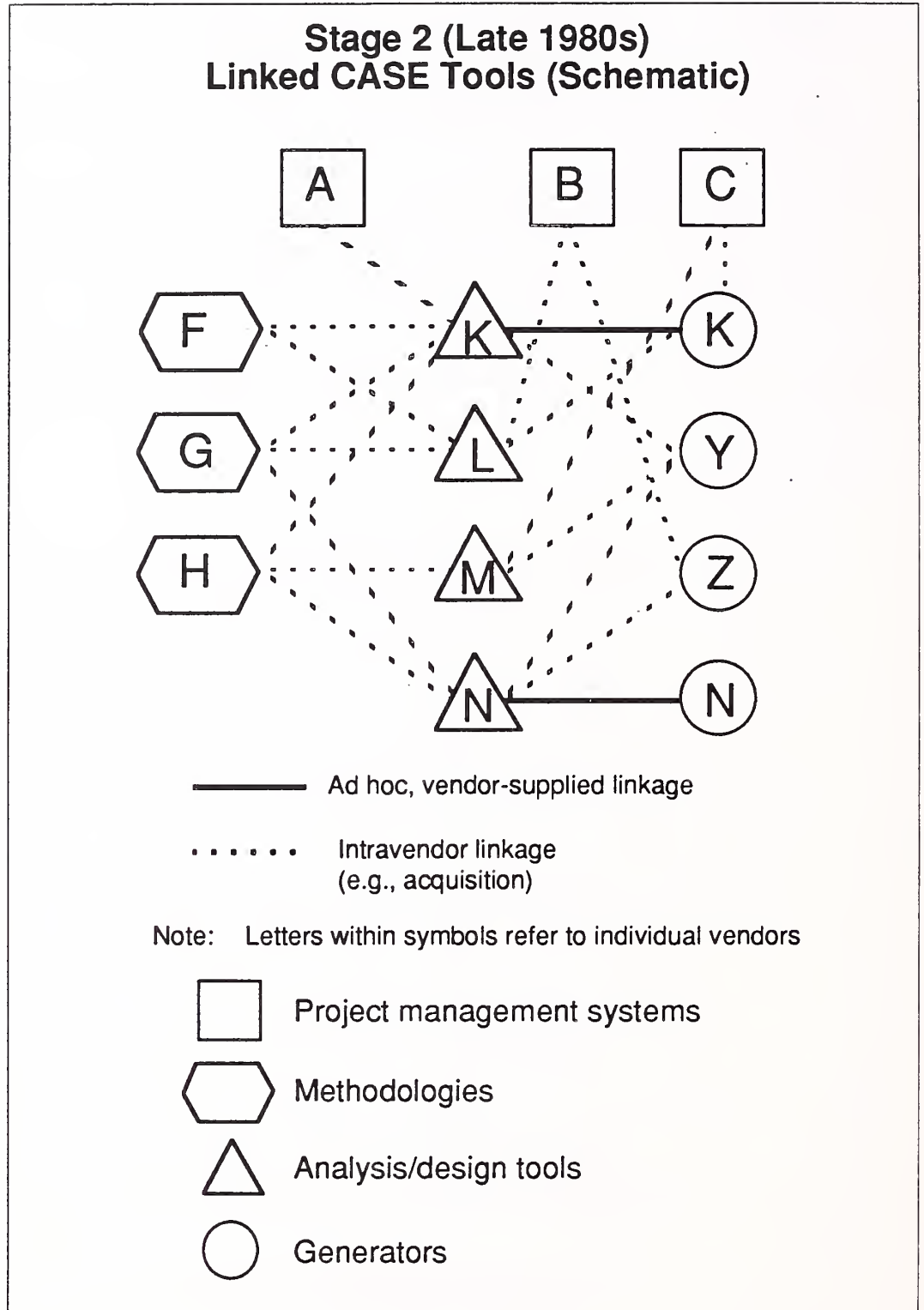
- What if a potential partner is unwilling to cooperate?

• Some vendors formed semiformal relationships, but most were promiscuous. Some marriages (i.e., mergers) occurred, but the total number of CASE tool vendors did not decline significantly.

Stage 2 brought no more order into the marketplace, and possibly less, than Stage 1. Customers (or more accurately, potential customers) were as confused and cautious as before:

- Some vendors were beginning to emerge as leaders, through some combination of name recognition, size, technical attractiveness, or market power.

- However, it was a rash (or very self-confident) IS department that would stake very much on a particular vendor (or combination of vendors) emerging victorious. To place a losing bet might well have meant wasted CASE development time and resources.

The risks in Stage 2 were often portrayed as opportunities; linkage, for example, was described as a chance for customers to select the "best of the breed" of different CASE tools. In a more mature market this might have been possible; as it was, Stage 2 was virtually doomed to failure from the start because of the enormous number of CASE products to choose from.

Stage 3: Repository-Based CASE Tools

Stage 3 also grew out of the frustrations with the isolated CASE tools of Stage 1. To oversimplify, linkage, rather than being secondary (as in Stage 2), was viewed as central to making the CASE concept function.

- Vendors stopped looking for a means of transferring information on data elements, data relationships, and logical processes between application development functions (i.e., CASE tools).

- Instead, information interchange became the center of the CASE activities. This eliminated the complexities, redundancies, and synchronization problems inherent in multiple linkages.

- The contrasts between the two approaches are shown in Exhibit IV-5. ("Repository" is used in Exhibit IV-5 because that term has the most currency.) The repository concept has a simplicity and economy that would have ultimately made Stage 2 obsolete even if

    - There had been an order of magnitude fewer CASE vendors competing in Stage 2

    - IBM had not emphatically endorsed the repository concept (and made the investments to make it real)

The term repository is so closely identified with IBM and AD/Cycle that it is sometimes forgotten that IBM

EXHIBIT IV-5

Linkage vs. Repository in Information Exchange
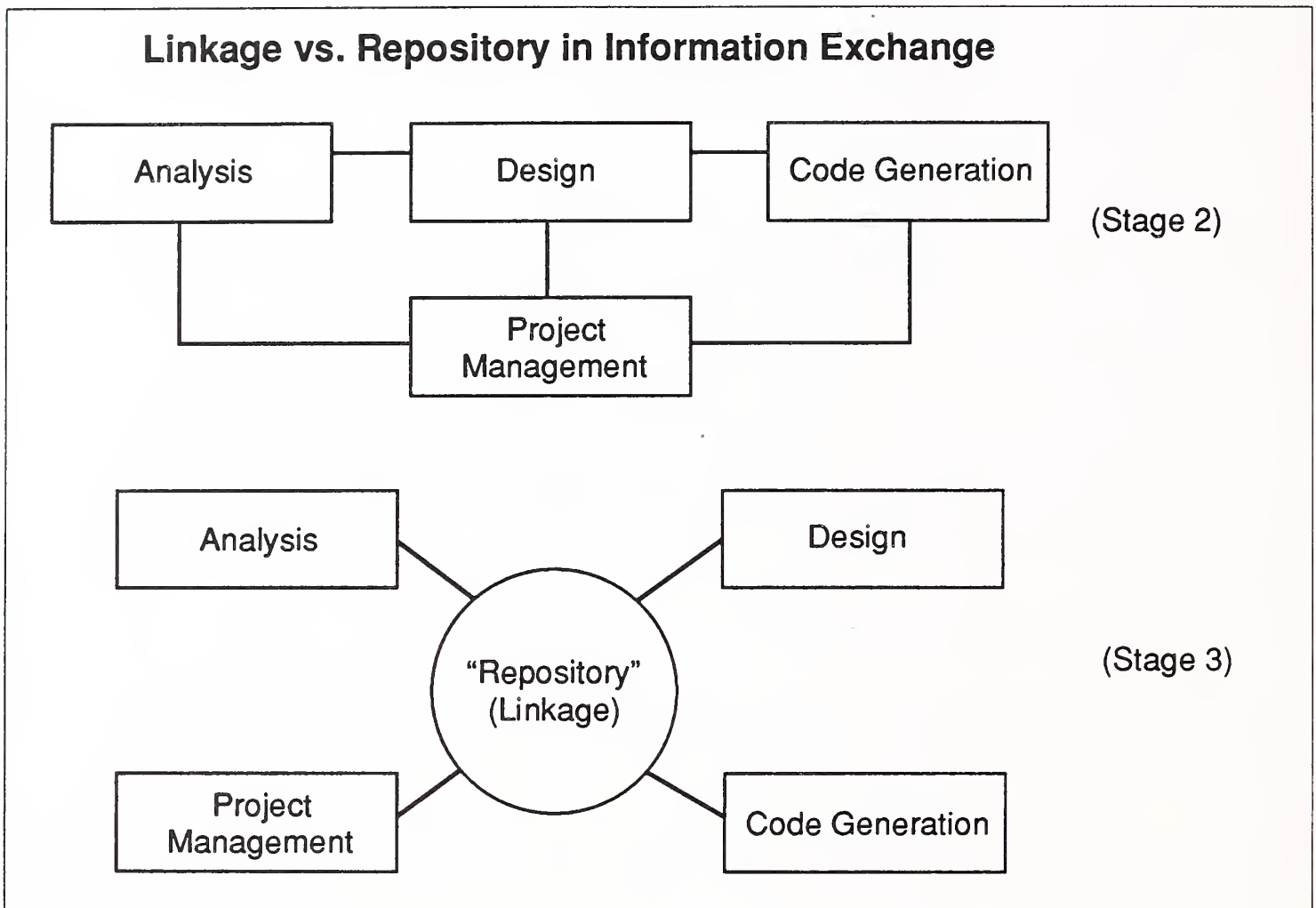
* Was a relative late-comer in its public support of the repository approach

* Bought much of the core technology

On the other hand, IBM provided a vital service by

* Producing a de facto standard for IBM platforms

* Accelerating the shrinkage in the number of CASE product vendors. The "noise" level caused by dozens of vendors in the marketplace has started to fall.

* Providing a stable target for customer planning

Even in a repository environment, there will be some products that have tighter links than others (as shown in Exhibit IV-6):

EXHIBIT IV-6

Stage 3 (Early 1990s)
Repository-Based CASE Tools (Schematic)
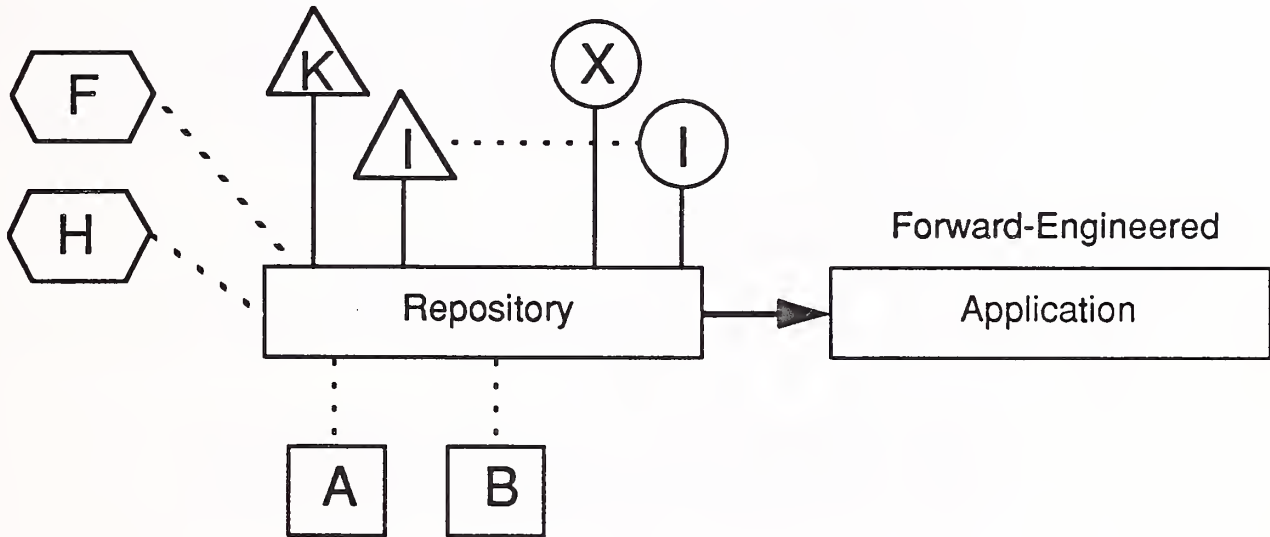
• • • • • •   Loose linkages

───────   Tight linkage

Note: Letters within symbols refer to individual vendors

☐   Project management systems

⬡   Methodologies

△   Analysis/design tools

◯   Generators

- Certain products/functions will be supplied by the same vendor; these products will obviously work more in concert and be kept in better step developmentally.

- Some vendors, like those offering project management systems, may wish to support concurrent projects across different types of repository and hardware platforms. Their linkages to any one repository must necessarily be looser than would be the case for a product directed at a single repository.

- Methodologies are in a somewhat different position: current methodologies, by definition, predate repositories; consequently, a repository has to conform somewhat to existing methodologies. Methodologies have typically had no specific vendor sponsor. However, as time goes on particular repositories and closely associated tools may become implicitly more receptive to certain types of methodologies.

Current repository-based CASE is at least implicitly aimed at the forward engineering of applications. This places very real constraints on its applicability to solving real-world applications problems, which often involve a mixture of new development and modifications to existing applications.

Stage 4: Repository-Based CASE Environment

In some ways Stage 4 is a further extension of Stage 3, in the same way that Stage 2 was an extension of Stage 1:

- Stage 4 will be largely upwardly compatible with Stage 3.
- Stage 4 will represent a series of incremental changes.
- Stage 4 will not appear dramatically as a single announcement.

The "blending" of Stage 3 into Stage 4 will be represented by one or more vendors developing tightly coupled groups of tools *and* methodologies around a particular repository architecture (shown in Exhibit IV-7).

- Where the repository design and execution is determined by a single vendor (e.g., IBM in AD/Cycle), at least one set of associated tools and methodologies will be offered—or at least tightly controlled—by that vendor. (See Chapter VI for a more extended analysis of IBM and AD/Cycle.)

- However, it will generally be in the interests of repository controllers to allow—and often encourage—third parties to provide alternative and niche offerings. This will provide limited-risk choices as well as a pseudo-open architecture for customers and other vendors.

The most visible addition in Stage 4 will be the linkage of forward engineering and re-engineering (Exhibit IV-7). Currently, re-engineering is isolated from the rest of CASE activities; as forward engineering and re-engineering are better coordinated, Stage 4 will take off (see Section C, below).

EXHIBIT IV-7

Stage 4 (Mid-1990s)
Repository-Based CASE Environments (Schematic)

——— Tight linkage

• • • • • • Intravendor linkage

Note: Letters within symbols refer to individual vendors

Project management systems

Methodologies

Analysis/design tools

Generators
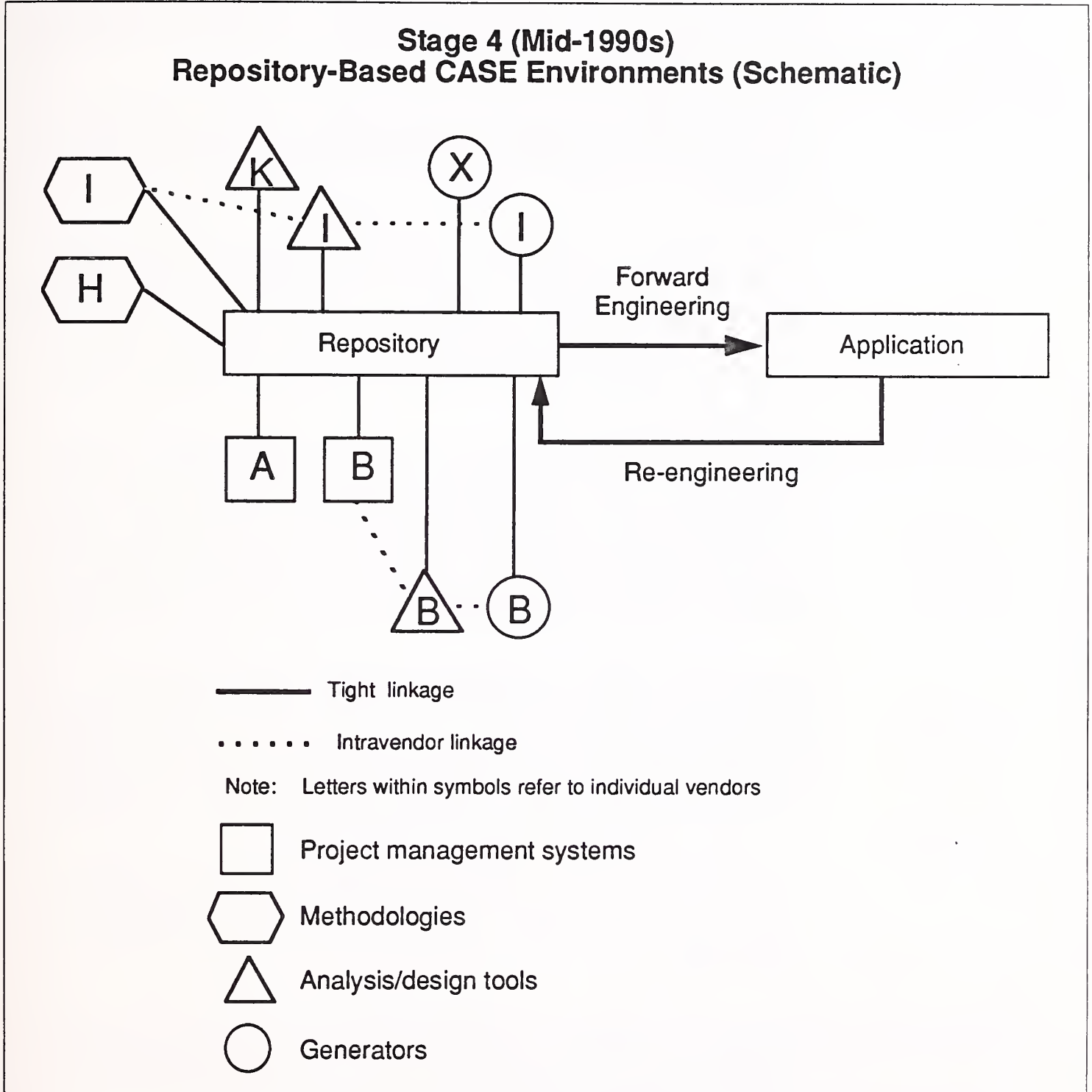
B

Integration: Summary

Looking at the stages of CASE development—both past and future—the driving force has been continuing integration. This is squarely in keeping with IS department requirements, as described in the prior chapter. Unfortunately, to date the pace of integration has been slow relative to user needs. The announcement and partial reality of AD/Cycle promises to bring CASE practice somewhat closer to CASE needs and realities.

However, AD/Cycle is not the full story: there are other offerings on the IBM platform, as well as considerable activity on major non-IBM platforms (DEC, Hewlett-Packard and, increasingly, UNIX). These platform issues will be discussed further in Chapter VI. However, several general technology trends are evident:

Tool Architecture: On the IBM platform, the transition to repository-based integrated tools is clear. On other platforms, linked tools have not been abandoned, although repositories represent one thread of vendor strategies.

Tool Standards: AD/Cycle has emerged as the de facto standard on IBM platforms; it is not clear whether there is any long-term place for other standards on IBM platforms. This raises the interesting issue whether vendors such as Andersen Consulting (Foundation) and Texas Instruments (IEF) will position their own de facto standards as those that can bridge heterogeneous platforms (see Chapter VI).

It is even possible that AD/Cycle or a variant could emerge as a de facto standard on non-IBM platforms. This possibility has been raised by a major CASE vendor that is *not* part of the AD/Cycle inner circle. This could occur for the same reasons that AD/Cycle was received so warmly by the IBM user community: the plethora of competing pseudo-standards in the non-IBM world is certainly as frustrating to CASE progress as it was in the pre-AD/Cycle IBM environment.

Methodologies: So far, CASE tool vendors have taken a hands-off approach to specifying particular methodologies. This is understandable, given the large amount of work that even now remains to be done on the core CASE technology itself. However, as the repository-based environments become more mature, the logic of the CASE situation will almost certainly impel CASE developers to make choices:

- Even now, for example, AD/Cycle is endeavoring to make the representation in its repository incorporate both the object-oriented and entity-relationship modeling approaches. The practical effects are not fully known.

- Many of the differences in methodologies are ones of form, not content (arrowheads, boxes, etc.). To the extent that these differences are abolished, there will be significant savings in training and much better communication within IS departments generally.

- On a strictly pragmatic level, arbitrarily selecting any one methodology would bring considerable benefits in terms of better communication, more efficient training, and better methodology-tool linkage.

- A considerable point is sometimes made of "selecting a methodology to meet the needs of an organization." This becomes suspect on closer inspection, especially if one recalls that the same point was made until recently concerning the selection of CASE tools themselves. Few organizations are truly different enough to need a unique methodology; even fewer have the resources to support their own methodologies. The acceptance of AD/Cycle itself has shown how much CASE users value uniformity over complexity.

Exhibit IV-8 summarizes these integration trends between the two types of platforms.

EXHIBIT IV-8

Integraton Trends—IBM and Non-IBM Platforms

	IBM Platform	Non-IBM Platforms
Tool Architectures		
Individual	Obsolete	Prevalent
Integrated Tools	Prevalent	Emerging
Repository-based	Emerging	On Horizon
Tool Standards		
AD/Cycle	De Facto	Possible
Other Platform- Specific	Under Pressure	Prevalent
Cross-Platform	Unclear	Possible
Methodologies	AD/Cycle- Driven	Mixed Trends

- On the whole, the IBM platform is one step ahead of the non-IBM platforms (assuming one accepts the logic and value of integration).

- To the extent this is true, then the previously cited vendor comment of AD/Cycle having a potential role on non-IBM platforms begins to make a great deal of sense:

  - It could take several years and considerable resources for an IBM competitor to create the functional equivalent of AD/Cycle.

- Given that IBM's AD/Cycle-related costs are well into the hundreds of millions of dollars, it is unlikely that any other vendor can do so.

- Therefore, adopting as much of AD/Cycle as possible on non-IBM platforms would be extremely logical. IBM, however, would not play a neutral role in this scenario (see Chapter VI).

C
Re-engineering

As discussed in the *Definitions* section of Chapter I, there are several current words and concepts used to describe the re-engineering process (re-engineering, restructuring, and reverse engineering) in addition to older terms (e.g., corrective maintenance, adaptive maintenance, enhancements, etc.) There is not yet wide agreement within the industry on the precise meaning of these terms. There is not even the hint of loose consensus that exists regarding some of the forward engineering terms.

Until recently, the re-engineering process was straightforward: the objective was to fix an application and sometimes to re-write it; this was (and is) called maintenance. These objectives will not change, since some significant element of data processing must always be reactive to outside events (including program failure). However, much of maintenance will increasingly be viewed as re-engineering.

Re-engineering will involve two basic choices: *reverse engineering* or *re-use*.

Reverse-engineering will be somewhat analogous to maintenance as it is now, but with considerable change in emphasis:

• Multiple changes over time will increasingly take place using reverse-engineered code as a starting point; much maintenance now is treated as if it were a one-time occurrence, even if similar one-time changes are made repeatedly.

• Reverse-engineered applications may have their life extended dramatically.

However, the full potential of re-engineering goes beyond the reverse-engineering and preservation of a particular application. Wider re-use of an application's constituents should prove to be equally valuable. This re-use can include the following:

• At the minimum, re-engineering technology can be used to understand the processes and data relationships in an application. This would be done preparatory to constructing a new application. For efficient communication the re-engineering and forward engineering should use the same conventions. Consistent conventions are needed because it may turn out that after inspection, the logic of the old application might be used to partially populate a repository.

- Populating a repository from the logic in a previously written application can be a shortcut as well as a means of preserving the data processing "heritage" of an organization.

- Finally, much larger pieces of an application can be used as the foundation for constructing an updated or expanded application.

- These steps form a continuum; the exact strategy to be followed is often not finally known until the organization is fully engaged in the re-engineering process.

Exhibit IV-9 provides an overview of these re-engineering options described above.

EXHIBIT IV-9

Re-engineering Options

Options (One/Both)	Reverse-Engineered Application	Re-used Application
Objectives (Some/all may be involved	• Stabilize application • "Re-write" • One-time/multiple changes • Short/long life expectancy	• Learn data/process logic • Help populate repository • Form base case for forward engineering
Attributes (Some/all may be involved)	• Restructured code • Logic tracing • Created modules • Graphical manipulation	• Entities • Relationships • Data base structures • Objects

The extent to which existing applications are reverse engineered versus being re-used can have important implications for individual firms and for the CASE industry as a whole:

- If a very high proportion of existing applications are re-used, then CASE environments that are forward-engineering focused (i.e., Stage 3 CASE) will be less useful. (If a high proportion are reverse engineered, then forward-only tools are much more acceptable.)

- Where a firm is highly committed to a changed technology base (e.g., client/server or enterprise information modeling), then re-engineered applications would only be cost-effective where short-term benefits predominated.

Exhibit IV-10 contrasts the different factors that help determine whether re-engineered or re-used applications would be most appropriate.

EXHIBIT IV-10

Factors Affecting Choice of Re-engineering Options

Factor	Re-engineering Options	
	Reverse-engineered Application	Re-used Application
Hardware/Software Platform	Unchanged	Changed
Host/Workstation Relationship	Unchanged	Changed
Linkage to Other Applications	Loose	Tight
End-User Design Involvement	Moderate	Intensive
Organizations' Repository Experience	Low	High
Forward Engineering Experience	Low	High

IV-16

Both vendors and IS departments realize the importance of re-engineering; both indicate that there is a significant gap between the importance they place on re-engineering and their knowledge of it (Exhibit IV-11). In this area, the gap is even wider on the vendors' side; this appears to be because more vendors have already awakened to the implications of Stage 4 CASE, its requirements, and its opportunities.

EXHIBIT IV-11

Importance and Knowledge of Re-engineering for Vendors and IS Departments
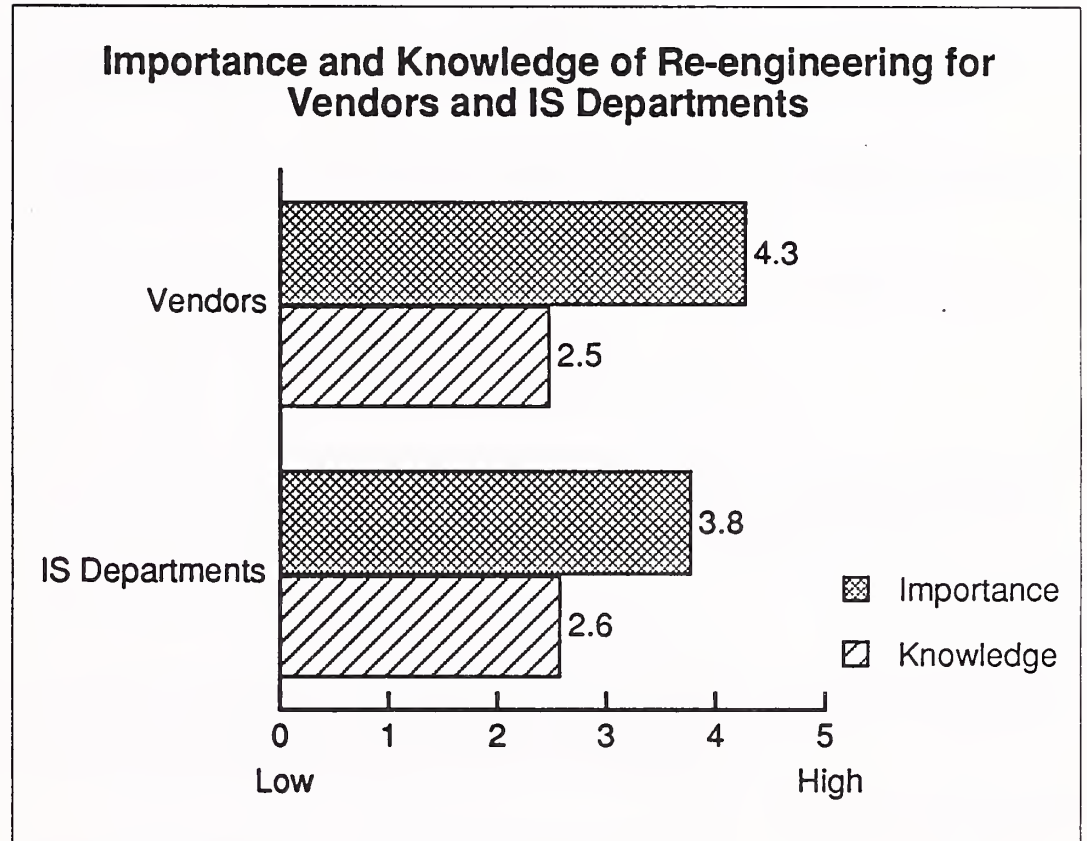
Integrating re-engineering with the rest of CASE will occur in phases, as shown in Exhibit IV-12.

• The integration of forward-engineering components is well underway (Phase 1).

• Work is now in process by several vendors (Viasoft, Language Technology, IBM, and others) to take current standalone back-end re-engineering tools and link them to:

  - A self-contained front end (within re-engineering; Phase 2)

  - The back end of forward-engineering tools (Phase 3)

• Once there is a self-contained front end/back end within re-engineering (Phase 2), then it would be feasible to tie the front end of re-engineering to the front end of forward engineering (Phase 4). This would close the loop and begin to fully integrate forward engineering and re-engineering.

EXHIBIT IV-12

Remaining Phases of Re-engineering

Front-End   Back-End

Forward
Engineering

Re-engineering

Phase
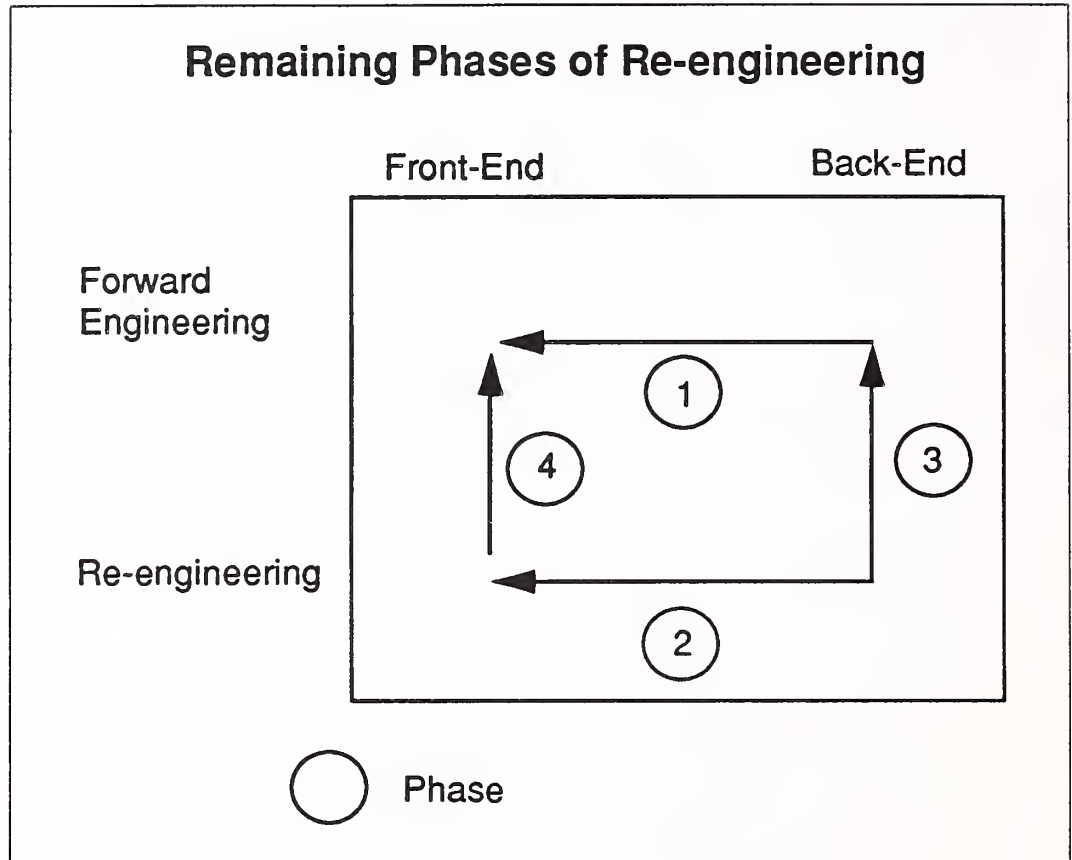
In 1991 INPUT expects a minimal amount of maintenance, modification, redevelopment and new development to be performed using re-engineering tools. This low usage is due to a lack of critical mass in re-engineering:

* Maturing tools that are still essentially standalone tools
* Re-engineering sponsorship by small vendors
* Lack of sponsorship by IBM
* Few methodologies; none widely accepted
* Little training available or used
* Low management priority given to maintenance

By 1996 INPUT expects this picture to have turned around markedly—essentially because all (or most) of the factors above will have been reversed. Chapter V provides INPUT forecasts in this area.

D

Distributed Applications

The term distributed applications is often shorthand for one or both of these computer environments:

* SQL-based inquiry services

* Client/server architecture—usually, although not necessarily, limited to high-end PCs and workstations in a LAN environment.

These environments are perfectly adequate for supporting analysis functions dispersed through an organization:

• Data is passed from one data base (server) to another (client).

• Precise data synchronization is not required, or daily/weekly synchronization is adequate.

• Work unit errors in programming, processing logic, security, etc. are not critical and/or are the responsibility of the work unit.

The requirements in a transaction-driven, distributed application are quite different:

• Where data is shared, changes in states must be simultaneous or occur under defined circumstances.

• Data locking and security is of the utmost importance.

This situation is even more critical where different processing locations are, essentially, peers. They will often have overlapping processing and data base responsibilities (application domains), as illustrated in Exhibit IV-13.

• The domains marked "A" are conventional applications operating on a single host (whether they supply workstations with data is a secondary issue from a design and implementation standpoint).

• The domain marked "B" is an intermediate form of distributed application.

  - One of the peers may serve as host, delegating and controlling processing logic; data, where decentralized, is synchronized and controlled by the host.

  - An alternative arrangement is for the two peers to be equal, with event-driven synchronization as in real-time systems.

• The domain marked "C" (and the other overlapping domains) represents complexity of a much higher order. A particular section of an application may interact with one or more applications.

Currently, CASE is implicitly aimed at "A"-type applications (as identified in Exhibit IV-13). As progress is made in understanding and dealing with the issues of distributed data bases in a transaction environment, CASE will become increasingly applicable to "B"-type applications. "C"-type applications are a somewhat different issue:

Application Domains and Multiple Peers
(Schematic)

☐ Processing Location

◯ Application Domain

A = Single application, single host

B = Single application, multiple peers

C = Multiple applications and peers
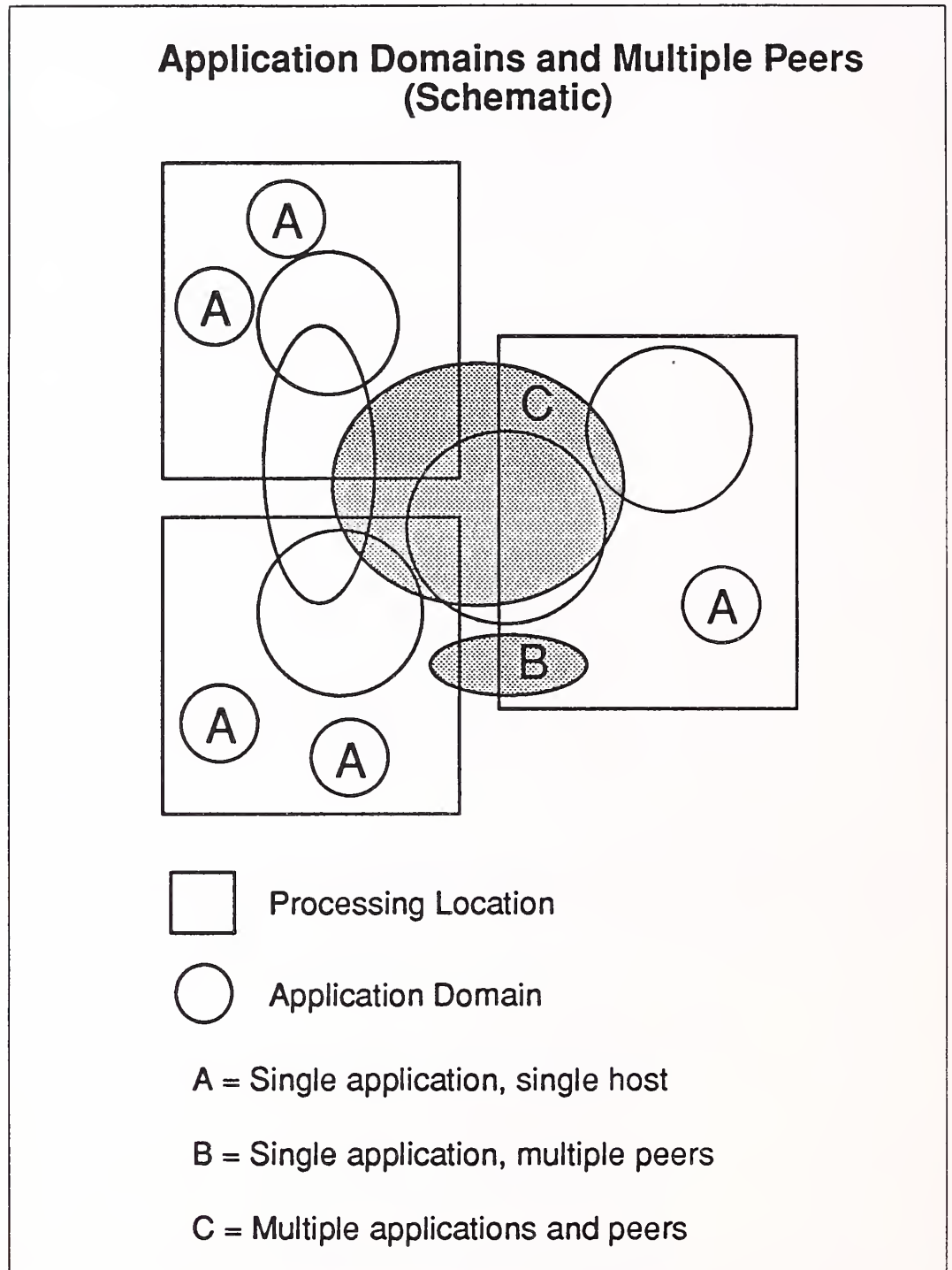
- Once "B"-type distributed data bases function adequately, it probably only requires a series of incremental technical steps to be able to handle "C"-type applications.

- CASE *tools* could also undergo these incremental changes reasonably quickly.

- However, in INPUT's view, the sticking point will not just be the technical aspects, but also the human aspects:

- CASE technology is an enormous help in keeping track of applications relationships. Ultimately, though, human beings must understand these relationships; even if a few key systems designers were able to accomplish this, it is unlikely that business users would be able to (in the sense of having sufficient interest or time).

- Wherever possible, then, distributed applications should be kept separate, or at most, exchange data and other information at a few sharply defined points.

- Otherwise, the intersections of complex systems may sometimes require going outside the CASE framework for analysis and implementation. This will undermine some of the rationale for, and benefits of, CASE.

Exhibit IV-14 summarizes the issues concerning application domains "A," "B," and "C."

With this background, it is not surprising that both vendors and IS departments place great importance on having CASE support for distributed applications (Exhibit IV-15).

• Both see a significant gap between importance and knowledge.

• The gap is considerably wider for vendors: they rate the importance higher and their knowledge lower.

The very large and significant gap on the vendor side is another argument strongly against any immediate and/or previously unannounced solutions appearing.

EXHIBIT IV-14

	A* Single Application/ Single Host	B* Single Application/ Multiple Peers	C* Multiple Applications/ Multiple Peers
Application Domains and Peer Processing			
Processing Elements	• All processing on host (mainframe or functional equivalent)	• Centralized logic design • Processing may be delegated • Event-driven processing may be utilized	• Single central design control difficult to achieve and maintain • Design and implementation highly localized • Event-driven processing
Data Elements	• Centralized data • Single DBMS control (for operations/ transactions) • Downloaded data for local analysis	• Data may be decentralized • If decentralized, may be synchronized and/or controlled by one peer (temporary "host") • Some secondary may be under jurisdiction of only one peer	• Decentralized data is norm • Event-driven data synchronization • Critical data under central jurisdiction

* Letter refers to domains illustrated in Exhibit IV-13

EXHIBIT IV-15

Importance and Knowledge of CASE Support for Distributed Applications for Vendors and IS Departments
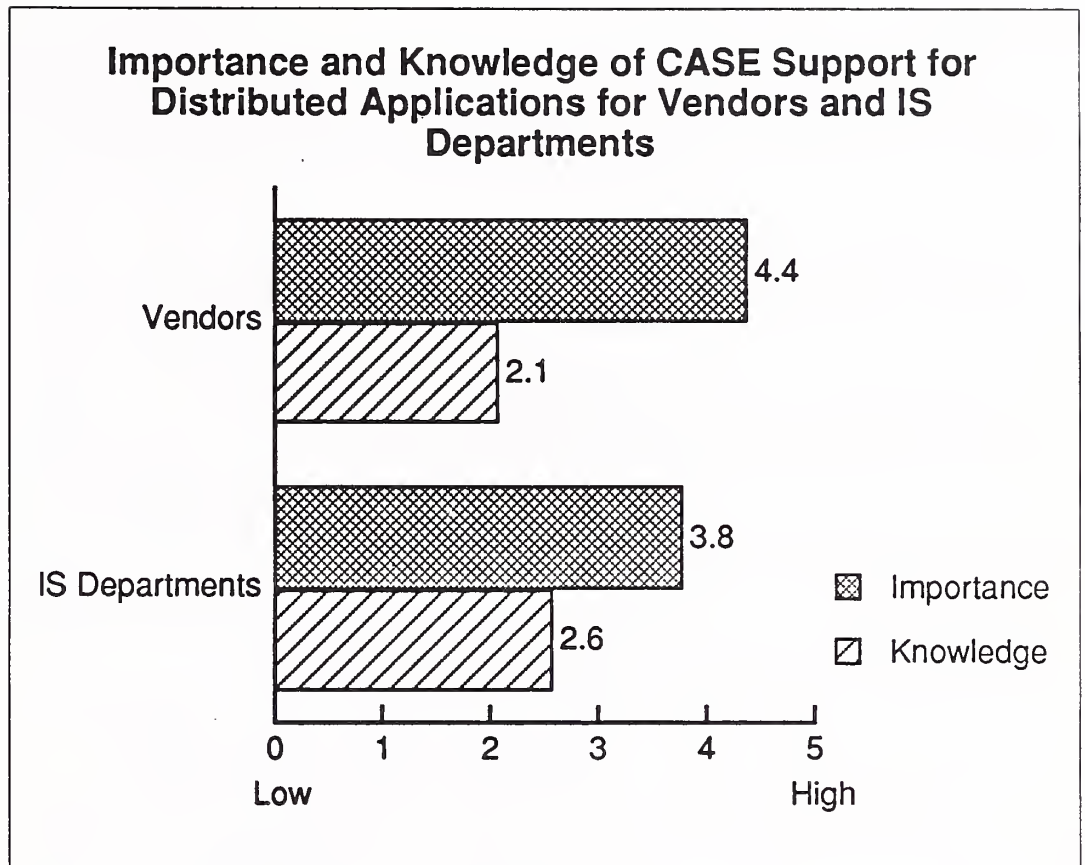
E

Resolution of Technical Issues

The critical technical issues as identified by INPUT's research and discussed earlier are:

- Integration and standards
- Re-engineering
- Distributed applications

1. Integration

In the near term (i.e., through approximately 1993) the direction of integration from a practical standpoint will be synonymous with AD/Cycle, its success and acceptance. From information currently available, AD/Cycle stands a very good chance of meeting its (and its customers') objectives (Exhibit IV-16).

An area where there is still some doubt is a semi-technical issue: how fast can AD/Cycle be absorbed, by individuals and by an organization as a whole?

- Face-to-face training will not be enough. There are not enough qualified people available to staff for the intensive and extensive levels of training required.

EXHIBIT IV-16

Probability of AD/Cycle Meeting Customer Requirements (In 1991-1993 Period)

Issue	Probability
Maintaining schedule	High
Meeting current design specifications	High
Developing successful vertical information models	High
Ability to handle very large models	Medium/High
Ability to handle very complex models	Medium/High
Development of scalable learning techniques	Medium

- "Scalable learning techniques" will be required, i.e., high-quality training for large numbers of people at different qualification levels.

- This could represent, at last, an area where interactive video training could come into its own.

Unfortunately, it is only just now becoming clear what training needs (and budgets) will be.

- Since AD/Cycle (even in the KnowledgeWare version) is relatively new, the exact dimensions of—and technical solutions to—training needs are not yet clear.

- In any event, the "early adopters" are probably not representative of the bulk of the CASE user population.

2. Standards

AD/Cycle has quickly emerged as the de facto IBM platform standard. It is unlikely that any other standard will exist on the IBM platform before the mid-1990s:

- IBM would have little incentive to make the totality of AD/Cycle into an ANSI standard because it would then lose control over a strategic resource (see Chapter VI).

- By the same token, other vendors would be equally unwilling to see AD/Cycle become a formal standard because this would cede control over a strategic area to IBM.

As other vendors have absorbed the full meaning of AD/Cycle, they have also understood:

- AD/Cycle has pre-empted the attention of most business application developers.

- An AD/Cycle-like environment costs a lot to develop, in terms of dollars, time, and skilled personnel.

- There may be niches (perhaps even very large niches) left unfilled by AD/Cycle; however, these will not be very evident until 1993, after the reality of AD/Cycle has become clear.

Consequently, there is very little chance of alternative de facto standards emerging in the IBM environment in the next five years, and only a slightly better chance in non-IBM environments.

The most interesting area to consider is whether standards will develop for defining CASE across different vendors' hardware and software platforms. Several *individual* vendors are moving in that direction (e.g., Andersen, Texas Instruments, and Index). However, a multiplicity of efforts will, after a time, impede rather than accelerate acceptance (as in Stage 2 CASE generally).

Cross-platform standards, therefore, are mostly a business and competitive issue. Consequently, in spite of a need for cross-vendor CASE environments, INPUT sees only a medium chance of this kind of standard emerging over the next five years.

Exhibit IV-17 summarizes the preceding analysis.

EXHIBIT IV-17

U.S. CASE Standards Scenarios (To 1996)

Standards Issue	Probability
AD/Cycle as de facto standard	High
Development of formal standards	Medium/Low
Alternate (de facto) standards • In the IBM environment • In other environments	Low Medium/Low
Development of cross-platform standards (Hardware/Software)	Medium

Source: INPUT assessment

3. Re-engineering

The issues involved in re-engineering are summarized in Exhibit IV-12: How likely is each phase to become a reality by 1993?

- Phase 1 (back end to front end within forward engineering) is a virtual certainty. However, in and of itself, this will provide marginal assistance because it will only be useful in day-one-forward applications.

- Phase 2 (back end to front end within re-engineering) also has a high probability of being achieved.

- Phase 3 (back end to back end) is somewhat more difficult, since current back-end re-engineering products have their own approach and architectures that are not now compatible with forward-engineering products.

- Phase 4 (front end to front end) is dependent on the successful completion of the prior step. This involves planning on the re-engineering side so that the front-end environments are similar.

Exhibit IV-18 summarizes these evaluations.

EXHIBIT IV-18

Probability of Resolving Re-engineering Issues by 1993

Issue	Exhibit IV-12 Reference	Probability
Back-end to front-end (within forward engineering)	Phase 1	Very High
Back-end to front-end (within re-engineering)	Phase 2	High
Back-end to back-end (from re-engineered code to forward engineering environment)	Phase 3	Medium
Front-end to front-end (from re-engineering to forward engineering environment)	Phase 4	Medium to high (once phase 2 completed)

4. Distributed Application Development

The key issue involving distributed applications is when and if the underlying distributed data base technology will be complete; this is not a CASE issue, per se, but it is critical:

• Without progress in the underlying distributed data base technology, applications development in this environment will obviously be very constrained.

• The schedule for CASE appearing in a distributed environment is consequently a lengthy one. If the time horizon for re-engineering is 1993, the horizon for distributed applications development is twice that, i.e., 1996.

Distributed development issues will probably be methodology driven; that is, what should analysis and design consist of in a distributed environment? In that case, what is the likelihood of the increasingly complex domain/peer relationship described in Exhibits IV-13 and IV-14 becoming thoroughly understood?

- INPUT believes there is a reasonable chance of a single-application/ single-host methodology being developed by 1996 (although almost certainly toward the end of that period).

- On the other hand, there is a low likelihood of multiple application/ multiple peer issues being resolved by that time.

Exhibit IV-19 summarizes INPUT's analysis.

EXHIBIT IV-19

Probability of Resolving Distributed Application Issues by 1996

Issue	Probability
Distributed data base segmentation and control (non-CASE issues)	Medium
Distributed design methodology developed	
• Single application/host	Medium (dependent on preceding)
• Single application/multiple peers	Low
• Multiple applications/multiple peers	Very low

Note: For a graphical representation of the issues, see Exhibit IV-13.

Source: INPUT Assessment

V

Market Forecast

V
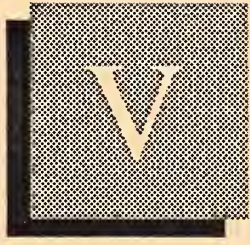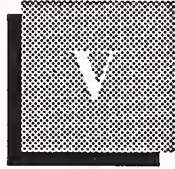
Market Forecast

A
Overview

Market forecasts are sometimes viewed as being primarily of interest to vendors. In this case, the forecast and its rationale is at least as important to IS departments:

- INPUT has provided a series of analyses on individual components of CASE growth and associated probabilities. These can serve as checkpoints against which to measure future developments.

- Some individual IS departments may differ from the norm—their potential may be for either faster or slower growth. These firms should compare their specific situations against the general environment.

The CASE product market is still one that is relatively immature. Because of this, the CASE product market is far more subject to variables than more mature markets. Because of the multiple variables affecting this market, INPUT has prepared its market forecast to reflect alternate scenarios.

The first section of this chapter provides a near-term and medium-term situation analysis of the significant market and technical factors. This analysis draws on the contents of the two previous chapters.

- The situation analysis provides the rationale for the quantitative forecasts.

- The multiple scenario approach permits readers who wish to make different sets of assumptions to set up their own sensitivity analysis for assessing the impact of individual market factors.

The resulting market forecast will be of obvious use and interest to software product vendors. The figures, and especially the reasoning behind them, should be important to other vendor groups as well.

- The quantity and intensity of CASE use is one of the prime drivers of the forecast. There is no information service vendor or IS department that will not be affected in the 1990s if CASE growth is explosive.

- IS planners must monitor CASE futures very carefully: overoptimism or overpessimism could be equally dangerous.

If CASE achieves a fast take-off, many areas will be affected in both corporations and vendors (Exhibit V-1).

EXHIBIT V-1

Impact of CASE Take-Off

Potential Impact On	Corporations			Software Products Vendors			
	Planners	Appl. Dev.	User Depts.	CASE Products	Other Sys. SW	Appl. SW	Prof. Svc./ Sys. Int.
Manner in which work is conducted (tactics)		✓✓	✓✓	✓✓	✓	✓	✓✓
Organizational structure	✓	✓✓	✓✓				✓
Future role of organization	✓	✓✓	✓	✓✓	✓	✓✓	✓✓
Business strategy	✓✓		✓✓	✓✓	✓✓	✓✓	✓✓

✓ = Important Impact
✓✓ = Very Important Impact

- The impact on application developers and CASE product vendors is self-evident.

- However, user departments could be affected at least as much since they could depend on IS to achieve much more than at present. Relationships would change as well.

- The business strategies of corporations as well as most information service vendors would need to be re-examined closely.

- Specific vendor impacts are analyzed in greater depth in Chapter VI.

B
Situation Analysis

1. Near-Term Issues (1991-1993)

There are two sets of near-term issues affecting market growth:

- Technology-related issues

- The "soft" issues (described in Exhibit III-10), which affect the extent to which an organization is ready ("organizational readiness") to absorb and make productive use of CASE.

Based on INPUT's research, these organizational readiness issues are even more important than the technology issues. Exhibit V-2 contains INPUT's assessment of a number of the organizational readiness issues for both 1991 and 1993 (a best- and worst-case assessment is provided for 1993).

- The sum of the "grades" for 1991 reflects near failure. This puts into perspective the earlier findings on the overall relative ineffectiveness of CASE (e.g., Exhibit III-3).

- The sheer number of such factors needing improvement will make progress relatively difficult; yet all the factors are important, and it is difficult to make a case that some can be ignored at the expense of others.

- The worst-case total for 1993 shows little improvement over 1991.

- The best-case total would virtually guarantee CASE success in a wide variety of settings.

INPUT concludes that in the near term, organizational readiness may serve as the most serious constraint to CASE progress.

If AD/Cycle is taken as a surrogate for overall technical progress, then near-term CASE technical issues are not serious barriers to progress (for a summary, see Exhibit IV-16).

Exhibit V-3 describes four possible near-term scenarios for CASE growth and acceptance (i.e., success). Other possibilities have not been analyzed in depth since they represent, in INPUT's opinion, combinations of very unlikely events:

- CASE software technology standing by itself is already beyond the low probability of success stage (Region I).

- It is quite unlikely that organizational readiness will be at a higher stage of development relative to CASE technology (Region II).

EXHIBIT V-2

CASE Organizational Readiness Factors:
1991 and 1993

Factor	1991	1993	
		Worst	Best
Culture/organization changes			
• Understanding of general issues	C-	C	B+
• Specific environment issues	C-	C	A
Methodologies			
• Evaluation criteria	C	C	A
• Integration into specific environment	C	C	B+
Measurement			
• Definition of success	F	D	C+
• Conducting measurements	D-	D-	B-
Implementation			
• Understanding success/ failure factors	D	C-	B+
• Planning	C-	C-	B+
• Applying success factors to specific environment	D	C-	B+
IS-User Relationships			
• General requirements	C-	C	B+
• Specific restructuring	C	C	B+
Training			
• Understanding general needs	C-	C+	B+
• Developing methodologies	D	D	A

Source: INPUT Assessment

EXHIBIT V-3

Near-Term (1991-1993) CASE Success Determinants: Alternate Scenarios

Organizational Readiness (Probability)

▨ Unlikely Events

◯ Scenarios

UIIS1
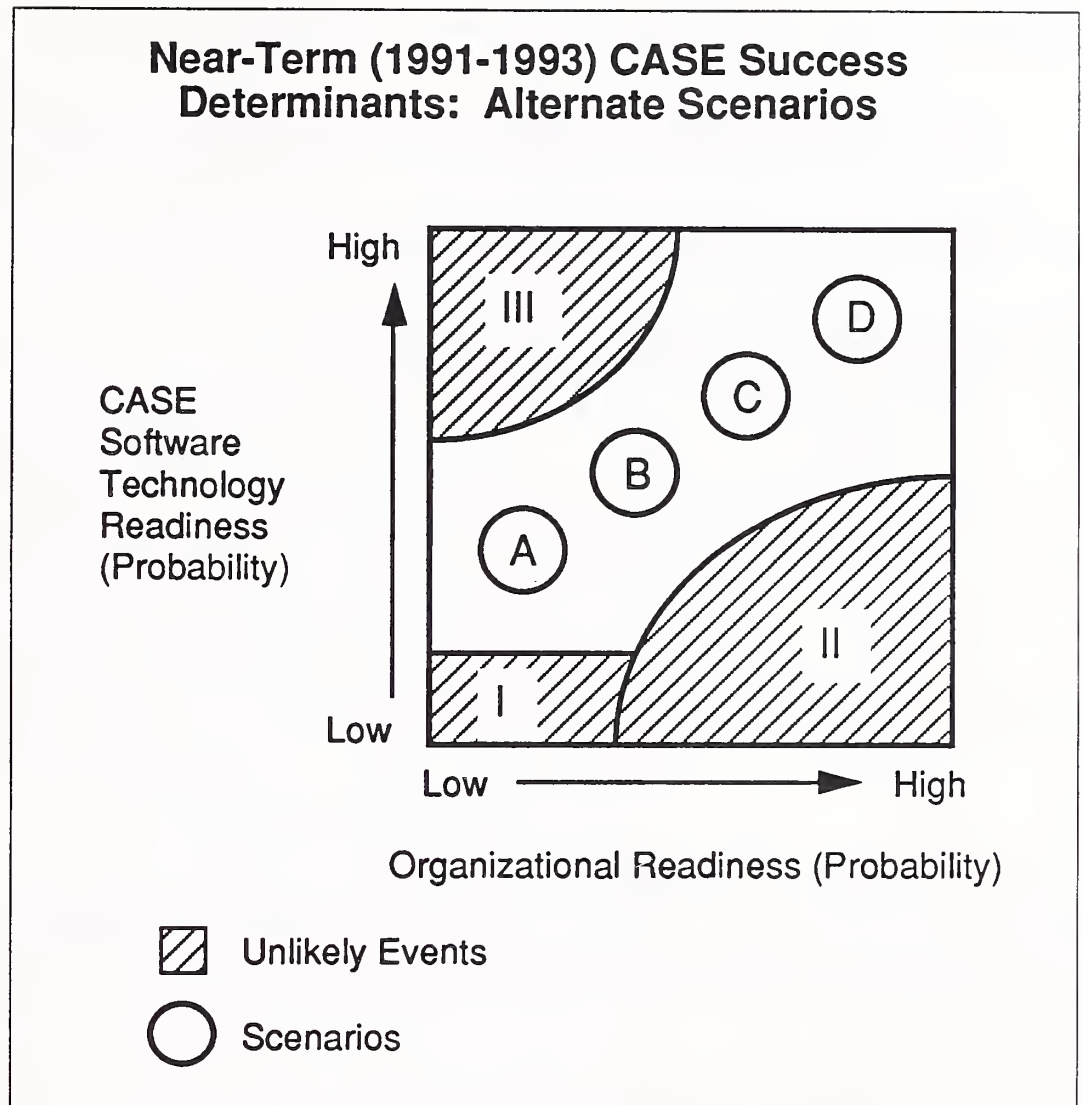
- High technical success would almost certainly have a "drag-along" effect on organizational readiness. For example, CASE tools that were relatively easy to use, incorporated self-training features, and used proven templates would be accepted in more organizations sooner. The effect would be that high technological readiness would not be associated with low organizational readiness (Region III).

Exhibit V-4 spells out the individual scenarios and assigns a probability with an accompanying rationale.

- INPUT has been impressed with the recent progress made in the underlying CASE technology generally (i.e., not limited to AD/Cycle). These technology improvements will encourage user organizations to take CASE more seriously. Current CASE technology will help establish wider CASE principles in customer organizations (Scenario B).

EXHIBIT V-4

Evaluation of Near-Term CASE Success Scenarios

Success Combination				Rationale
Scenario	Technology	Organizational	Probability	
A	Medium/ Low	Low	.25	Technology success is likely to be at least medium/high
B	Medium/ High	Medium	.50	This level of technical success is quite likely; some organizational readiness "drag-along" by CASE technology likely
C	High	Medium/ High	.15	Organizational readiness will be a bottleneck
D	High	High	.10	Organizational readiness will be a severe bottleneck

- A less attractive combination is shown in Scenario A, where neither technical progress nor organizational readiness are as good. There is even a chance that Scenario B could turn into Scenario A—i.e., negative experiences of early users could reduce the number of organizations that believed they were ready for CASE.

- Scenarios C and D are very positive ones: the technology makes widely perceived breakthroughs and increases organizational readiness. INPUT believes that it will be difficult for very many user organizations to make their own unassisted breakthroughs. So far, there are very few outside organizations (consultants and vendors) that have focused on offering support services to help make breakthroughs.

2. Medium-Term Issues (1994-1996)

In the medium term, the organizational readiness factors will continue to be important.

- The near-term progress (or lack of progress) will heavily influence the impact in the 1994-1996 period.

- If near-term organizational readiness progress is very slow, the prognosis for 1994-1996 will be of continued slow progress.

The technical issues will become more important during this period:

- If re-engineering issues are resolved on the timescale shown in Exhibit IV-18, then re-engineering is likely to become an important CASE factor during this period.

- Distributed application development is less likely to be supported (Exhibit IV-19).

Therefore, a key question is the relative importance of re-engineering versus distributed development during the next five years.

These issues revolve around the kinds of applications development environments that exist now, compared to the likely environments that will exist in 1996. For this analysis, INPUT has drawn on research performed in the last six months across several of its programs (details in Chapter I).

3. New versus Maintenance Activities

Currently, new development and maintenance activities each account for about 40% of application development activities. The remainder are modifications, i.e., something more than fixes, but less than full-scale new development.

The boundaries between these activities are notoriously fuzzy—there are, for example, fewer and fewer "new" applications that do not build at least to some degree on what has gone on before.

By 1996, the basic conceptual distinctions between new development and maintenance activities will still exist; however, re-engineering concepts and practices will have taken serious hold by then:

- Almost half of maintenance activities will consist of re-engineered applications (using the distinctions developed in Exhibit IV-9).

- At least half of "new" development will build on consciously re-used applications.

The distinctions between new, maintenance, and enhancement activities will become even less precise in five years, in large part because of re-engineering. Exhibit V-5 illustrates these changes.

EXHIBIT V-5

V-8

New, Maintenance and Enhancement Activities: 1991-1996

Reverse-engineered   Reused

- Maintenance
- Enhancements
- New Development
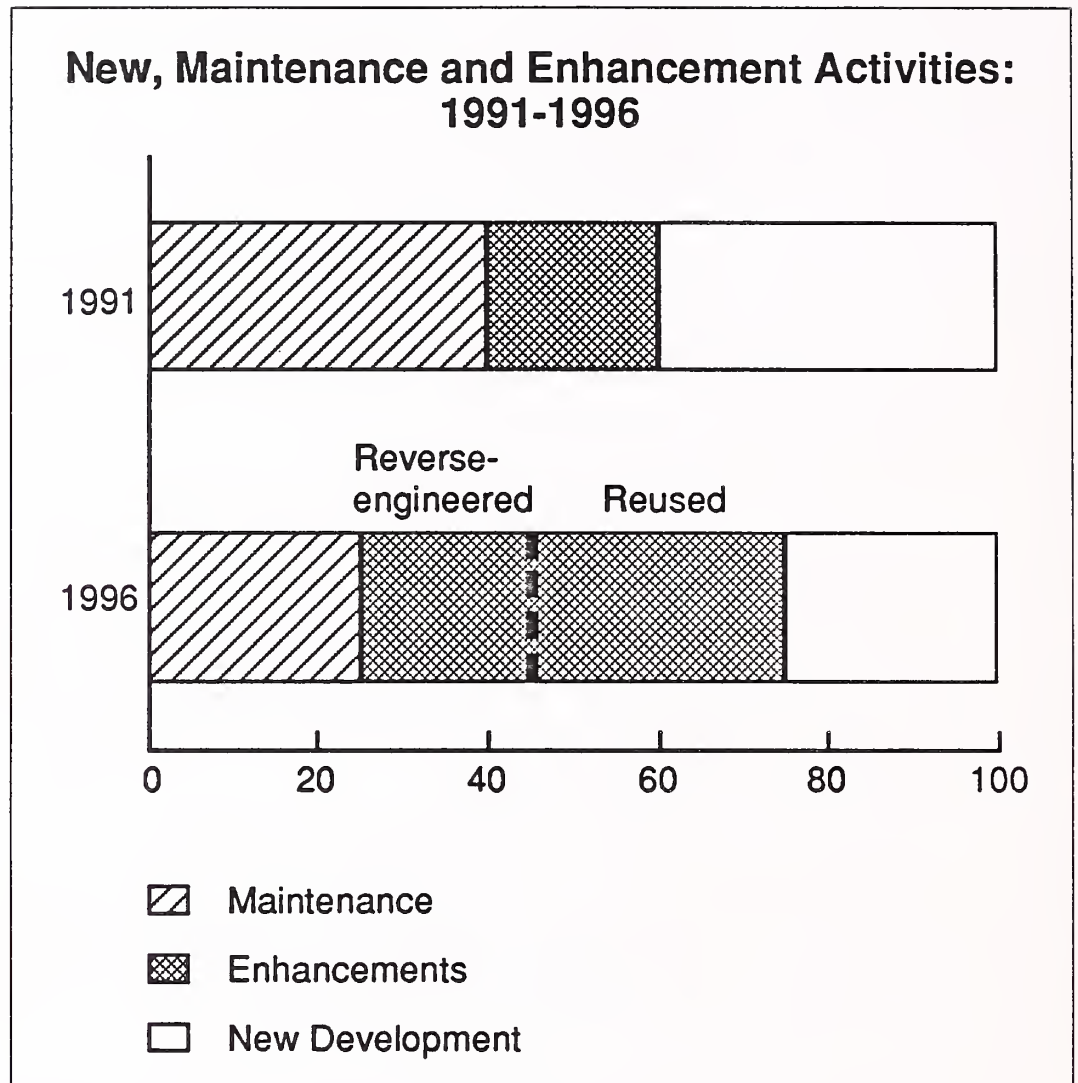
To the extent re-engineering is made easier, more correct, and more efficient by using CASE products, then the CASE market will be able to grow at a faster rate. If customers are forced to use unintegrated tools, with gaps between tools and some tools performing suboptimally, then this part of the CASE market will show lower growth.

4. Host-Based versus Multiple Peer Activities

INPUT estimates that close to three-quarters of development resources are now devoted to host-based applications; this will fall to a little over half by 1996 (Exhibit V-6).

- Host-led applications work will increase moderately.

- Work on multiple peer applications will more than double (although starting from a modest 7% in 1991).

INPUT estimates that only half of new development consists of classic host-based development.

EXHIBIT V-6

Host-Based, Host-Led and Multiple Peer Development: 1991-1996

Legend:
- ▨ Host-Based
- ▩ Host-Led
- ☐ Multiple Peer
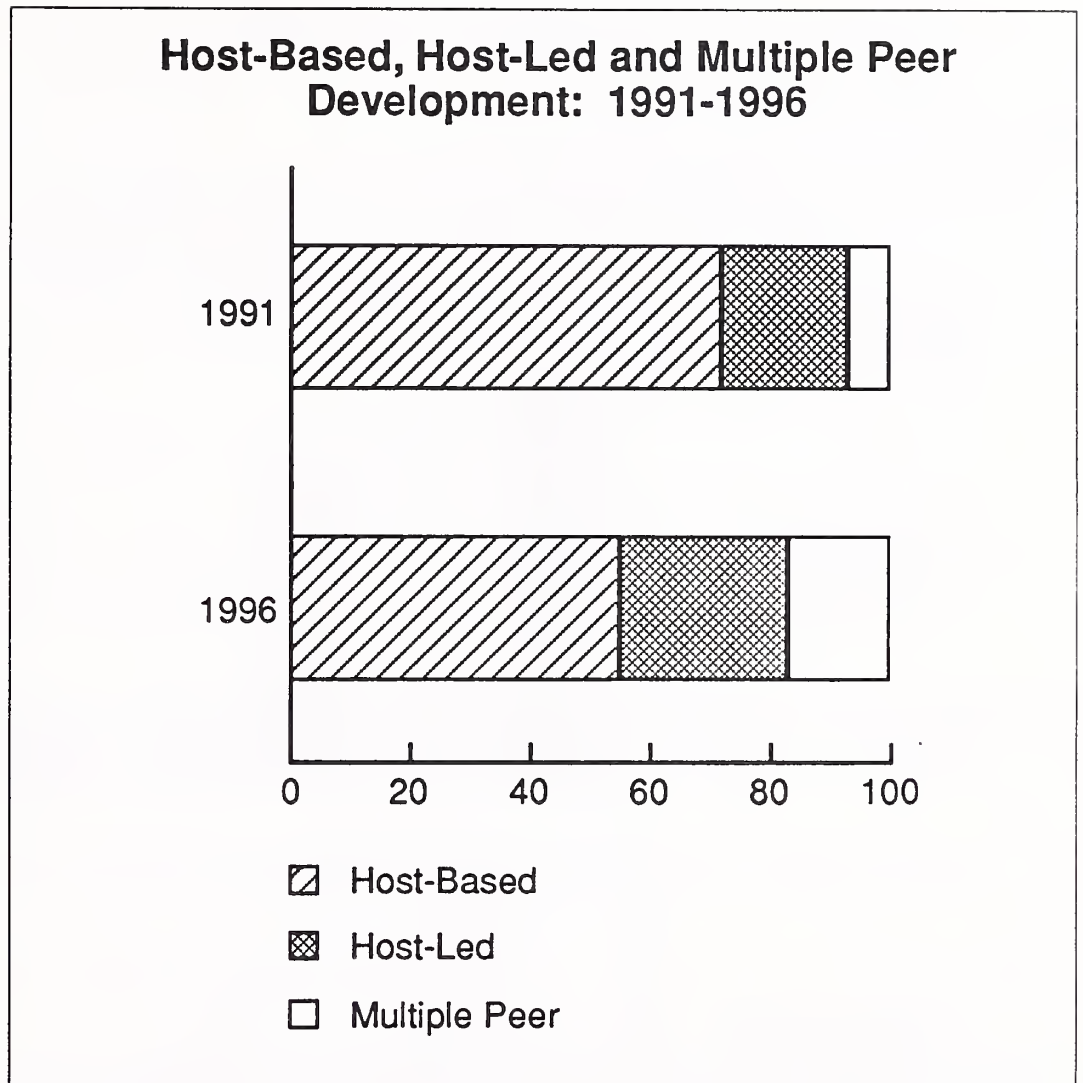
- Almost all of the rest conforms to the "host-led" model (described in Chapter III), typically a host performing most processing, supported by PCs to which well-defined functions have been decentralized.

- Only a small amount of new work is aimed at true multiple peer environments, usually involving linked workstations.

Each of these environments generates maintenance/enhancements, with the great majority, not surprisingly, directed at more traditional environments.

INPUT expects the picture to change markedly by 1996.

- Multiple peer environments will account for a majority of new development that does not involve the use of re-used applications.

- Half of host-led applications will involve upgrading older applications via re-used code.

Exhibit V-7 summarizes INPUT's view as to the distribution of types of development by application focus.

EXHIBIT V-7

Changes in Type of Development by Application Focus: 1991-1996

Source: Appendixes E&F
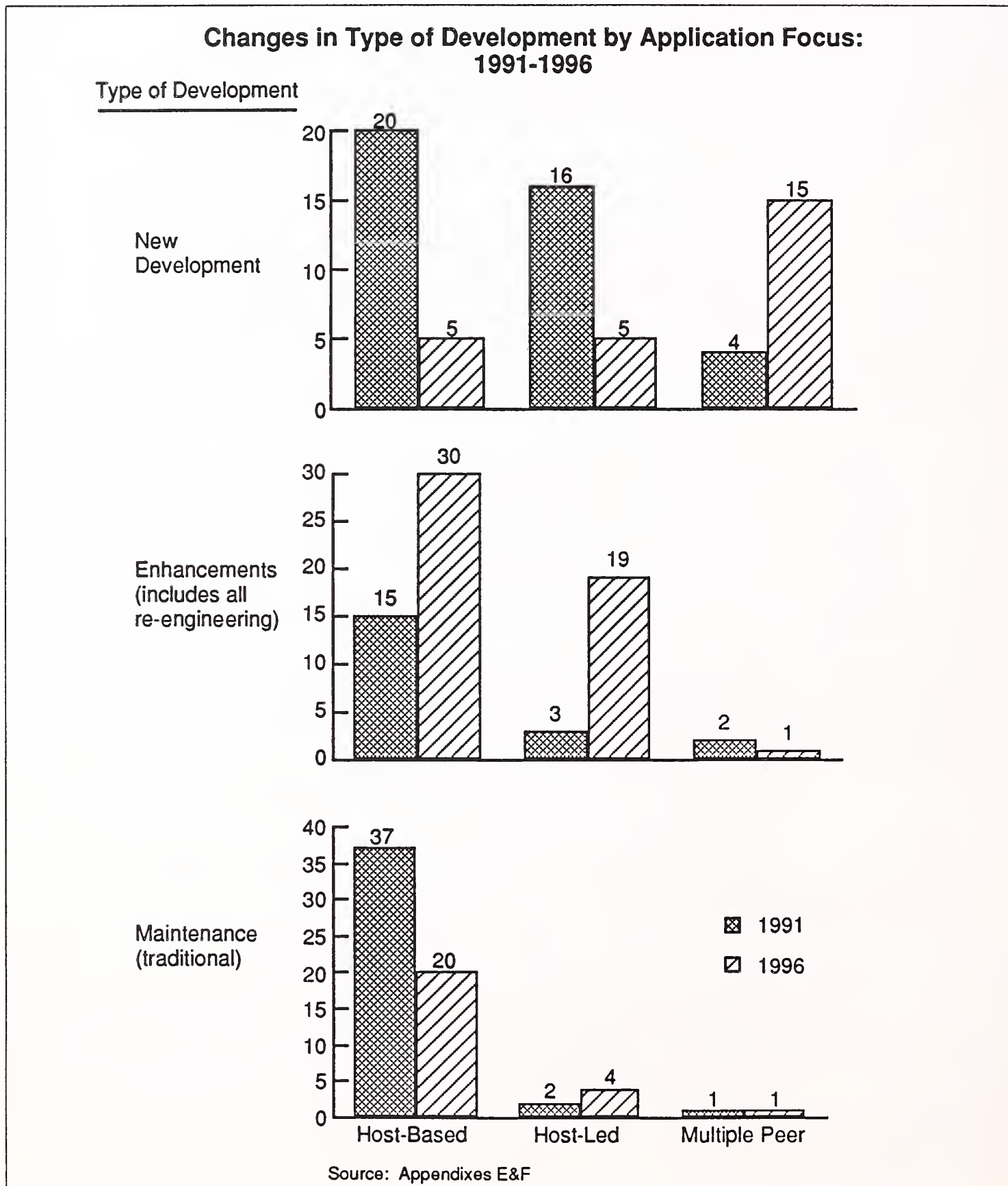
- The new development and host-based axes together account for over 90% of activities. This seems to bode well for the focus of current CASE tools.

- In reality, however, CASE is now focused on host-based new development (and, to a degree, on host-led new development).

- This is a quantitative indication of the existing importance of the re-engineering market and the extent to which it is not being served.

C
Forecasts

1. Application Environment Forecasts

In 1991, about one-third of application development could use CASE tools. By 1996, potential CASE focus will have almost doubled. Even more important, the greatest need and opportunity will be in the re-engineering areas.

Even if CASE does not have much to offer multiple peer applications and they still have to be built the "old-fashioned way," this will only be a secondary issue to vendors and most IS organizations.

This highlights the importance of re-engineering to CASE users and CASE vendors.

2. CASE Product Growth

As discussed at the beginning of the chapter, the CASE market's future growth will be heavily affected by the following:

- Near-term considerations will be heavily influenced by organizational readiness.

- Medium-term growth will be greatly influenced by developments in re-engineering techniques.

Exhibit V-8 (and its backup, Exhibit V-9) show the three scenarios:

- INPUT considers the middle scenario the most likely: adequate, but not maximum, progress in organizational readiness and re-engineering.

- The "low" scenario essentially encompasses a lack of further advances in CASE. CASE will continue to grow but in a non-strategic mode that is oriented mainly to technical staff.

- The "high" scenario assumes that both the "soft" and "hard" issues are resolved satisfactorily. Growth might in fact be even higher if not for limitations in training, staffing, and the general ability of organizations to absorb CASE techniques.

EXHIBIT V-8

CASE Product Growth Scenarios: Summary

CAGR
(Percent)

34

— High

xxxxxxxx Most Likely

—— Low

$ Millions

2500

2000

1500

1000

500

0

22

13

1990   1991   1992   1993   1994   1995   1996

Source: Exhibit V-9
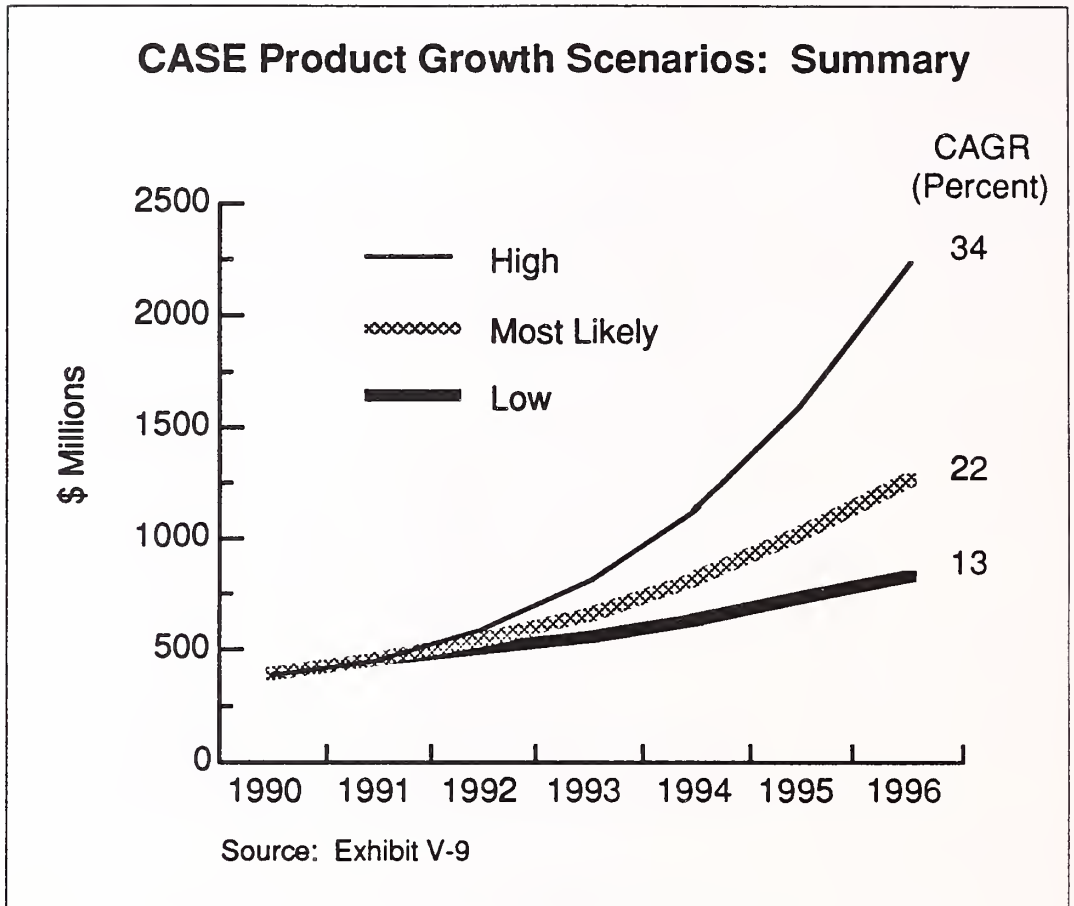
EXHIBIT V-9

CASE Product Growth Scenarios: Summary

	Scenarios					
	Low ($ M)	Growth (Percent)	Mid ($ M)	Growth (Percent)	High ($ M)	Growth (Percent)
1990	390	-	390	-	390	-
1991	450	15	450	15	450	15
1992	495	10	540	20	585	30
1993	545	10	645	20	815	40
1994	625	15	810	25	1,140	40
1995	720	15	1,010	25	1,600	40
1996	830	15	1,260	25	2,240	40

VI

Competitive Environment

VI
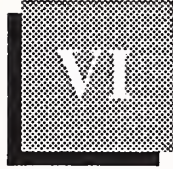
Competitive Environment

A
AD/Cycle Dominance

As indicated in Chapters III and IV, AD/Cycle has been welcomed by both users and vendors as offering a potentially fully integrated tool that will serve as a de facto standard in the business application market. This is also shown in market measures (see Exhibit VI-1).

- IBM carefully chose the "close vendor partners" in which it has made equity investments: products from IBM, KnowledgeWare, Index Technology, or Bachman Information Systems are currently represented at three-quarters of the sites interviewed.

- This shows impressive power for the AD/Cycle family, even if allowances are made for the following situations:

  - Products purchased only for R & D and comparison purposes

  - Products purchased but never used

- Even more impressive is that 25% of the sites planned to install AD/Cycle. Note: The (unprompted) responses were *not* "KnowledgeWare" or "Index," but "AD/Cycle"; this indicates the power of IBM's marketing as well as its product concept.

Both vendors and users rate the importance of AD/Cycle highly, although for vendors, AD/Cycle is of almost overwhelming importance (Exhibit VI-2). Interestingly enough, AD/Cycle is one area where users are reasonably satisfied with their current level of knowledge.

- This is a tribute to IBM's educational efforts as well as the widespread discussion in the trade press and at seminars.

- INPUT believes that the vendor gap shown between importance and knowledge may be a more realistic position, given that there are still many unknowns associated with AD/Cycle.

EXHIBIT VI-1

AD/Cycle's Market Share

Current CASE Products

Planned CASE Products
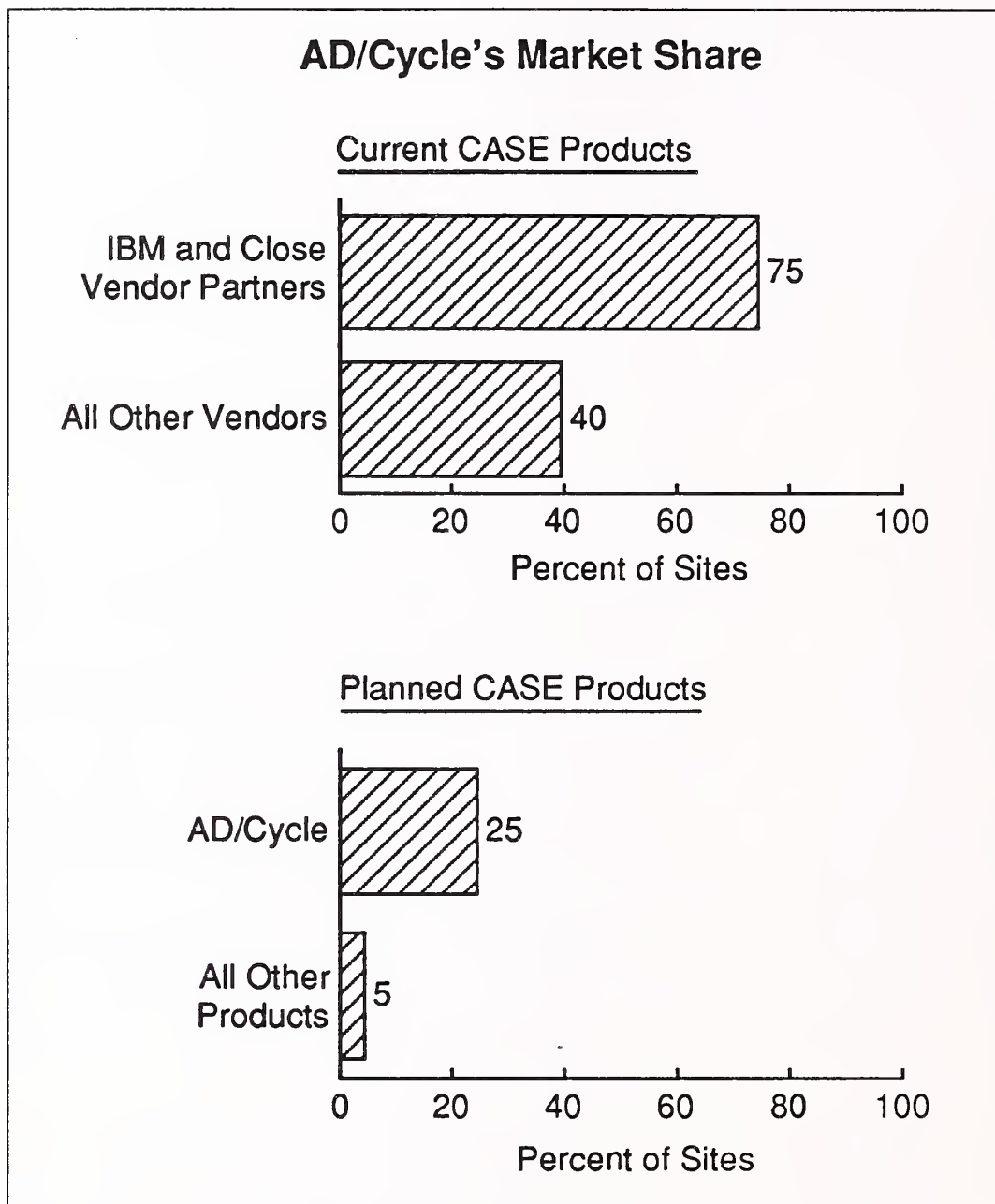
Vendors show strikingly less interest in non-AD/Cycle products (Exhibit VI-3).

• This bears out conversations with vendors, where the only two topics of conversation were their own products and AD/Cycle.

• The user profile was quite similar to that for AD/Cycle, although somewhat less intense.

EXHIBIT VI-2

**AD/Cycle Knowledge:
Importance and Current Satisfaction of
Vendors and IS Departments**

Vendors
- 4.4
- 3.5

IS Departments
- 3.7
- 3.4

Importance
Satisfaction

0 1 2 3 4 5
Low   High

EXHIBIT VI-3

**Non-AD/Cycle Application Development Products:
Importance and Current Knowledge of
Vendors and IS Departments**

Vendors
- 3.6
- 3.6

IS Departments
- 3.3
- 3.1

Importance
Knowledge

0 1 2 3 4 5
Low   High
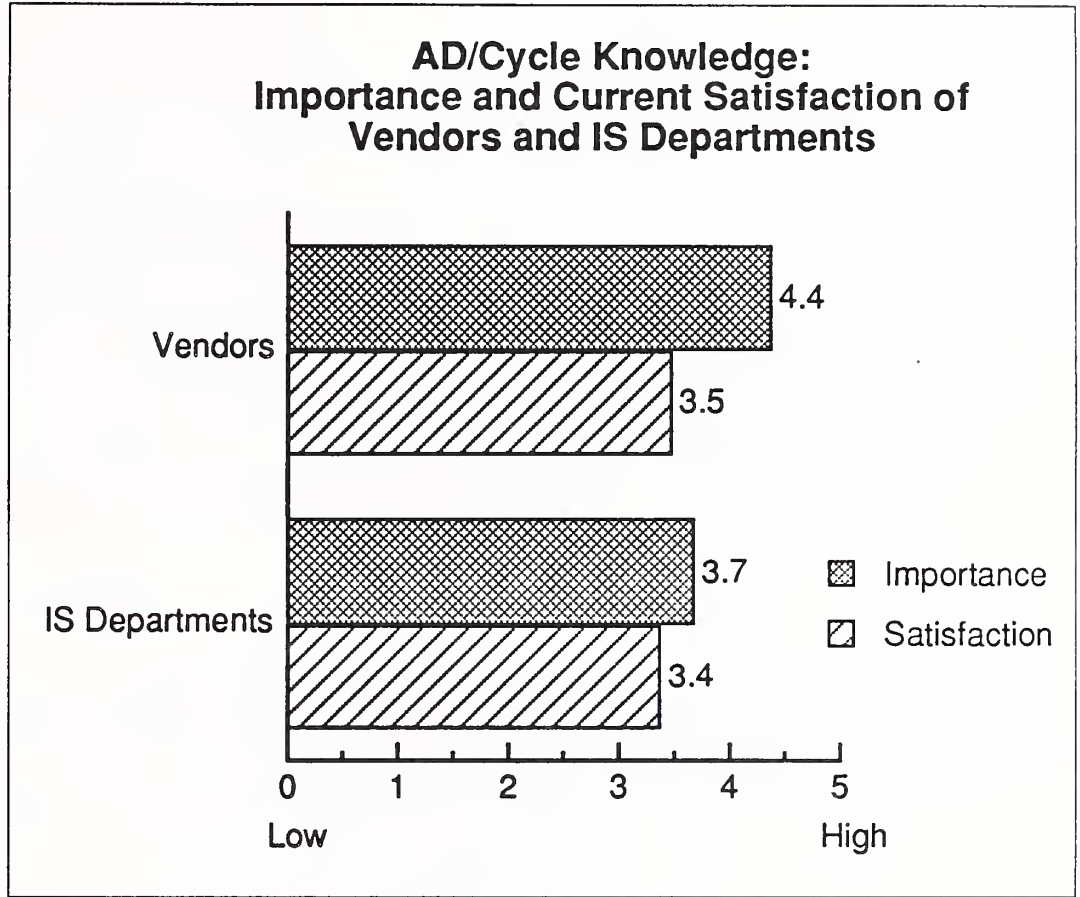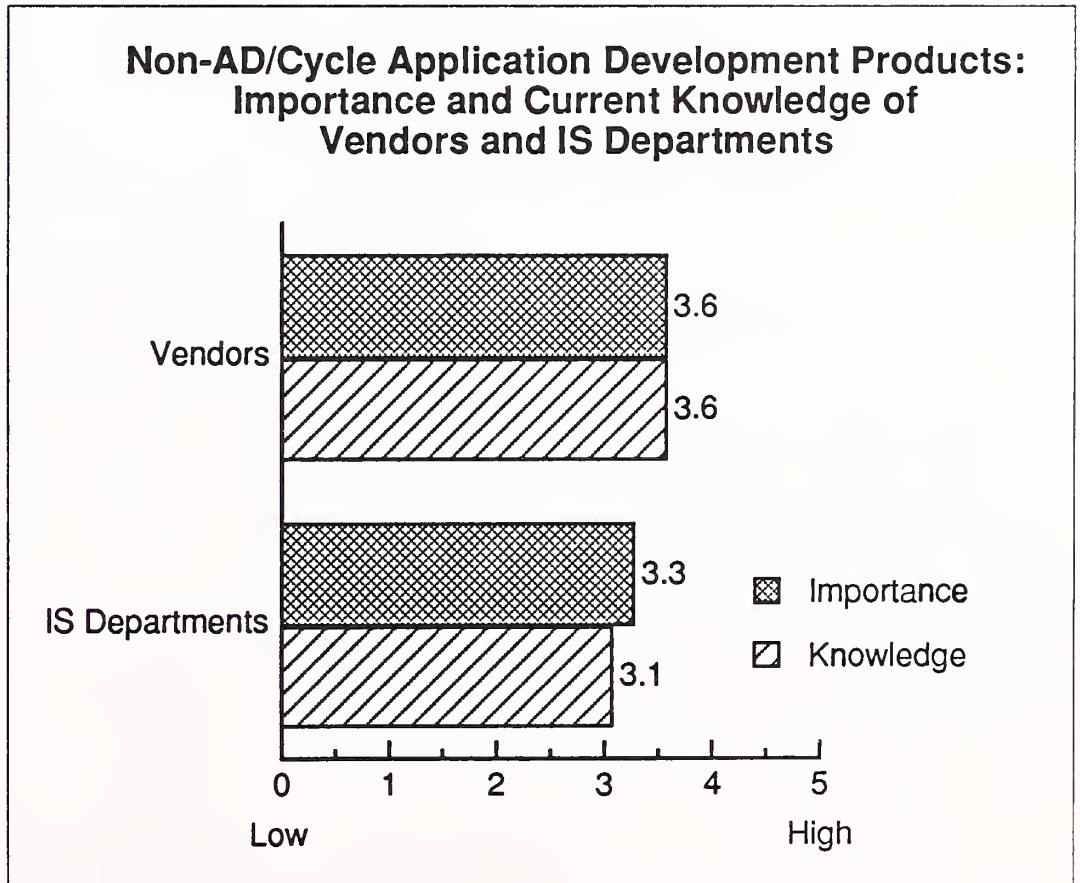
B
Leading CASE Product Vendors

Exhibit VI-4 shows the leading vendors in the CASE product market.

These companies account for approximately 75% of the market's revenues in 1990.

EXHIBIT VI-4

Leading CASE Vendors by Estimated 1990 U.S. CASE Product Sales

- KnowledgeWare
- Intersolv
- Texas Instruments
- Cadre
- Pansophic
- Andersen Consulting
- Oracle
- Synon
- CGI
- Viasoft
- Transform Logic
- DEC
- Interactive Development Environments
- Computer Associates
- Manager
- Bachman

Note: Excludes real-time tools, debugging tools, project management, 4GLs, decision support, report writers

KnowledgeWare was the stellar performer, doubling its revenues from 1989 to 1990. It is no coincidence that KnowledgeWare now comes closest to "being" AD/Cycle (and has not been bashful in making this known).

IBM itself is not even on the list yet, since AD/Cycle is, so far, made up almost wholly of third-party products. Four of the six CASE companies in which IBM has made an investment are on the list. The six CASE-related equity partners are:

- KnowledgeWare
- Index Technologies
- Synon
- Bachman Information Systems
- Systematica
- Easel Corporation

C

CASE Product Vendor Strategies

There are two types of CASE product vendors operating in the current market: hardware vendors and independent CASE software product companies (although with IBM's investments, this line has blurred somewhat). This section will examine the strategies of IBM and DEC and then examine the common threads in the strategies of the independent vendors.

1. IBM

In the changing environment of the 1980s, IBM saw its hardware sales growth shrink and a continued erosion in overall account control. The *strategic* elements in its CASE initiative can potentially provide impetus for IBM's hardware growth and account control. These strategic elements include:

- Rapid application development
- Building a proprietary CASE environment
- Providing CASE product options to customers
- Co-opting potential third-party competitors
- Providing CASE-based applications solutions

See Exhibit VI-5 for the relationships between IBM's objectives.

EXHIBIT VI-5

IBM's Intermediate and Final CASE Objectives

Rapid Development	De Facto CASE Standard	CASE Product Options	Third-Party CASE Co-option	CASE-Based Applications

Improved Application Implementation

Additional Hardware Sales
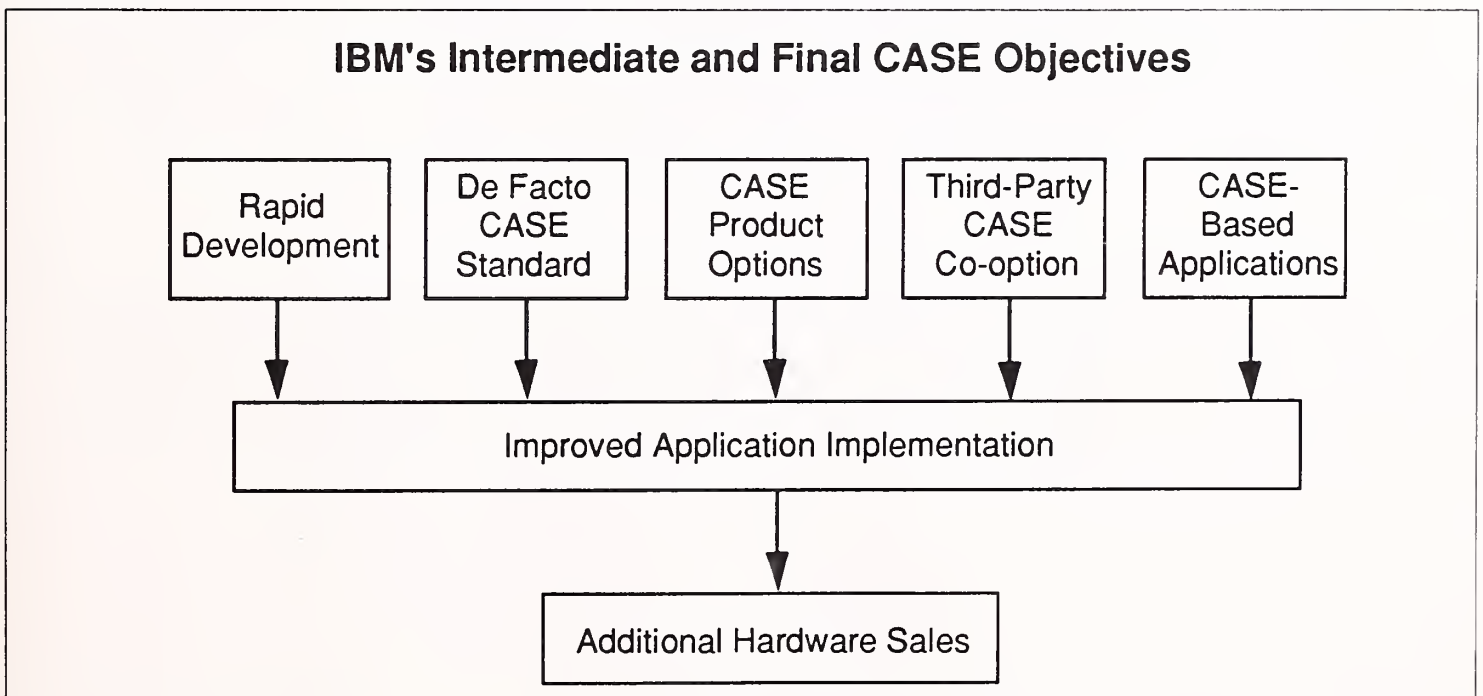
a. Rapid Application Development

This is the technical heart of CASE, of course. The faster that business-driven applications can be built, the more hardware is needed—a crude equation, but real. However, two barriers have to be overcome:

- CASE acceptance and related culture change are potential bottlenecks.

- The right paths to CASE development are still difficult to find.

Rapid application development will by itself contribute only marginally to account control since a system of even more rapid application development could displace it.

b. De Facto Standard

AD/Cycle as it is evolving is semi-open in respect to IBM's sharing of technical information and adopting outsiders' suggestions. However, IBM controls the process. While copyright and trade secrets will protect some of the core technical knowledge, the sheer bulk of AD/Cycle will discourage most other vendors from trying to duplicate it. This could result in the type of account control that MVS now provides, the difference being that customers may be content with this situation if they perceive that they benefit from IBM's dominance of CASE.

INPUT believes AD/Cycle will gradually produce de facto methodology standards:

- The front-end tools offered by IBM and its equity partners will be more receptive to certain methodologies than others.

- IBM has assigned a high priority to its own consulting and professional services activities. By the end of 1991, virtually all of IBM's systems design-related activities will be utilizing as many parts of AD/Cycle as are feasible in a particular assignment. IBM is very likely to settle on a limited number of methodological approaches in its own use of AD/Cycle.

c. CASE Product Options

One of the unique features of the AD/Cycle strategy is its incorporation of other vendors' software products into an IBM "product." The products come from vendors in which IBM has a made an equity investment. This approach provides customer benefits that will reinforce account control:

- Customers are given a choice of products that are essentially compatible and replaceable—but all are under IBM's ultimate control.

- There will be internal competition among the partners and between them and IBM. This way neither IBM nor its customers are locked into a single technology path.

d. Co-Option of Third Parties

Related to the offering of AD/Cycle product options, but more subtle and more powerful, is the co-option of third parties: at the announcement of AD/Cycle IBM also announced a list of over 40 "development associate" vendors that would be cooperating with IBM. This list included many potential direct competitors; since then most significant CASE product vendors have announced that they will be compatible with AD/Cycle. Even some other hardware manufacturers are building AD/Cycle bridges into their CASE planning.

e. CASE-Based Application Solutions

Creating applications software packages on top of AD/Cycle is a very important long-term objective. IBM's investments in applications software product companies (e.g., Policy Management Systems) could begin a move in this direction. However, IBM will rely largely on the market acceptance of AD/Cycle to convince application product companies to take this step. If AD/Cycle-based packaged software reaches critical mass, both hardware sales and account control will be helped significantly.

f. Summary

Exhibit VI-6 summarizes the role that the strategic elements of CASE could have on IBM's business objectives. IBM's strategy is a broad-based one: not every element has to achieve its maximum potential for IBM's strategy to be a success overall. For example, even if IBM lost part of its proprietary control of AD/Cycle, its overall account control strategy could still succeed.

EXHIBIT VI-6

The Role of CASE in Supporting IBM's Business Objectives

Strategic CASE Elements	Business Objectives	
	Account Control	Hardware Sales
CASE-based applications solutions	H	H
Co-option of third parties	H	M/H
Rapid application development	M/L	H
Proprietary CASE environment	H	L
Provision of CASE product options	M/H	M

Key: H =   High importance of CASE component
      M =   Medium importance
      L =   Low importance

2. DEC

IBM has opted for a CASE environment where it can achieve virtually total control. DEC had followed this same path in the late 1980s as it began to offer an increasingly full and sophisticated set of application building tools. It was natural for DEC to build its own development software:

- The same type of strategic considerations which impelled IBM to control its own applications development environment would apply to DEC as well, although with slightly less intensity.

- This culminated in the summer of 1990 with the announcement of the future direction of its dictionary product, CDD+. CDD+ was announced as serving as the basis for a repository architecture.

- At the same time, the entire concept was renamed Cohesion. Besides being a repository product functionally analogous with AD/Cycle, Cohesion would ultimately run on non-VAX platforms (UNIX, OS/2, and perhaps others).

However, three months after the Cohesion announcement, DEC announced a partnership with Texas Instruments whereby the TI product, IEF, would be ported to the VAX line. In early 1991, DEC made a similar announcement regarding Andersen Consulting's Foundation product. (See Exhibit VI-7.)

EXHIBIT VI-7

DEC's Overlapping Strategies

1980s   Internally Developed Tools

1990   CDD+/Repository Architecture   Cohesion   ?   • IEF (Texas Instruments)

• Foundation (Andersen Consulting)

1990s   UNIX, OS/2 Platforms
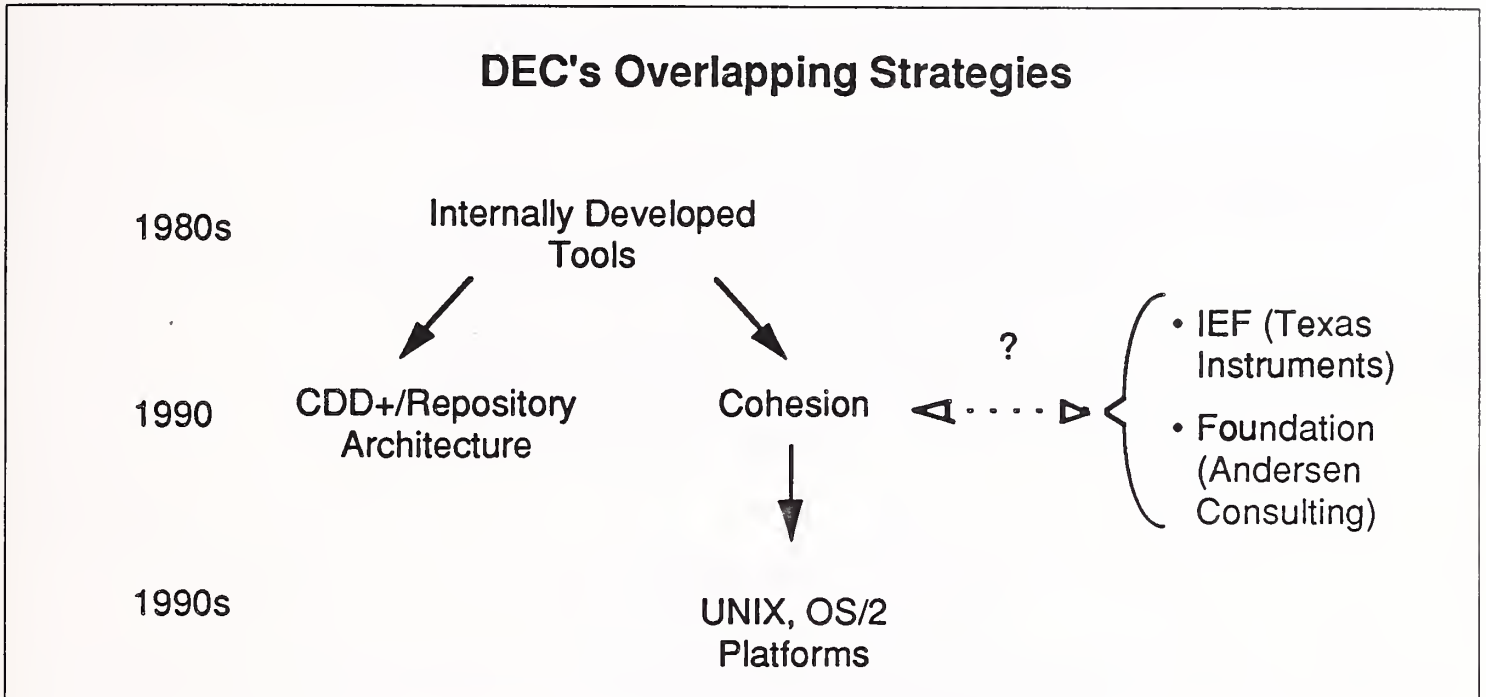
DEC is now in the position of sponsoring three comprehensive environments for its VAX platforms. Those from its partners will provide multi-platform connectivity to IBM and other environments.

• This kind of choice will give VAX customers a selection of CASE environments to work in. This is somewhat similar to the AD/Cycle philosophy.

• DEC will also be able to hedge its bets on the ultimately successful VAX-based CASE environment. If Cohesion should not proceed as expected or one of its partners falls by the wayside, DEC would still have CASE-based solutions to offer its core market.

• It is also possible that Cohesion will be able to absorb technology from its partners. This could accelerate Cohesion development and also provide greater compatibility.

However, DEC (and its customers) do run risks in this approach:

• The main risk is that in the longer run DEC will not be perceived as having a strategy. Sponsoring three different CASE approaches is something that no other vendor has attempted.

• CASE integration across the VAX line will be extremely difficult because DEC will not be sponsoring a de facto standard like IBM has in AD/Cycle. DEC may be underestimating the extent to which its customers require an AD/Cycle-like approach.

• DEC's partners may lose interest in either the VAX platform or, conceivably, CASE itself. For both TI and Andersen Consulting, their CASE products are important but not vital to the firm's continued wellbeing. In any event, these agreements are nonexclusive, and TI and DEC could find other partners that could prove distracting.

3. IBM and DEC Strategies

Both IBM and DEC have taken different paths in traversing from standalone CASE to repository CASE (Exhibit VI-8).

EXHIBIT VI-8

**IBM and DEC
Overlapping Strategies**
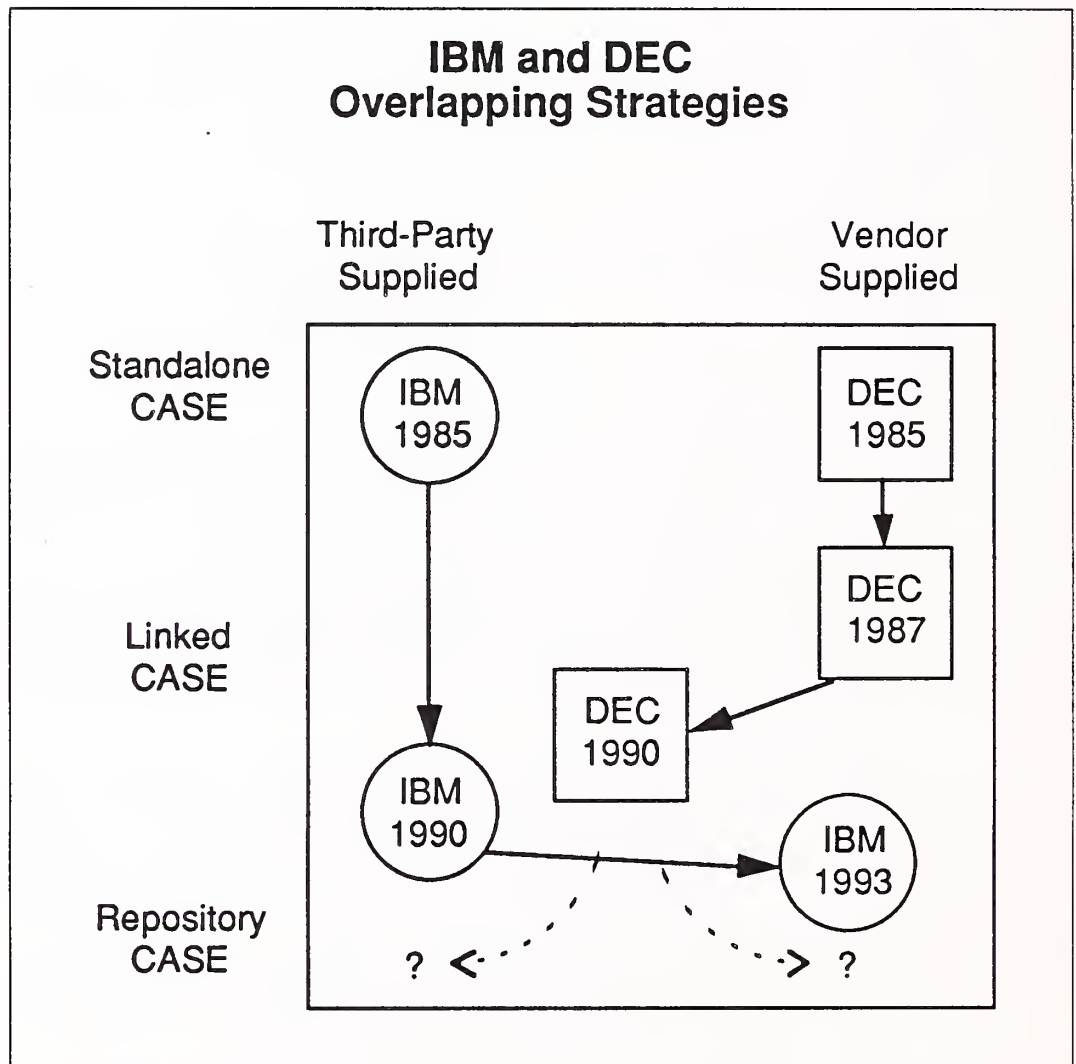
• IBM initially depended entirely on the third-party community for CASE products. This position has now changed completely.

• DEC, on the other hand, may have begun the opposite journey. However, the ultimate basis for its repository is still not clear.

4. Independent Vendors

Until recently, most independent CASE product vendors focused on the IBM 370 series as the target platform, with the IBM PC as the developmental platform.

- AD/Cycle changed that; those receiving the consolation prize of "Vendor Associate" discovered that companies in which IBM made an investment ("equity partner") had the inside track.

- As in the case of TI and Andersen, there has been a search for friendlier platforms. UNIX has aroused particular interest.

Exhibit VI-9 provides a snapshot of CASE vendor groupings.

EXHIBIT VI-9

CASE Vendor Groupings

	AD/Cycle Equity Partner	AD/Cycle Vendor Associate	DEC Partner	DEC Compatibility	UNIX Platform
KnowledgeWare	X	X			
Intersolv	X	X			X
Texas Instruments		X	X	X	X
Cadre		X	X	X	X
Pansophic		X			
Andersen		X	X	X	
Oracle		X	?	X	X
Synon	X	X			
CGI		X			X
Viasoft		X			
Transform Logic		X			
DEC			X	X	X
Interactive Dev. Environment				X	X
Computer Assoc.					
Manager		X			
Bachman	X	X			

- Multiple platform offerings may be more attractive to independent vendors compared to basing offerings solely on the IBM platform.

- Multiplatform implementation will also offer a capability that is not now a feature of AD/Cycle.

- Mergers and acquisitions provide another means to provide additional capabilities. Exhibit VI-10 shows mergers and acquisitions involving leading product vendors.

EXHIBIT VI-10

Selected CASE Mergers and Acquisitions

- KnowledgeWare (Database Design and Tarkenton Software)
- Intersolv
- Cadre (Northwest Instruments and MicroCase)
- Pansophic (Telon product)
- Transform Logic/Nastec
- IBM (minority investments in KnowledgeWare, Index Technology, Synon, and Bachman Information Systems)

D

Other Types of Vendors

1. Overview

Most commercial CASE-connected offerings are still focused on CASE software products and tools. Exhibit VI-11 analyzes the offerings of vendors at a recent CASE conference exhibition:

- The vast majority of vendors were selling front-end or back-end tools. (The percentages in Exhibit VI-11 slightly *understate* the proportion of CASE product offerings, since some exhibits contained products from two or more vendors.)

- Most of the CASE-connected services involved the supplying of CASE product implementation and installation services. Several were offering re-engineering services.

EXHIBIT VI-11

Offerings of CASE Products vs. CASE Services

CASE Products and
Services

7%

Services

11%

3%

CASE
Methodology

79%

CASE Products

Source: Analysis of 62 vendors at a 1991 CASE exhibition
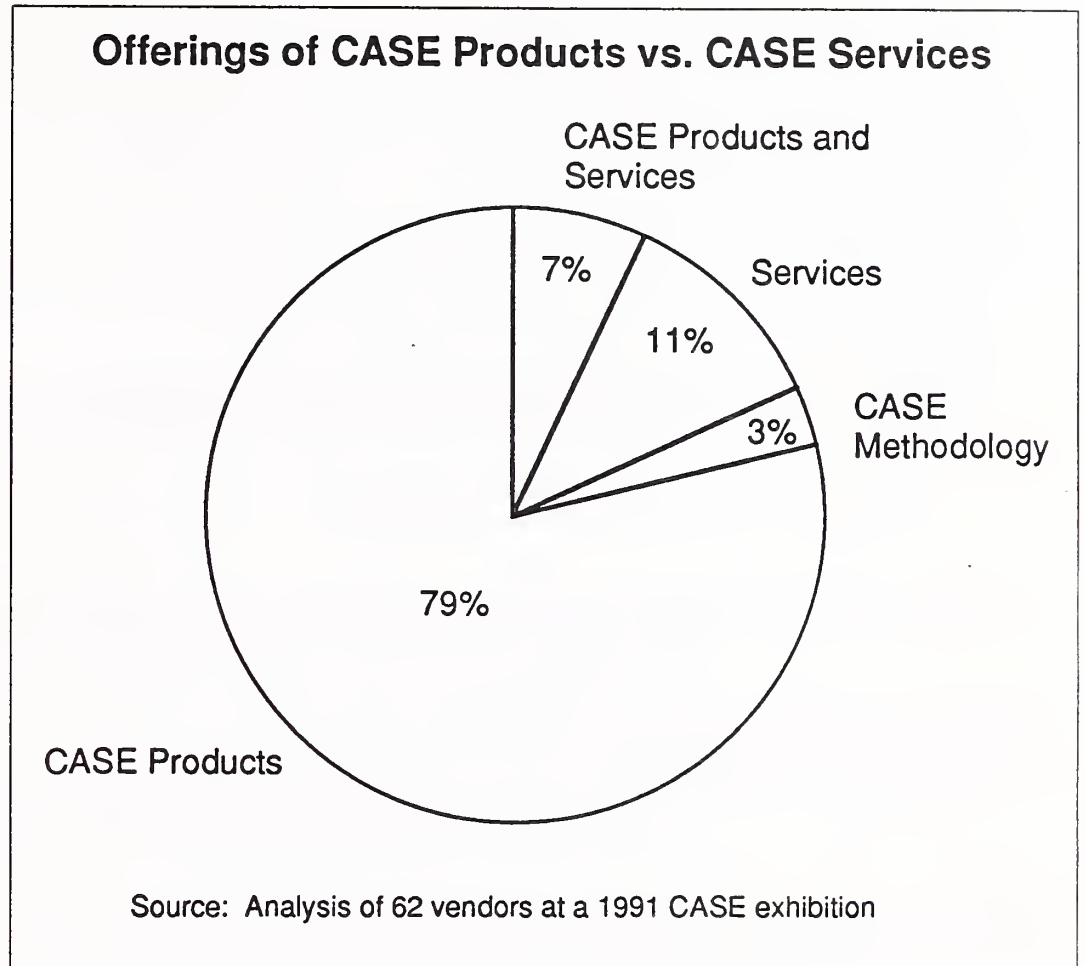
Looking into the future, the focus of CASE offerings will almost certainly change. There will be many fewer CASE products on the market:

• As noted earlier, there is industry consensus that the number of CASE product vendors will be dropping sharply.

  - The principal technical and market impetus will come from the need for integration.

  - Financial pressures will continue to mount for the secondary players as their revenues plateau and investors become wary.

2. CASE Support Software

INPUT expects that niche markets will develop around core CASE product offerings to fill specialized needs.

• This will be analogous to the current market for DB2 support tools.

• However, it is important to note that it took several years for very many DB2 support tools of consequence to appear. Potential tool suppliers had to understand DB2 and the needs of the DB2 market, obtain financing, and then produce and market products.

- INPUT expects a similar market to grow up around AD/Cycle (and possibly some of the other products). However, following the analogy of DB2, such tools will not begin to appear until 1992 to 1993.

Potential areas for such support include:

- Tightly integrated project management

- "Snap-in" methodology modules

- Business information models for specific processes (using object-oriented techniques to the extent these will be supported).

3. Application Software

IBM has stated on several occasions its long-term view of CASE (i.e., AD/Cycle) serving as the foundation for third-party software products. The potential attractions of such products for a vendor's internal operations are significant:

- The potential benefits from AD/Cycle are just as large for commercial software producers as they are for corporate application developers.

- Even more important, CASE techniques could improve product modification and maintenance.

Attractiveness to customers could be even more important:

- CASE-built applications software products could be tailored to the specific needs of a customer. This tailoring would make packaged products much more attractive:

  - Currently a customer's operations must often conform to the software product. CASE-built software products would have the potential to conform to the customer's way of doing business.

  - The uniformity of current packaged software makes it difficult to provide a unique competitive edge. CASE-built products should have the flexibility to permit corporations to proceed in different strategic directions utilizing a nominally standard software product.

- For example, some large customers have historically bought applications packages to serve as a framework for extensive custom modification. CASE-built products would formalize this process and make it viable for much smaller organizations to use.

Attractive as this might be in concept, the risks are not insignificant:

* Making such a conversion would be a tremendous undertaking for an established vendor in terms of time and dollars. Until the CASE technology is well established, there is also some technical risk involved.

* Established vendors would be faced with supporting CASE and non-CASE product lines for some time.

  - The ultimate switching of all non-CASE customers to the CASE-based environment would be a long-term operation, at best.

  - Some customers would be unwilling or unable to make the changeover.

  - Dual support would negate some of the benefits of offering CASE-based products.

  - In principle, some of the lost benefits could be gained back by using the CASE-based product to generate the standard product; however, it is not clear at this point what proportion of both product versions could be jointly supported.

* New vendors (or established vendors offering new products) would not have these dual product line trade-offs to make. However, they would have the same funding and development hurdles to surmount.

Understandably, vendors will be cautious in this area. They will be doubly cautious with the recent history of OS/2 before them:

* Many vendors geared up to develop and offer OS/2-based products upon the initial announcement.

* The risk was seen as reasonable, given OS/2's undoubted technical advantages and IBM's backing.

* OS/2, of course, has not taken off. The early-adopter vendors have found themselves with very slow-selling products.

* The investment in CASE products is at least an order of magnitude larger than for most OS/2 products.

Exhibit VI-12 shows how CASE-related factors are currently balanced between the positive and negative.

EXHIBIT VI-12

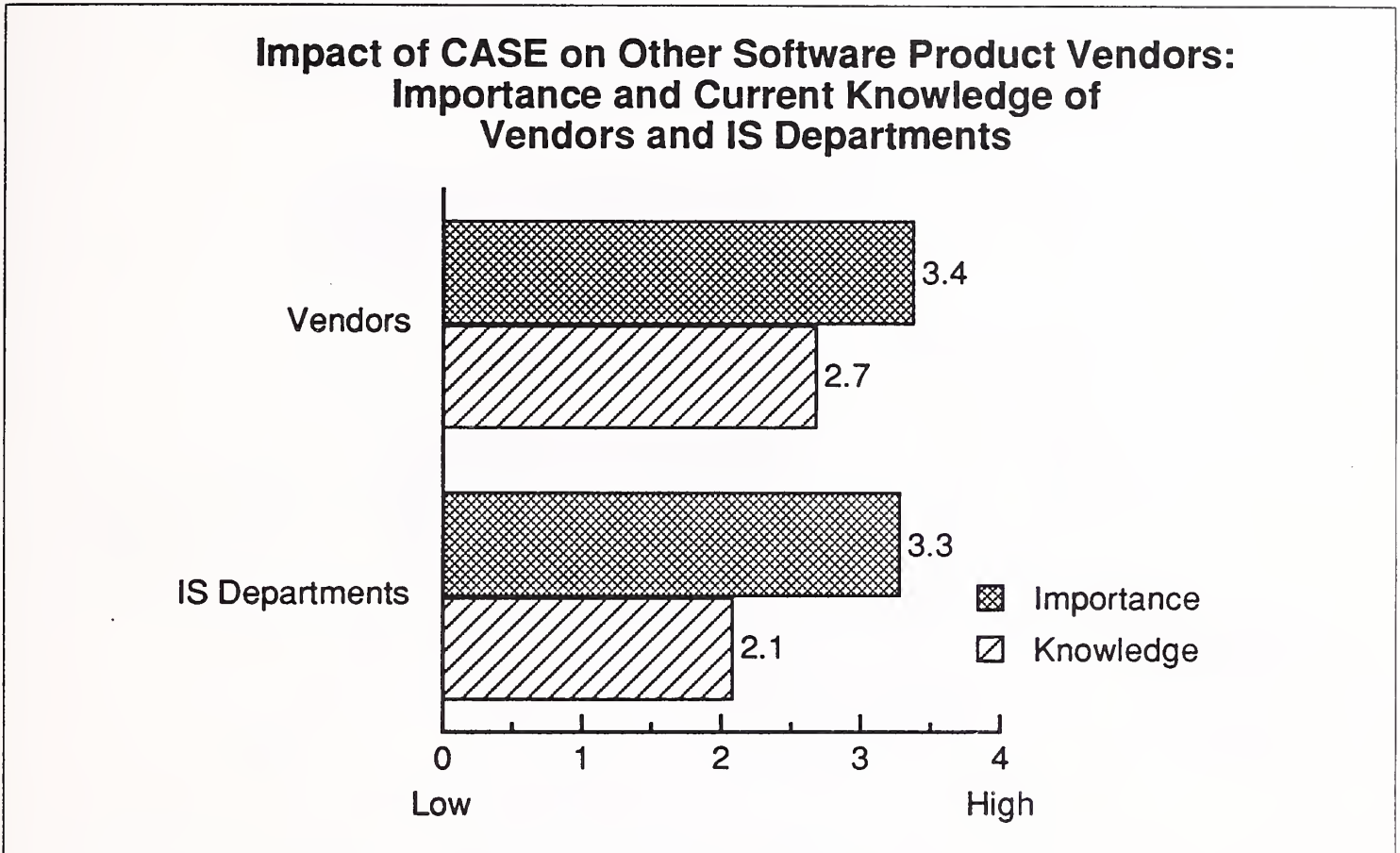## CASE-Related Application Software Product Issues

Factors	Positive	Negative
Product	• Quality • Timeliness • Flexibility	• Technical risk • Time and dollar resources • Dual product support
Customer	• Higher quality • Tailoring capabilities	• Acceptance rate • Integration plans
Timing	• Tie-in to customer CASE planning	• Too early • Too late

INPUT's research has confirmed the underdevelopment of this general area (Exhibit VI-13):

• Both vendors and IS departments see this issue as being of moderate importance now.

• The levels of knowledge and understanding are extremely low.

This is an area that needs more research, especially on how CASE-built applications fit into customers' long-term CASE plans.

Impact of CASE on Other Software Product Vendors:
Importance and Current Knowledge of
Vendors and IS Departments

Vendors — 3.4 (Importance), 2.7 (Knowledge)

IS Departments — 3.3 (Importance), 2.1 (Knowledge)

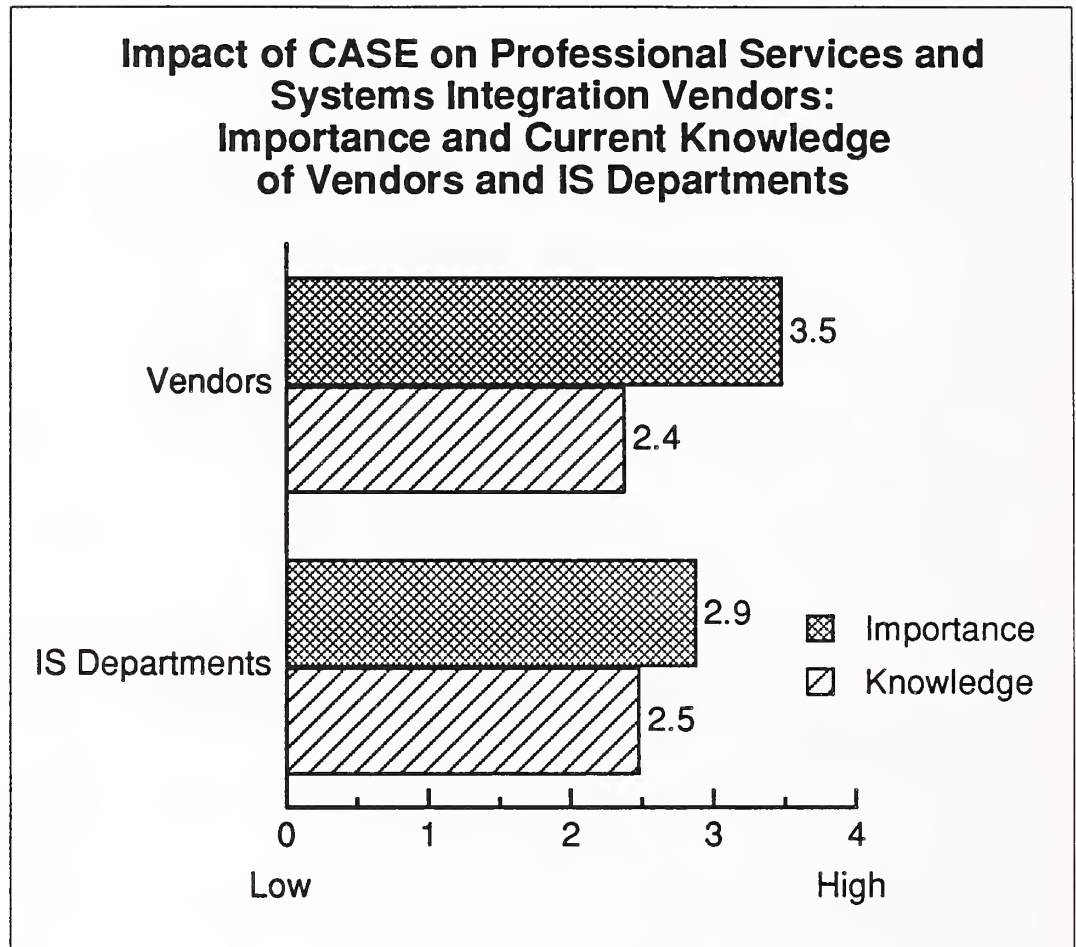Scale: 0 (Low) 1 2 3 4 (High)

▨ Importance
▧ Knowledge

4. Professional Services/Systems Integration Firms: CASE-Based Development Services

CASE vendors are becoming more aware of the importance of CASE to professional service/systems integration vendors, but they find their knowledge of options limited (Exhibit VI-14). IS departments have not yet awakened to the potential importance CASE holds for them in combination with externally supplied professional services.

• Professional services firms and systems integrators within the information services industry will soon have to make a series of strategic decisions concerning their CASE position. These decisions are similar to those facing IS departments; however, the vendor position is much more highly leveraged.

  - The correct decision on the position of CASE will bring vendors larger benefits.

  - Incorrect decisions could prove disastrous. This is because a higher proportion of vendor work is new business, which is much more CASE-sensitive than the maintenance/modification work that makes up most IS department work.
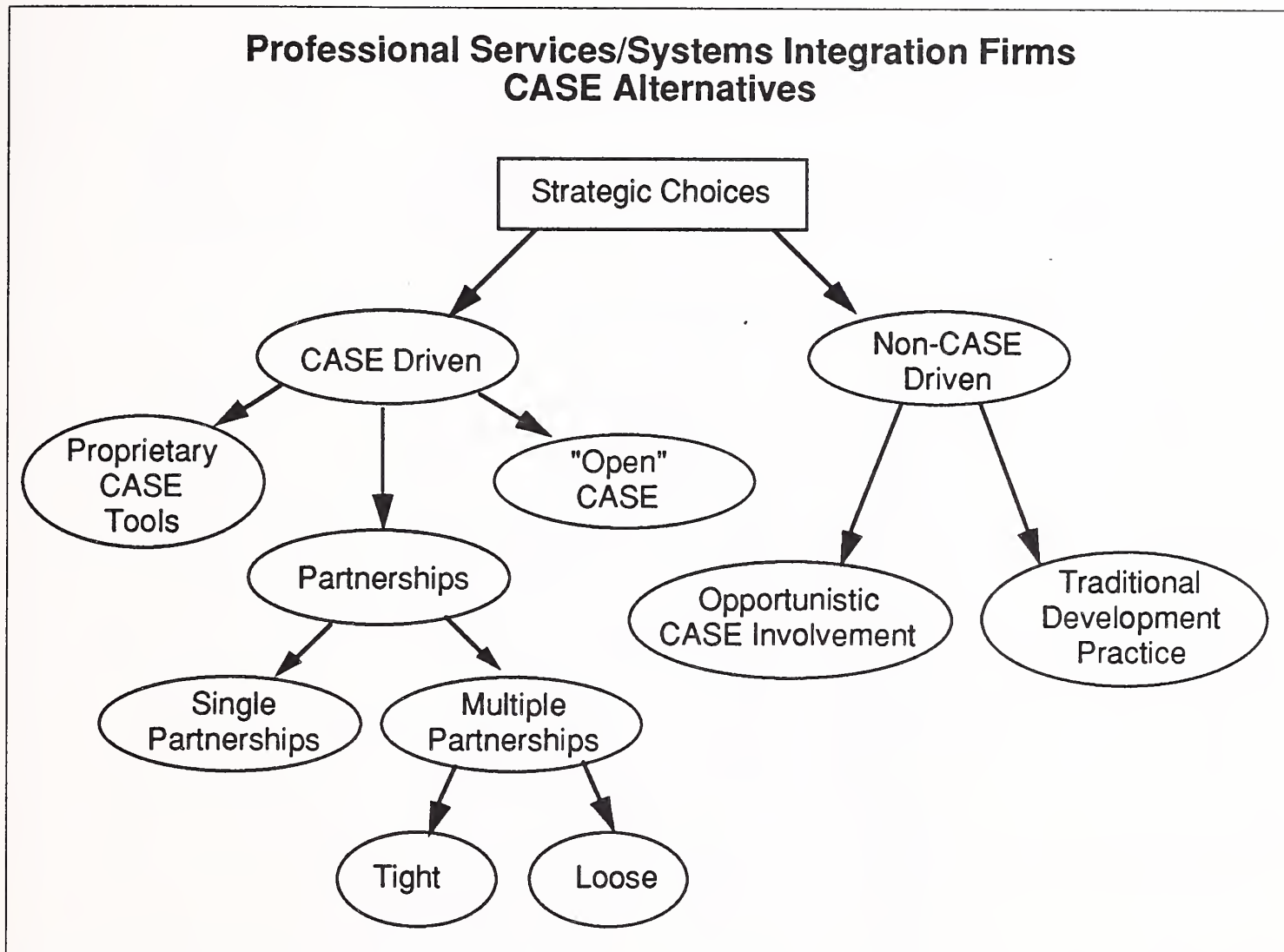
EXHIBIT VI-14

**Impact of CASE on Professional Services and
Systems Integration Vendors:
Importance and Current Knowledge
of Vendors and IS Departments**

Professional service firms and systems integrators [to be called systems integrators for the remainder of this section for the sake of brevity] are faced with many strategic choices in regard to CASE
(see Exhibit VI-15).

• "Non-CASE driven" is basically business as usual; this is consistent with the decentralized structure of most systems integration firms, giving local and vertically focused managers the flexibility they need to respond to market needs. However, this approach runs the risk of adjusting too slowly to major changes in the market environment, such as CASE.

• The CASE-driven choices are not simple ones:

  - Building on a firm's own proprietary tools can be very efficient and certainly provides account control. However, a firm may end up in a technical blind alley or be bypassed by market factors over which it has little control (such as AD/Cycle).

EXHIBIT VI-15

Professional Services/Systems Integration Firms
CASE Alternatives

```
                        ┌─────────────────────┐
                        │  Strategic Choices  │
                        └─────────────────────┘
                           ↙              ↘
                   ┌──────────────┐   ┌──────────────┐
                   │ CASE Driven  │   │  Non-CASE    │
                   └──────────────┘   │  Driven      │
                    ↙    ↓    ↘       └──────────────┘
          ┌───────────┐  │  ┌────────┐   ↙        ↘
          │Proprietary│  │  │ "Open" │
          │ CASE      │  │  │ CASE   │  ┌─────────────┐  ┌─────────────┐
          │ Tools     │  │  └────────┘  │Opportunistic│  │Traditional  │
          └───────────┘  │              │CASE Involve-│  │Development  │
                   ┌────────────┐       │ment         │  │Practice     │
                   │Partnerships│       └─────────────┘  └─────────────┘
                   └────────────┘
                    ↙        ↘
          ┌────────────┐  ┌────────────┐
          │ Single     │  │ Multiple   │
          │Partnerships│  │Partnerships│
          └────────────┘  └────────────┘
                           ↙        ↘
                    ┌────────┐  ┌────────┐
                    │ Tight  │  │ Loose  │
                    └────────┘  └────────┘
```

- The other extreme is what might be termed an "Open CASE" strategy where a systems integrator will work with many CASE vendors (although the list may be limited for reasons of feasibility and technical critical mass).

- The remaining options come under the broad heading of "partnership." These can range from loose arrangements that are only one step away form an "Open CASE" approach to an exclusive arrangement with a single vendor. In between are tighter, multiple partnership arrangements that have a formal structure.

As Exhibit VI-16 shows, there are multiple positive and negative aspects to each potential partnering arrangement when looked at from the standpoint of the systems integrator. The major trade-offs involve:

EXHIBIT VI-16

Analysis of CASE Partnering Arrangements from Standpoint of Professional Services/Systems Integration Firms

Partnering Arrangements

	Propriety Tools	Single Partner	Multiple Partners-Tight	"Open" CASE/ Loose Partnering
Positive Aspects	Efficiency Control tool direction Account control	Partner develops tools Leverage for coordinating technical and business strategies Potential for long range relationship	Partner develops tools Choice of tools Choice of partnering arrangements	Choice of tools Great flexibility in technical direction Ad hoc arrangements
Negative Aspects	Potential customer resistance Resources to support tool Commitment to a potential technical dead end	Incomplete control over product direction Could be crippled by partner's business reverses Commitment to a potential technical dead end	Little control over product direction Partners may not value relationship or enter into conflicting relationships	No control over product direction Difficult to attain critical mass of knowledge

- The trade-off between controlling or influencing the technical direction of a CASE product and becoming overcommitted to a suboptimal solution

- Having a close relationship with a partner at the expense of being hurt if the partner should change direction or suffer a business reverse

Many customers will in the future have a much higher interest in systems integrators' utilization of CASE. By the same token, customer plans for and use of CASE will be at least as important to systems integrators.

- Where a systems integrator is committed to one CASE tool (or a small selection of CASE tools), will the customer accept the commitment?

- If several systems integrators are developing applications for an organization but are using different CASE tools, will the customer organization understand the long-term implications?

- If a customer corporation has adopted a particular CASE tool approach, will all integrators have to conform?

- How feasible will it be to retrofit applications built by a systems integrator with CASE tool A, to the new standard involving CASE tool B?

5. Professional Services/Systems Integration Firms: Other CASE-Related Services

As discussed in the prior subsection, most analyses of systems integration and CASE revolve around the use of CASE in the systems development process (including the re-engineering component).

However, this may be too narrow a view of corporate needs in connection with CASE. This is especially true in view of the large number of "soft" CASE problems that have surfaced in IS departments (see Exhibit III-10).

It is fairly obvious that there are needs for broader scale assistance in "acclimating" a corporation to the "organizational readiness" issues (see Exhibit V-2).

However, acclimatization cannot be done in a vacuum: acclimatizing would be linked to a broad program of CASE-related training. Such training would include:

- Training CASE users in methodology use
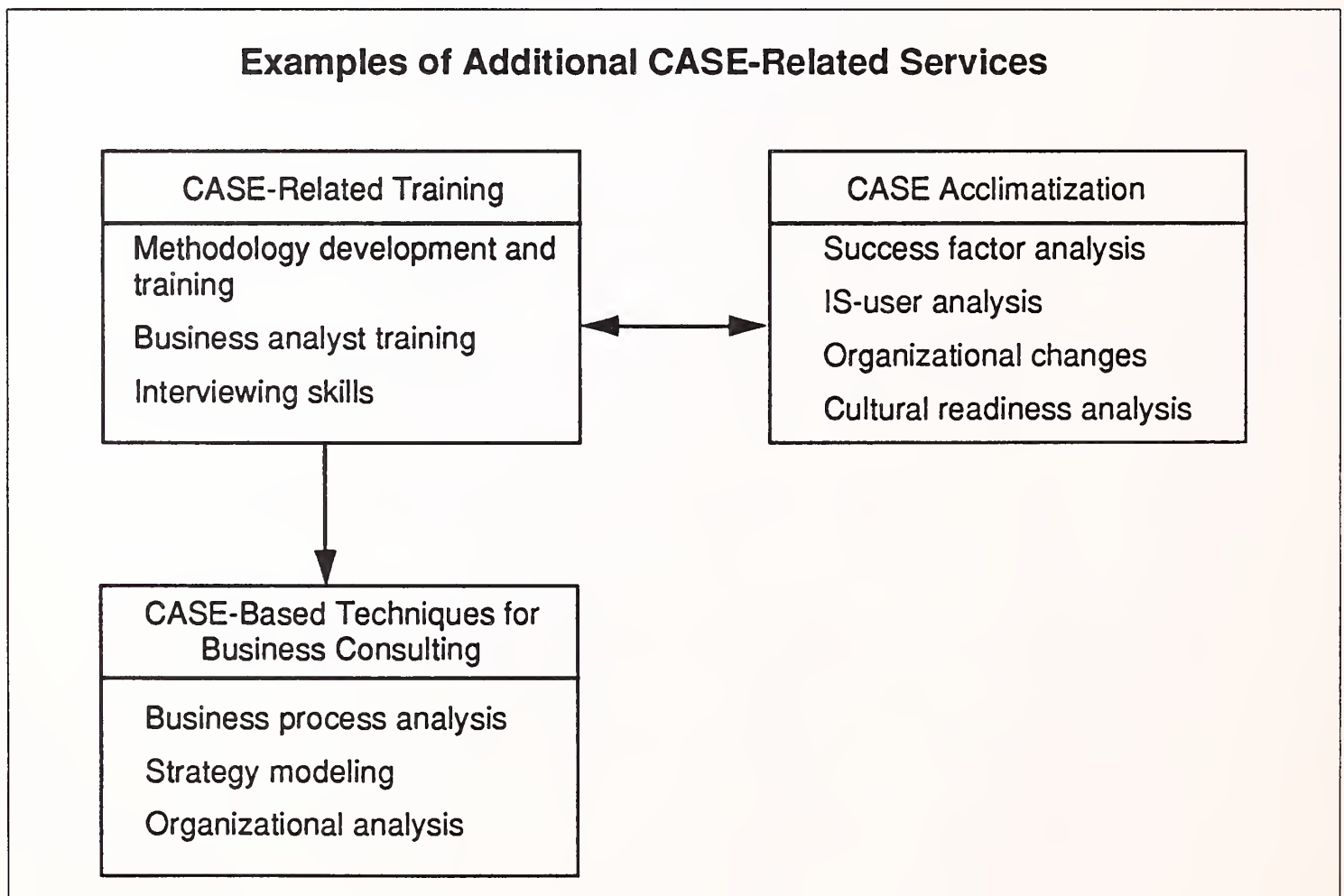
- Training business analysts

- Comprehensive training in interviewing skills (since the critical elements in CASE environments will shift from properly *solving* the systems problem to properly *defining* the systems problem).
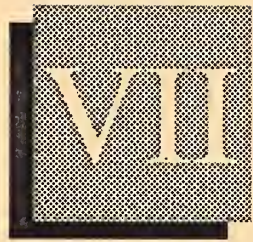
An even broader, but legitimate use of CASE knowledge and technology is in business-related consulting, i.e., in the "upstream" activities that may or may not lead to systems consulting. The kinds of activities where CASE techniques could be appropriate include:

- Analyses of business practices, process, and rules

- Strategic audits, evaluating an organization's competitive advantages

- Organizational analysis using CASE diagramming and relationship tools

This list is meant to be illustrative, not exhaustive. More research is needed to confirm and expand this list. Exhibit VI-17 summarizes the examples provided.
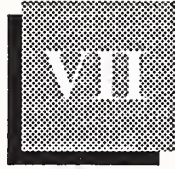
EXHIBIT VI-17

Examples of Additional CASE-Related Services

CASE-Related Training
Methodology development and training
Business analyst training
Interviewing skills

CASE Acclimatization
Success factor analysis
IS-user analysis
Organizational changes
Cultural readiness analysis

CASE-Based Techniques for Business Consulting
Business process analysis
Strategy modeling
Organizational analysis

VII

Conclusions and Recommendations

VII

Conclusions and Recommendations

A
Conclusions

CASE's promise is still largely in the future.

- The vast majority of large organizations are using CASE, but generally only in a fragmentary way.

- The impact of CASE and its effectiveness is rated quite low so far.

The principal barriers to a CASE "breakthrough" have been:

- Non-integrated CASE tool environments

- The lack of organizational readiness to exploit the CASE technology

Repository-based CASE tool environments (notably AD/Cycle) offer good prospects for integration. (That is, Stage 3 CASE products, as shown in Exhibit IV-6.) The readiness of the typical organization to take full advantage of even the first generation of Stage 3 products is still in doubt.

INPUT's view is that the key technical issue over the next five years will be re-engineering:

- It is reasonably close to resolution of the remaining open technical issues.

- When fully resolved, re-engineering will offer the most payback for the typical IS organization.

Distributed application development is also an important technical issue. However, the underlying distributed data base technology is still not fully fixed or defined. Therefore, CASE for building distributed applications is essentially on hold until the more basic technology issues have been addressed. INPUT does not expect CASE environments for distributed application development to be available before the mid-1990s.

Currently, at least 100 vendors offer CASE products. For several years there has been consensus that the industry would have to consolidate. In 1990, this trend became evident for vendors offering products primarily for IBM platforms:

• AD/Cycle had a chilling effect on most competing products, as many buyers froze their plans to evaluate AD/Cycle.

• Based on INPUT's research, the majority of new purchasers will move toward AD/Cycle.

• Undercapitalized product vendors and/or those with a low share in the IBM market will be faced with several options, including one or more of the following:

  - Merger

  - Development of niche products

  - Conversion to a professional services firm

  - Migration to other platforms

INPUT expects the vendor shakeout to continue, leaving a relatively small number of vendors that will offer fully functional integrated CASE products on the major platforms.

Exhibit VII-1 summarizes the major conclusions described above.

EXHIBIT VII-1

Summary of Conclusions

- CASE still in "promise," not delivery, stage

- Major barriers

  - Integration

  - Organizational readiness

- Re-engineering: Significant progress expected

- Distributed application development: limited progress expected

- AD/Cycle

  - Will probably meet most integration needs

  - Will accelerate vendor consolidation

B
Recommendations

1. CASE Users

Each organization that expects to gain CASE benefits will have to make a thoroughgoing commitment to CASE. Exhibit VII-2 is a sample of the type of readiness evaluation that should be conducted in order to make an effective commitment.

The most important concrete output from this kind of planning exercise is to understand the applicability of general CASE success/failure factors to a firm's specific environment.

IS departments should also begin the preparation required for re-engineering.

- IS departments should evaluate current major applications in the context of future application plans.

EXHIBIT VII-2

VII-4

Organizational Readiness Evaluation

- Cultural/organizational readiness

    - Applicability of factors to specific organizational setting

    - IS/user relationships

    - Assessment

    - Development of action plan

- Development methodology

    - Assessment of current needs and practices

    - Comparison to availability methodologies

    - Implementation

- Measurement

    - Identification of application development metrics

    - Test and evaluation

- CASE planning

    - Success/failure factors assessment

    - Applicability to specific organizational environment

- This analysis could produce one of a wide range of conclusions: from a few changes in an application to a re-analysis of a business system.

- Between these extremes are applications that need a significant amount of change: Some may be reverse engineered and others may be re-used.

Selecting the reverse engineering or re-use option will depend on multiple factors:

- The extent to which existing hardware/software platforms are going to be changed. The more changes involved, the more likely that reverse-engineering will not be suitable.

- Loose linkages to other applications will make reverse engineering more attractive.

- Intensive end-user design involvement, on the other hand, would favor re-use.

- The extent to which an organization is experienced and committed to forward engineering and repository technology would favor re-use.

Exhibit VI-3 summarizes these factors.

EXHIBIT VII-3

Factors Affecting Choice of Re-engineering Options

Factor	Re-engineering Options	
	Reverse-engineered Application	Re-used Application
Hardware/Software Platform	Unchanged	Changed
Host/Workstation Relationship	Unchanged	Changed
Linkage to Other Applications	Loose	Tight
End-User Design Involvement	Moderate	Intensive
Organizations' Repository Experience	Low	High
Forward Engineering Experience	Low	High

The result of this analysis will help determine a firm's overall re-engineering strategy, its tactics, and the types of re-engineering tools that will be most appropriate.

2. CASE Product Vendors

The chief challenge for every CASE vendor is how to come to terms with the market reality of AD/Cycle. This includes:

- Changes or modifications to prior strategic direction

- Technical linkage (or non-linkage)

- Developing a niche strategy

Generally, vendors that are affected (or potentially affected) by AD/Cycle can choose among three strategies:

- Erecting a "firewall" between their product and AD/Cycle (e.g., selecting incompatible architectures and/or platforms)

- Building a bridge to AD/Cycle

Finding a niche function within AD/Cycle

Exhibit VII-4 illustrates these strategies

EXHIBIT VII-4

AD/Cycle CASE Vendor Options
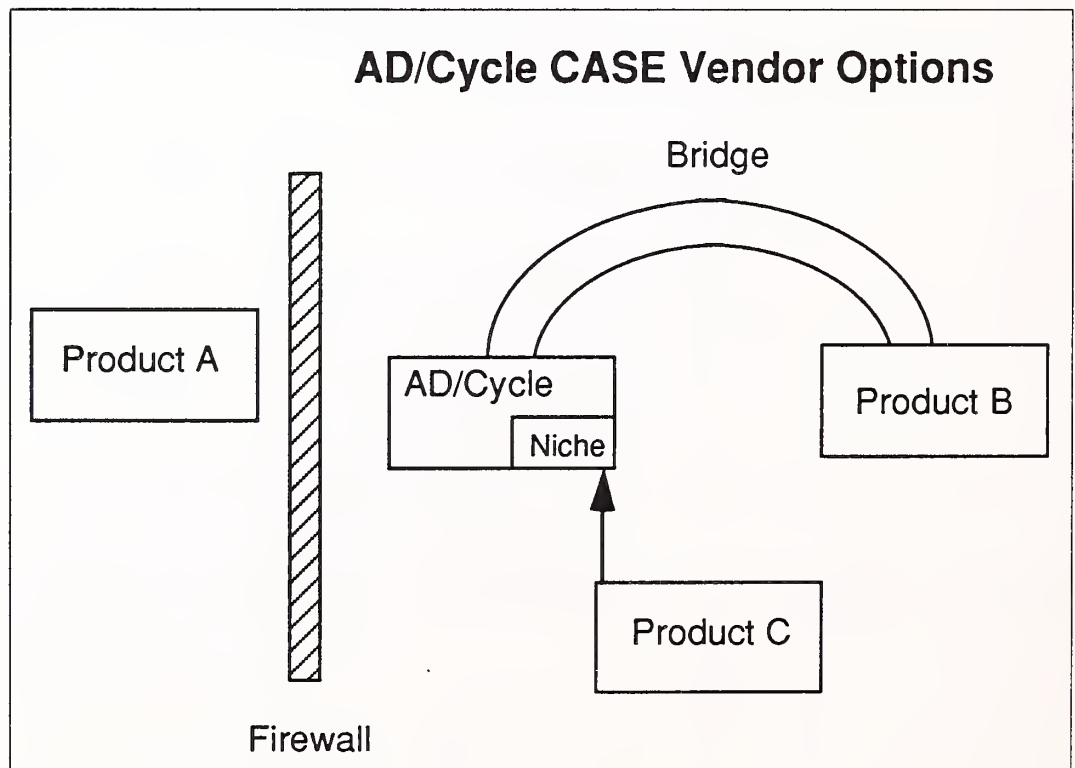
In addition, product vendors should also:

- Weigh offerings (or extending offerings) in professional services

- Evaluate which platforms should be given priority for both development and operations

- Develop a partnering strategy

All this will have to take place within a financial environment where investments and paybacks will have to be carefully balanced.

In the medium term, CASE product vendors with an adequate installed base can continue to exploit current customers, as a worst-case strategy. This means, however, that understanding success and failure factors for a specific customer environment can be at least as important as the technical adequacy of the underlying CASE product. These recommendations are summarized in Exhibit VII-5.

EXHIBIT VII-5

CASE Product Vendor Recommendations

- AD/Cycle

- Professional services

- Partnering

- Investment

- Exploit installed base
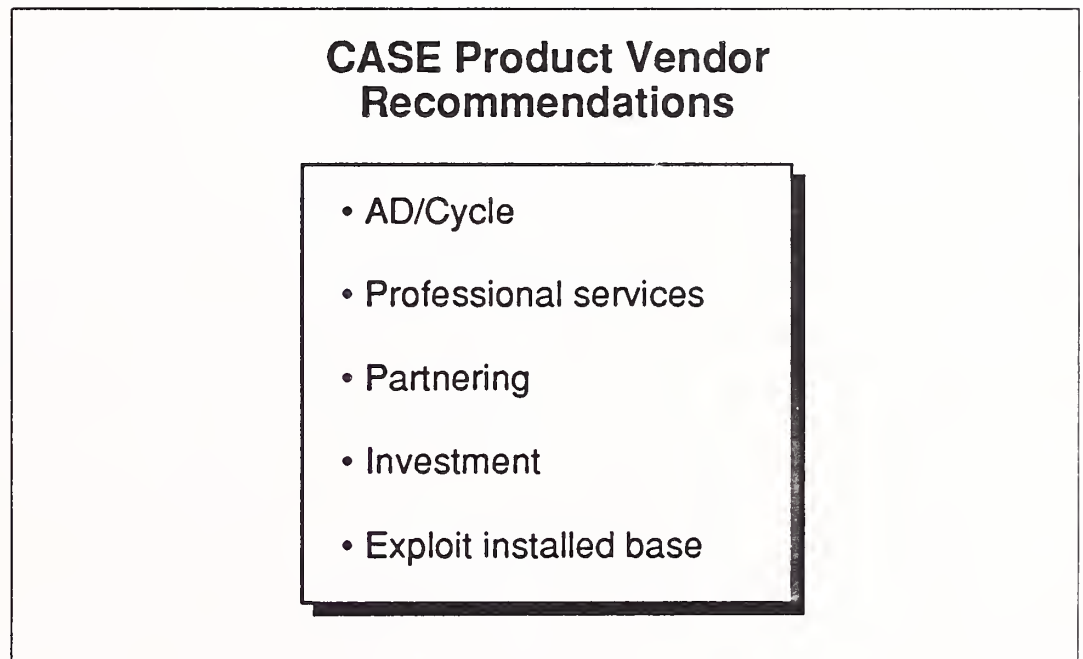
3. Applications Software Product Vendors

For the most part it is too early to be offering CASE-built products. However, given product lead times, every vendor should now be developing two interrelated strategies.

- What part to play in AD/Cycle

- How useful—and over what time period—CASE-built products would be to their particular client bases.

4. Professional Services/Systems Integration Firms

The timeframe for developing a CASE strategy for professional service firms and systems integrations is far shorter than it is for applications software vendors.

- Each vendor should by now have a well-defined CASE strategy. This need not be a publicly announced strategy; however, some version of the strategy must be communicated to customers and prospects.

- Each CASE strategy will grow out of an individual firm's market position and technical capabilities.

- Each firm must develop a specific strategy for dealing with AD/Cycle. This can range from treating AD/Cycle on an ad-hoc basis to making AD/Cycle a firm's official development environment.

- Given the dynamic nature of the CASE market, professional services/ systems integration vendors should also adopt one or more fallback strategies.

Appendixes
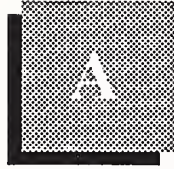
IS Management Questionnaire (Mail)

INPUT, in cooperation with POSPP, is conducting an assessment of a number of key IS technology and implementation trends. Included are LANs and servers, image processing, applications development, and data center operations. The questionnaire can be completed by the corporate IS function for its activities or by a division-level IS group.

Your response to the questions below will provide the foundation for INPUT's annual report on the state of the information systems function. INPUT will be presenting the results of this research at a future meeting to which you will be invited.

Your participation is appreciated. Please mail your completed questionnaire by November 9, 1990, to: **Ellen Snoyer, POSPP, 3230 Commander Drive, Carrollton, TX 75006.**

Demographics

1a.   What is your position/title? _____

1b.   Which of the following describes your information systems organization?
         ____ Corporate IS   ____ Division IS

1c.   Are you responsible for the telecommunications function? ____ Yes ____ No

2.   In which of the following industries is your organization?

         ___ Discrete Manufacturing   ___ Insurance
         ___ Process Manufacturing   ___ Medical
         ___ Transportation   ___ Education
         ___ Utilities   ___ Services
         ___ Telecommunications   ___ Federal Government
         ___ Retail Distribution   ___ State & Local Gov't.
         ___ Wholesale Distribution   ___ Consumer & Home
         ___ Banking & Finance   ___ Other (Specify)

3. What is the revenue of your organization?

         a. Revenue   b. Number of Employees
         ___ Over $10 billion   ___ Over 10,000
         ___ Over $1 billion   ___ Over 5,000
         ___ Over $500 million   ___ Over 1,000
         ___ Over $100 million   ___ Over 500
         ___ Over $50 million   ___ Under 500
         ___ Under $50 million

4a.   What is the size of your organization's information systems expenditures?

___ Over $500 million   ___ Over $100 million   ___ Over $50 million
___ Over $10 million   ___ Over $5 million   ___ Under $5 million

4b.   What is the average age of your systems? _____ yrs.

4c.   What is your current application backlog? _____ yrs.

4d.   How is information systems organized?
        _____ Centralized   _____ Decentralized   _____ Combination

Technology Trends & Issues

5a.   Using a check mark (✓), indicate the status of each of the following technologies.

New Technology		Status of Use		
		In Use	Planned - 1991	Planned - 1992
LANs/Servers				
Image Processing				
Cooperative Processing				
Distributed DBMS				
CASE	Engineering			
	Commercial			
AI/Expert Systems	Standalone			
	Imbedded			
Voice/Data Integration				
Wide-Area Networks				
Municipal-Area Networks				
Object-Oriented Programming				
UNIX	Engineering			
	Commercial			
Systems Application Architecture				
Open Systems				

5b.   What are the primary inhibitors to implementing new information technologies?

(1) _____

(2) _____

(3) _____

5c.   When are you most likely to address a new technology?

_____ Availability of a new technology
_____ As a by-product of an application system project
_____ Other (specify)_____

LANs & Servers

6a.   What is the number of operational LANs within your organization?_____

6b.   What is the projected number of operational LANs?
1991 _____   1992 _____   1995 _____

7.   Using a check mark (✓), indicate the level of integration between these LANs.

Type of LAN Interconnection	Degree of LAN Interconnection			
	None	Low	Medium	High
LAN-to-LAN				
LAN-to-Server				
LAN-to-Midrange				
LAN-to-Mainframe				
LAN-to-WAN				
LAN-to-MAN				

8.   Who has responsibility for management and support of the LAN environment?

_____ Corporate IS   _____ Division IS   _____ User

9.   How would you rate the use of LAN technology within your organization? (Circle one)

Not Effective   Effective   Very Effective

1   2   3   4   5

10. Using a check mark (✓), indicate the status of the following applications and tools on LANs within your organization.

LAN Applications	In Use	Planned - 1991	Planned - 1992
PC tools (spreadsheet, etc)			
Desktop publishing			
Electronic mail			
Mainframe DBMS queries			
Executive Information Systems			
Accounting			
Order entry			
Sales reporting			
Production scheduling			
CAD/CAM			
CASE			
Other (specify)			
Other (specify)			

Image Processing

11. What is the status of image processing within your organization?

___ In production   ___ Considered and deferred
___ Prototype   ___ Not applicable
___ Planned for 1991   ___ Not considered to date
___ Under consideration

12.   Please list image processing applications in use or planned and, using a check mark (✓), indicate the status of each.

Image Processing Applications	In Use	Planned - 1991	Planned - 1992
(Specify)			
(Specify)			
(Specify)			
(Specify)			

13.   What are the three most critical issues in image processing, based on your experience to date?

(1)   _____

(2)   _____

(3)   _____

14.   Who is funding the image processing activity?

___   Information Systems
___   Corporate User Department
___   Division/Business Unit
___   Other (specify) _____

15.   What role(s) are vendors playing in your image processing program?

____   Software Product Provider
____   Hardware Provider
____   Consultant
____   Systems Development
____   Systems Integration
____   Systems Operation
____   None

16.   How would you rate the use of image processing technology within your organization? (Circle one)

Not	Effective	Very
Effective		Effective
1	2	3	4	5

Applications Development

17a.　Please rank the top 5 (from 1 to 5) applications development issues in terms of their relative importance over the next two years.

___ CASE　　　　　　　　　　　　　　　___ Human resource availability
___ Relational DBMS　　　　　　　　　___ Funding
___ Distributed DBMS　　　　　　　　　___ Vendor capabilities
___ Re-engineering existing applications　___ End-User application development
___ Workstation-based applications

17b.　What other issues are critical to your applications development program?

(1)　_____

(2)　_____

(3)　_____

18a.　What is the current percentage of development resources allocated to the following?

____% Maintenance　　　　　____% Enhancement　　　　　____% New Development

18b.　How effective are your efforts to control application maintenance resource consumption?

Not Effective		Effective		Very Effective
1	2	3	4	5

18c.　Please indicate which of the following approaches you have used to control application maintenance resources.

____ Limited resource allocation　　　　____ Set up maintenance-only function
____ Assign to user　　　　　　　　　　____ Contract with outside vendor
____ Re-engineering of applications　　　____ Recoding products
____ Replace with purchased software product
____ Other (specify)_____
____ Other (specify)_____

19a.　Please indicate your status with CASE technology.

____ In use　　　　　　　　　　____ Prototype
____ Under consideration　　　　　____ Considered and not in use
____ Not being considered

19b.　If in use, what percent of your development staff is using CASE tools?　____%

19c.   If in use, are CASE tools being applied to:

_____ New development   _____ Re-engineering existing applications   _____ Both

19d.   What are the three most critical issues with CASE, based on your experience to date?

(1)   _____

(2)   _____

(3)   _____

20.   If you are using CASE, how would you rate its effectiveness? (Circle one)

Not Effective		Effective		Very Effective
1	2	3	4	5

Data Center Management

The following questions address the trends to automate mainframe data centers and to use systems operations vendors to manage those centers.

21.   Is there more than one mainframe data center?
_____ Yes   _____ No

22.   If there is more than one mainframe data center, is there an active consolidation effort in process or planned?

_____ In process   _____ Planned for 1991
_____ Not planned   _____ Considered and rejected or deferred

23.   Using a check mark (✓), classify your current mainframe data center objectives by the following.

Objective	Planned for within which year			
	1990	1991	1993	1995
Fully Staffed Operation				
Consolidation of Centers				
Dimmed-Lights Operation				
Lights-Out Operation				
Systems Operations Vendor				

24.   Using a check mark (✓), indicate which of the following technologies are being used to manage your data center(s).

Data Center Management Tools	In Use	Planned - 1991	Planned - 1992
Network Control Tools			
AI/Expert Systems			
Security Control			
Console Message Supression			
Other (Specify)			

25.   Are you using or considering using a vendor to provide data center operations and/or network management?

a. Data center operation
____ Using
____ Considering
____ Considered and not using
____ Have not considered

b. Network management
____ Using
____ Considering
____ Considered and not using
____ Have not considered

26.   If using a vendor for data center operations or network management, are the services provided on-site or remotely?

a. Data center operation
____ On-site
____ Remote

b. Network management
____ On-site
____ Remote

27.   If using a vendor for data center operations, who owns the equipment?

____ Client   ____ Vendor

28.   Indicate which of the following services are provided by your systems operations vendor.

____ Data Center Operations   ____ Applications Maintenance
____ Network Management   ____ Applications Development

29.   If you are using a systems operations vendor, how would you rate its effectiveness? (Circle one)

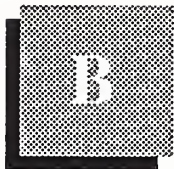| Not Effective		Effective		Very Effective
1	2	3	4	5

B

IS Management Questionnaire (Telephone)

1.   What is the approximate size of your company's IS systems budget?

__over $500 million   __over $100 million   __over $50 million
__over $10 million   __over $5 million   __under $5 million

2.   How would you compare the support from vendors of new technology now as compared to their support a few years ago?

____worse   ____a little better   ____a lot better
____about the same   ____somewhat better

2a.   On a scale of 1 to 5 with 1 representing none, what effect does vendor support have on your acquisition of new technology?

              1   2   3   4   5

I would like to ask a few questions regarding your use of LANs.

3.   How many operational LANs do you now have? _____

4.   How many will you add next year? _____ and in '92 _____?

5.   Is your implementation of LANs the result of user pull _____ or IS push_____ Both _____?

6.   What is the primary LAN interconnection in your organization?

_____

_____

7.   Is your IS operation centralized _____ decentralized _____ or both?

      If centralized, go to question 7a.

7a.   Is the use of LANs leading you to a decentralized IS operation? _____ Yes _____ No

      If yes, go to 7b; If no, go to 7c.

7b.   How fast? _____

7c.   Do you expect them to do so in the future? _____ Yes _____ No

      If yes, go to 7d.

7d.   How soon? _____

8.   On a scale of 1 to 5 with 1 representing not effective, how would you rate the use of LAN technology within your company?

                  1   2   3   4   5

Now I would like to ask you a few questions about optical image management.

9.   What is the status of image processing in your organization?

      __ In production   __ Considered and deferred
      __ Prototype   __ Not applicable
      __ Under consideration   __ Not considered to date

9a.   On a scale of 1 to 5 with 1 representing not effective, how would you rate the use of image management technology within your   company?

                  1   2   3   4   5

9b.   What difficulties did you have implementing your system?

      _____

      _____

      _____

9c. How did you cost justify the acquisition of the system?

_____

_____

_____

10. On a scale of 1 to 5 with 1 representing completely unsatisfactory, how do you rate your vendor's role in implementation and support?

    1   2   3   4   5

11. What does the term *multimedia* mean to you?

_____

_____

_____

12. On a scale of 1 to 5 with 1 representing none, what impact do you expect it to have on your organization within the next few years?

    1   2   3   4   5

Next I would like to ask you a few questions about CASE.

13. Are you using CASE? ____ Yes ____ No   If yes, go to 13a.

13a. Are you using it for reverse engineering? ____ Yes ____ No If yes, go to 13b.

13b. On a scale of 1 to 5 with 1 representing not at all effective, how do you rate reverse engineering with CASE?

    1   2   3   4   5

If yes to 13, go to 13c.

13c. On a scale of 1 to 5 with 1 representing none, what impact has the use of CASE had on maintenance costs?

    1   2   3   4   5

Just a few more questions.

14.   Are you familiar with object-oriented programming? ____ Yes ____ No   If yes, go to 14a.

14a. What does that term mean to you?

_____

_____

_____

15.   Are you using OOP? ____ Yes ____ No   If yes, go to 15a.

15a. How are you using it?

_____

_____

_____

16.   Are you an IBM shop? ____ Yes ____ No   If yes, go to 16a.

16a. Will SAA have a significant impact on your IS operations?

____ Yes ____ No

If yes, what?

_____

_____

_____

16b. When? _____

If no to 16, why not?

_____

_____

_____

17.　Are you using UNIX? ____Yes ____ No

If yes, go to 17a. If no, go to 18.

17a.　On Mainframes____　Midrange____　Workstations ____

17b.　What applications are you running?

____ Engineering ____ Operations ____ Business

18.　Do you expect to adopt UNIX?____Yes ____ No

If yes, go to 18a.

18a.　When?_____

18b.　Will you use it on ____ Mainframes ____ Midrange ____ Workstations

If yes on 18, go to 18c.

18c.　What applications will you run on UNIX?

____ Engineering ____ Operations ____ Business

If no to 18, why not?

_____

_____

_____

19.　Are you using relational data base management systems? ____Yes ____ No

20.　Are you using or considering distributed data bases? ____Yes ____ No　　If yes, go to 20a.

If no to 20, go to 21.

20a.　Have you experienced difficulties with them? ____Yes ____ No　　If yes to 20a, go to 20b.

20b.　What difficulties?

_____

_____

_____

21.   Why not?

_____

_____

_____

Thank you for your cooperation. I will send you a summary of the survey results, which you should receive in January.
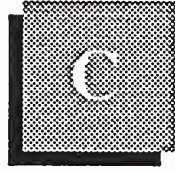
Application Development Manager Questionnaire

IS Departments

1. First, I would like for you to briefly describe the extent of CASE activities now underway in your organization.

   _____

   _____

   _____

2. What are your organization's future plans?

   _____

   _____

   _____

3. What have you found to be the main problems in maximizing CASE's potential in your organization?

   _____

   _____

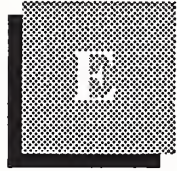   _____

Both IS Departments and Vendors

4.   Now I would like to ask you about some specific topics that we are considering including in our service. For each one, please tell me how important this kind of information is to you and how satisfied you are with your current information. Feel free to make any comments. (Rate importance and satisfaction on a scale of 1-5, with 5 being high.)

	Importance	Satisfaction	Comments
Case studies of CASE successes, with analysis of reasons	_____	_____	_____ _____
Case studies of CASE failures (or limited successes) with analysis of reasons	_____	_____	_____
An analysis of CASE critical success factors, based on the experience of over 200 companies	_____	_____	_____ _____
How application design and capabilities change due to CASE technology	_____	_____	_____ _____
CASE impact on end-user departments and corporate strategy	_____	_____	_____ _____
CASE impact on packaged software products and vendors	_____	_____	_____ _____
CASE impact on professional services vendors and systems integrators	_____	_____	_____
An analysis of CASE vendors, their strategies and viability	_____	_____	_____ _____
AD/Cycle capabilities and future direction	_____	_____	_____
Analyses of other CASE products? (Which?)	_____	_____	_____
CASE market size and growth (broken out by product type, platform, customer type, etc.)	_____	_____	_____
CASE standards	_____	_____	_____
Re-engineering	_____	_____	_____

Distributed systems development   ____   ____   _____

Other technical issues (describe)   ____   ____   _____

Other (describe)   ____   ____   _____

5.   What sources do you use to supply your CASE information needs? Please be as specific as possible, including how well they meet your needs. (Use list below as prompts, if necessary)

- Seminars/Conferences
- In-house education
- Consultants
- Subscription services
- General publications, books
- Informal information from peers

_____

_____

_____

_____

6.   Do you have any other questions and comments?

_____

_____

_____

D

CASE Vendor Questionnaire

Vendors

1. What CASE-related products and services do you now offer?

    _____

    _____

    _____

2. How receptive have you found the market generally for CASE-oriented products and services? Why?

    _____

    _____

    _____

3. What future plans do you have (that are non-proprietary)?

    _____

    _____

    _____

Both IS Departmetns and Vendors

4. Now I would like to ask you about some specific topics that we are considering including in our service. For each one, please tell me how important this kind of information is to you and how satisfied you are with your current information. Feel free to make any comments. (Rate importance and satisfaction on a scale of 1-5, with 5 being high.)

	Importance	Satisfaction	Comments
Case studies of CASE successes, with analysis of reasons	_____	_____	_____ _____
Case studies of CASE failures (or limited successes) with analysis of reasons	_____	_____	_____
An analysis of CASE critical success factors, based on the experience of over 200 companies	_____	_____	_____ _____
How application design and capabilities change due to CASE technology	_____	_____	_____ _____
CASE impact on end-user departments and corporate strategy	_____	_____	_____ _____
CASE impact on packaged software products and vendors	_____	_____	_____ _____
CASE impact on professional services vendors and systems integrators	_____	_____	_____
An analysis of CASE vendors, their strategies and viability	_____	_____	_____ _____
AD/Cycle capabilities and future direction	_____	_____	_____
Analyses of other CASE products? (Which?)	_____	_____	_____
CASE market size and growth (broken out by product type, platform, customer type, etc.)	_____	_____	_____
CASE standards	_____	_____	_____
Re-engineering	_____	_____	_____
Distributed systems development	_____	_____	_____
Other technical issues (describe)	_____	_____	_____
Other (describe)	_____	_____	

5.   What sources do you use to supply your CASE information needs? Please be as specific as possible, including how well they meet your needs. (Use list below as prompts, if necessary)

   • Seminars/conferences
   • In-house education
   • Consultants
   • Subscription services
   • General publications, books
   • Informal information from peers

   _____

   _____

   _____

   _____

6.   Do you have any other questions and comments?

   _____

   _____

   _____

Type of Development by
Application Focus: 1991

EXHIBIT E-1

Application Focus

Type of Development	Host-based	Host-led	Multiple Peer	Total
New Development	20	16	4	40
Enhancements	15	3	2	20
Maintenance	37	2	1	40
Total	72	21	7	100

Source: INPUT estimates

F
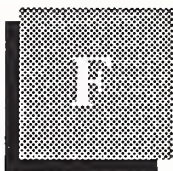
Type of Development by Application Focus: 1996

EXHIBIT F-1

Application Focus

Type of Development	Host-based	Host-led	Multiple Peer	Total
New Development	5	5	15	25
New Development via Re-used Applications	15	14	1	30
Maintenance via Reverse-engineered	15	5	0	20
Traditional Maintenance	20	4	1	25
Total	55	28	18	100

Source: INPUT estimates

Report Quality Evaluation

To our clients:

To ensure that the highest standards of report quality are maintained, INPUT would appreciate your assessment of this report. Please take a moment to provide your evaluation of the usefulness and quality of this study. When complete, simply fold, staple, and drop in the mail. Postage has been pre-paid by INPUT if mailed in the U.S.

Thank You.

1. Report title: **The Future of CASE: 1991-1996** (UIIS1)

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

3. Please indicate extent report used and overall usefulness:

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

4. How useful were:

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

5. How useful was the report in these areas:

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

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

_____

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

_____

8. Other comments or suggestions: _____

_____

_____

Name _____   Title _____

Department _____

Company _____

Address _____

City _____   State _____   ZIP _____

Telephone _____   Date completed _____

Thank you for your time and cooperation.

M&S 633/01 12/89

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