CIRCUIT-SWITCHED SYSTEMS INTEGRATION

OPPORTUNITIES AND CHALLENGES

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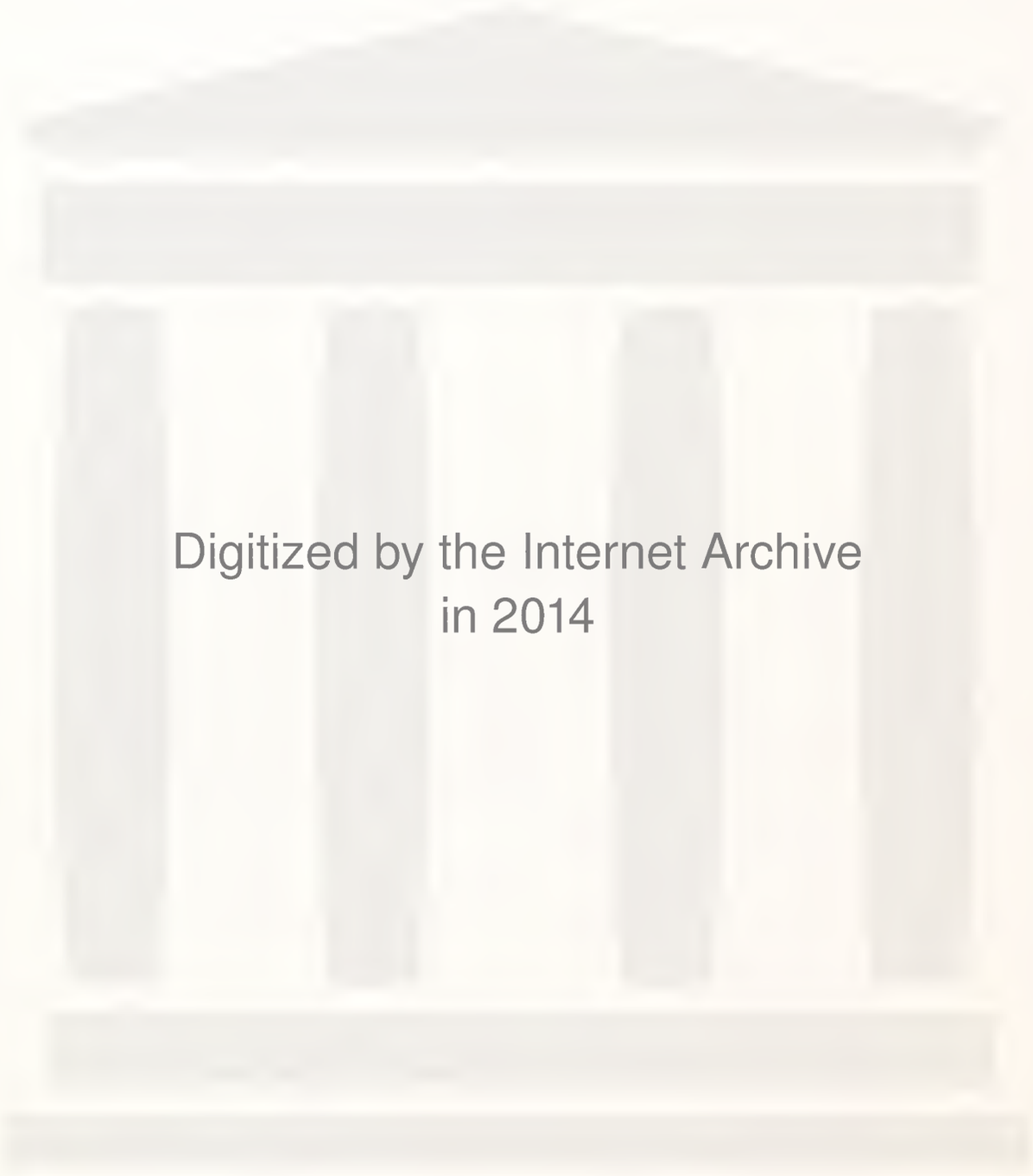

COMMERCIAL SYSTEMS INTEGRATION: OPPORTUNITIES AND CHALLENGES

COMMERCIAL SYSTEMS INTEGRATION: OPPORTUNITIES AND CHALLENGES

ABSTRACT

INPUT estimates that the market for commercial systems integration will generate SI "fees" of $64 million in 1985 and grow 21% annually to $119 million in 1990.

Vendors see a need to address the growing user requirement for commercial systems integration. In some market segments, SI is not only an opportunity for additional revenue but also a necessary additional service to be offered to remain competitive.

The report includes the major user and vendor forces driving the SI market, a systems integration market forecast, typical activities of a systems integrator, vendor selection criteria, and recommendations.

This report contains 102 pages, including 29 exhibits.

COMMERCIAL SYSTEMS INTEGRATION: OPPORTUNITIES AND CHALLENGES

CONTENTS

COMMERCIAL SYSTEMS INTEGRATION: OPPORTUNITIES AND CHALLENGES

EXHIBITS

1 INTRODUCTION

I INTRODUCTION

- In its Market Analysis and Planning Service (MAPS) report New Professional Services Opportunities, 1984, INPUT explained the changing structure of the computer services industry with respect to marketing and distribution channels and identified significant new opportunities for professional services vendors within this new distribution environment. One opportunity was for vendors to assume the role of systems integrators. INPUT argued that with the "make or buy" cost decision shifting to the "buy" option in some solution areas, the role of the integrator would become increasingly important.

- The "buy" side of the equation continues to grow in 1985, and the opportunities for systems integration (SI) have grown as well. Many vendors have now positioned their professional services capabilities to exploit the SI market.

- But as with any emerging market, the SI boundaries are not clearly defined and the potential and risks are not adequately documented.

- This report focuses on SI in commercial markets and identifies the opportunities and challenges associated with this exciting role for vendors of professional services.

A. REPORT SCOPE AND OBJECTIVE

- INPUT's objective in this report is to analyze current market conditions and vendor activities in order to identify key issues and trends to support vendor decisions regarding entry or expansion in this marketplace.

- While the model of systems integration activities in the federal government will be used to define and explain commercial SI, this report is strictly focused on commercial systems integration.

- Since SI is emerging from a variety of user requirements and vendor offerings, several traditional information services delivery modes will be discussed. However, market factors and revenue forecast data should be interpreted only within the SI market as defined in Chapter III. Revenue forecasts, in particular, include only the integration activities of integrators and exclude revenue derived from other products/services that may be a necessary part of the integration assignment.

B. REPORT METHODOLOGY

- The data for this report was derived from previous INPUT reports (see Appendix B) and from interviews with systems integrators for the federal government, current integrators in the commercial market, and other information services vendors who, in INPUT's view, are or should be exploring commercial SI.

C. REPORT ORGANIZATION

- This report has been organized into the following sections:
  - Executive Summary.
  - Market Analysis and Forecast.
  - Competitive Environment.
  - Recommendations.
- Two appendices are provided to aid in report use:
  - Definitions.
  - Related INPUT Reports.

II EXECUTIVE SUMMARY

II EXECUTIVE SUMMARY

- This Executive Summary is designed in a presentation format to:
  - Help the busy reader quickly review key findings.
  - Provide a ready-to-go executive presentation, complete with script and visual aids.
- Key points of the report are summarized in Exhibits II-1 through II-9. On the left-hand page facing each exhibit is a script explaining the contents of the exhibit.

A. MAJOR USER FORCES DRIVING SI MARKET

- Many corporations are finding that information systems are at the heart of their businesses. More than a support structure, IS has come to represent the competitive edge, even the product/service, of companies who have not previously thought of themselves as being in the information industry.

- But, corporations are finding that internally developed IS integration is complex for several reasons.

  - New technologies offer more advanced workstations, flexible integrated telecommunications capabilities, and integrated data base structures.

  - The IS staff seldom has expertise in newer technologies, and attention to meeting current IS needs consumes the time that would be required for designing and implementing new solutions.

  - There is a preference for sharing the risk of complex solutions with vendor(s).

  - While there is an ever-rising sea of technological solutions, no single vendor seems able to delivery the ideal solution, and dealing directly with multiple vendors can be more costly and time-consuming.

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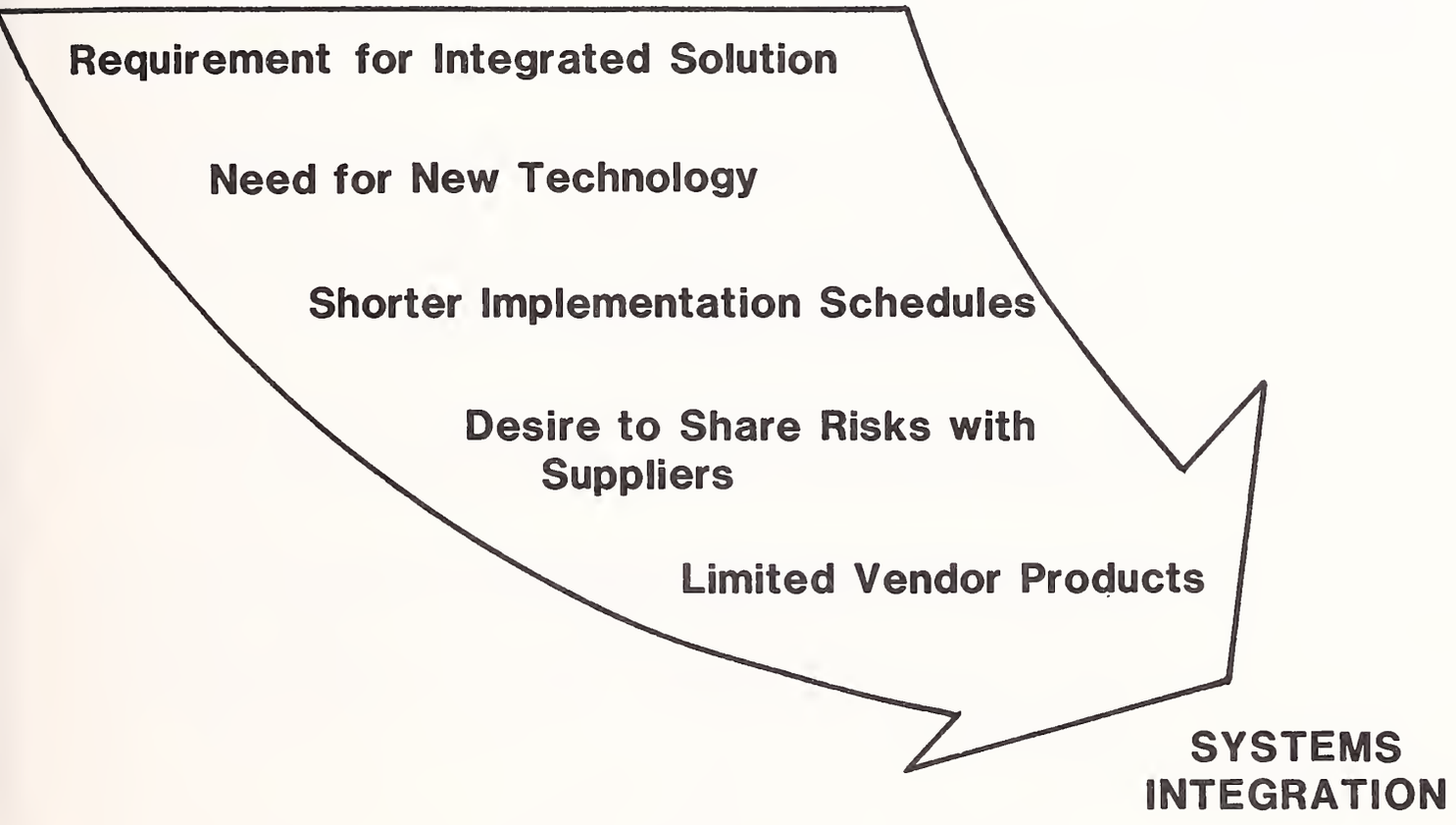
MAJOR USER FORCES DRIVING SI MARKET



B. MAJOR VENDOR FORCES DRIVING SI MARKET

- Information systems and services vendors have not been oblivious to the increasing demand for integrated IS facilities.

  - Vendors see a need to address the growing user requirement for systems integration. In some market segments SI is not only an opportunity for additional revenue, but also a necessary additional service to be offered to remain competitive.

  - As user requirements expand and technology changes, no single vendor is able to implement the total solution required. When the requirements are complex and the necessary technology is elaborate, products and services of multiple vendors may be required.

  - New vendor distribution relationships expand product opportunities and bring the vendor closer to the SI capabilities being required.

  - These emerging vendor-vendor relationships also afford the SI vendor the opportunity to spread the inherent risks of complex integration among a number of subcontractors, limiting the SI vendor's exposure to financial failure.

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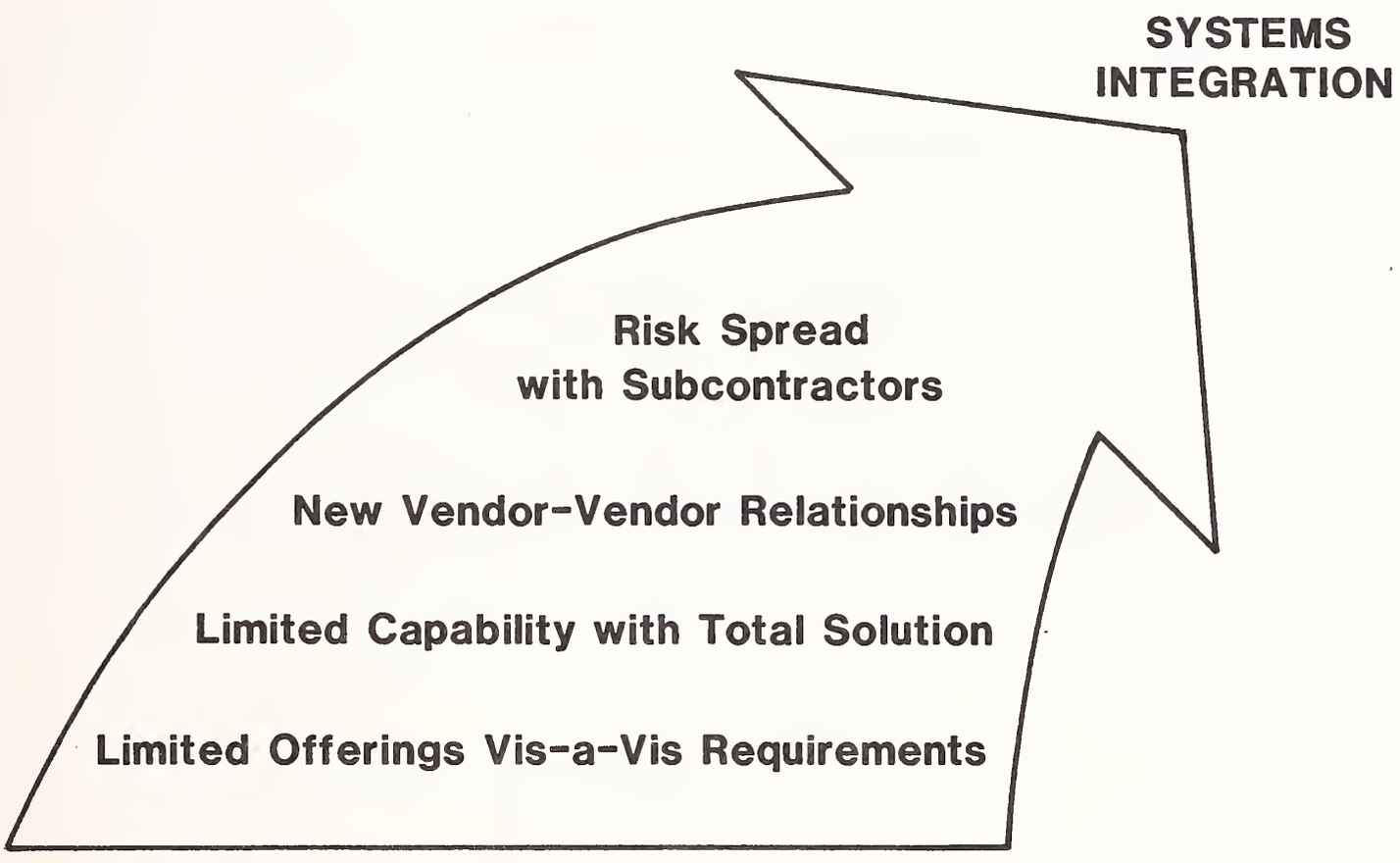
MAJOR VENDOR FORCES DRIVING SI MARKET



C. COMPONENTS OF AN SI DEFINITION

- Systems integration is a process in which a vendor or team of vendors assumes total responsibility for providing the information products/services which result in a comprehensive solution to an information systems problem. In this process the customer-integrator arrangement is such that the customer is made to feel that one vendor is providing all aspects of the solution. The customer interacts with the systems integrator, and, to the extent possible, other vendors who may be subcontractors to the integrator for portions of the solution are transparent to the customer.

- While the integrator may be providing some or all of the products and services that comprise the solution, the integrator's first responsibility is to the customer and to the assurance that, within the constraints of the project, the best solution will be implemented. In essence, the integrator sits on the customer's side of the buyer-vendor dyad, representing the customer and acting as the customer's advocate. The integrator, among other things, provides comprehensive project management for every aspect of the project.

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COMPONENTS OF AN SI DEFINITION

- Team of Vendors
- Provide a Comprehensive Solution
- Integrator Assumes Project Management
- Other Vendors May Be Transparent to User

D. TYPICAL ACTIVITIES OF A SYSTEMS INTEGRATOR

- Activities of the integrator's role are depicted in Exhibit II-4. Typical tasks in complex integration projects toward which these activities are directed include:
  - Feasibility and tradeoff studies.
  - Systems design.
  - Selection/configuration of hardware and network.
  - Selection of systems software.
  - Selection/modification of applications software.
  - Installation of hardware systems.
  - Installation of software systems.
  - Demonstration and test.
  - Documentation.
  - Client staff training.
  - Operation and maintenance of hardware/software systems.
  - Other customer support services.
- The integrator's role in actually providing the products/services that comprise the solution is secondary to his complex project management role.

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TYPICAL ACTIVITIES OF A SYSTEMS INTEGRATOR

- Technical Counseling
- Configuration Management
- Subcontractor Negotiations
- Master Scheduling
- Reporting
- Operations Management
- Customer Support

E. SYSTEMS INTEGRATION MARKET FORECAST

- This market forecast covers only vendor revenue derived from the assumption of responsibility for providing the products and services which result in a comprehensive solution to an information systems problem.

- INPUT estimates that the market for systems integration will generate SI "fees" of $64 million in 1985 and grow by 21% annually to $119 million in 1990.

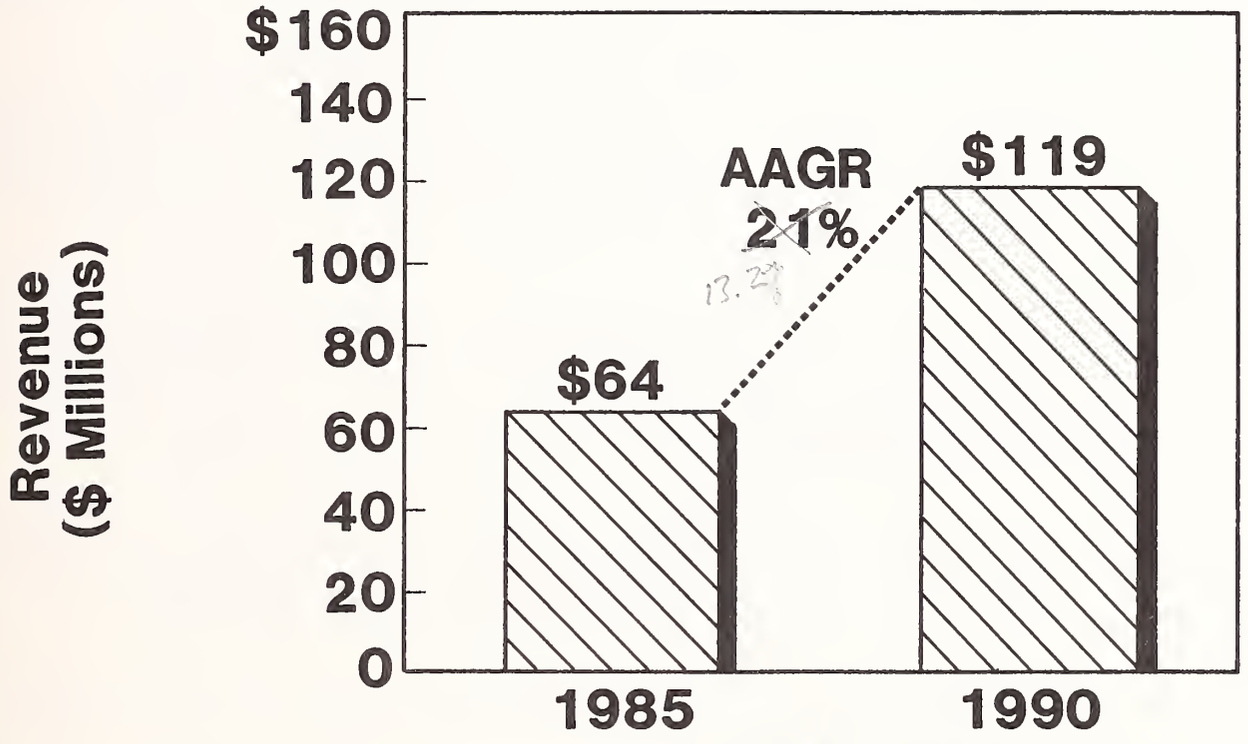
- This revenue is allocated for the vendor's role as an integrator. Since this amount is generally less than 10% of the total dollar size of most SI projects and since integrators may receive revenue from supplying other products/services required in the course of the project, the total size of SI-related revenue is considerably larger.

- Major opportunities should be realized from customer requirements for:

  - Large-scale integration within selected industries and medium-scale integration in specific application areas.

  - Integration of core business applications, support applications, and technology-oriented applications.

SYSTEMS INTEGRATION MARKET FORECAST



F. VENDOR SELECTION CRITERIA

- From the customer's perspective, the "ideal" integrator is a vendor who:

  - Will quickly analyze the corporate situation and identify the critical issues against a backdrop of corporate strategies, aided by the vendor's application knowledge and industry experience.

  - Will apply integration experience to design an acceptable solution that takes advantage of appropriate technology within the constraints of the integration project.

  - Will affect relationships with third-party vendors that ensure the acquisition and implementation of components of the solution which are cost effective.

  - Will provide project management skills that will result in a successful integration of these components on time and within budget.

  - Will provide or cause to be provided other support services that may be required.

  - Will maintain a near constant dialog with corporate management, keeping them informed of progress and problems.

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VENDOR SELECTION CRITERIA

- Application Knowledge
- Industry Experience
- Integration Experience
- Breadth of Offerings
- Network Design and Implementation
- Project Management Skill
- Support Reputation

G. PRIOR EXPERIENCE OF VENDORS ENTERING THE SI MARKET

- While few vendors are currently well positioned in the SI market, there are many who have material or conceptual assets that could be leveraged to profitably exploit the opportunities in the commercial systems integration market.

  - Federal government SI vendors have established their capabilities in the federal market and may transport those skills to commercial markets.

  - With a significant portion of the expenditure for systems integration going to mainframe and minicomputers, it is not surprising that users look to these vendors as the prime contractor and, therefore, the "integrator."

  - Specialized business area systems vendors who have developed expertise with standalone turnkey systems could move from that arena to the custom SI market.

  - Professional services firms, particularly those with design experience or those who have been subcontractors to any of the above, may try SI on their own.

PRIOR EXPERIENCE OF VENDORS ENTERING THE SI MARKET

- Current SI Vendors to Federal Government
- Computer/Communications Hardware Vendors
- Specialized Turnkey Integrators
- Professional Services Vendors
- Vendors Subcontracting to Any of the Above

H. SI MARKET SHARE WILL BE LIMITED

- In the long run, a few large systems vendors will dominate both the large- and medium-sized intergration markets. These vendors will have made commitments to both establishing vendor-vendor relationships and developing or acquiring complex project management expertise. The major issue will be whether these larger vendors can overcome limitations in applications and industry experience that may accrue as they expand their base of experience.

- Many remaining SI vendors will need to find opportunities in smaller SI applications or industries as they focus on areas of expertise. These vendors should also consider subcontracting to larger vendors on SI projects.

- The current status of many vendors suggests that they are not yet adequately positioned to exploit SI opportunities. Some of the current deficiencies are:

  - Limited expertise in target industry or application area.

  - Restricted approaches to SI solutions.

  - Financial or managerial limitations prohibiting risk assumption.

  - Lack of discipline in bidding SI projects.

  - Inadequate delegation of authority to the project manager.

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SI MARKET WILL BE LIMITED

- A Few Large Systems Vendors Will Dominate
- More Vendors Will Find Niches
- Many Vendors Will Suffer From Liabilities

I. RECOMMENDATIONS

- The unknowns inherent in the early market growth of systems integration should not limit vendors' exploration of its potential. To explore and exploit opportunities, vendors should establish specific action agendas that include identifying and understanding specific SI projects, analyzing the risks involved, and leveraging capabilities and vendor relationships that enhance the viability of the SI vendor.

  - Vendors must see the problems as the prospective client does and then tailor the proposed SI approach to meet the client's perceived needs and concerns. The approach should solve the problems, not sell the solution.

  - The SI clients increasingly require the vendor to assume the financial responsibility for implementation of a satisfactory solution with resultant greater risk. If this risk is not properly contained and managed, the vendor stands to lose a great deal. It is essential that these risks be defined early and appropriate tools and procedures put in place.

  - A key to success in the systems integration market is the number, quality, and duration of relationships that the SI bidder has with prospective subcontractors. These relationships are important both as a credential of the management skill of the integrator and as a potential source of additional revenue for the integrator.

RECOMMENDATIONS

- Establish Supplier-Subcontractor Relationships Early
- Identify, Contain, and Manage the Risks
- Fit the Solution to the Customer's Needs

III MARKET ANALYSIS AND FORECAST

III MARKET ANALYSIS AND FORECAST

- The watchword of information services during the mid 1980s has become "integration." Users bespeak of requirements that call for the integration of data processing functions and vendors offer computer and communications hardware and software systems that permit the integration of aspects of the data processing environment. Out of this has emerged a new professional services opportunity that expands and consolidates various activities such as consulting, design, and turnkey services. In this section, that opportunity is qualified by specific definition and quantified by a vendor revenue forecast. This section also delineates the issues likely to impact the future growth of this market segment.

A. THE CONCEPT OF SYSTEMS INTEGRATION

1. A DEFINITION OF SI

- Systems integration is perhaps best defined as a process in which a vendor or team of vendors assumes responsibility for providing the information products/services which result in a comprehensive solution to an information systems problem. In this process the customer-integrator arrangement is such that the customer is made to feel that one vendor is providing all aspects of the solution. The customer interacts with the systems integrator, and, to the extent possible, other vendors who may be subcontractors to the integrator

for portions of the solution are transparent to the customer. To be sure, there are situations where some or all of the subcontractors are, by the client's choice, contracted directly by the client. For simplicity in this report, the focus will be primarily on situations where the SI vendor is exclusively responsible for subcontracting for other vendors.

- This relationship is depicted in Exhibit III-1. The customer has identified a problem that requires the integration of existing or yet-to-be-acquired hardware, software, or services. With time or resource constraints or the desire to consider alternative solutions, the customer requires a systems integrator who will manage the total project and deliver the desired solution. The customer anticipates that his (the customer's) role will involve input regarding the problem and proposed solutions, oversight of the integration process, and final testing and acceptance of the solution.

- While the integrator may be providing some or all of the products and services that comprise the solution, the integrator's first responsibility is to the customer and to the assurance that, within the constraints of the project, the best solution will be implemented. In essence, the integrator sits on the customer's side of the buyer-vendor dyad, representing the customer and acting as the customer's advocate. The integrator, among other things, provides comprehensive project management for each and every aspect of the project. A model of the respective roles is depicted in Exhibit III-2. Typical tasks in complex integration projects toward which these activities are directed include:

  - Feasibility and tradeoff studies.

  - Systems design.

  - Selection/configuration of hardware and network.

  - Selection of systems software.

EXHIBIT III-1

OVERVIEW OF SYSTEMS INTEGRATION ACTIVITIES AND ROLES

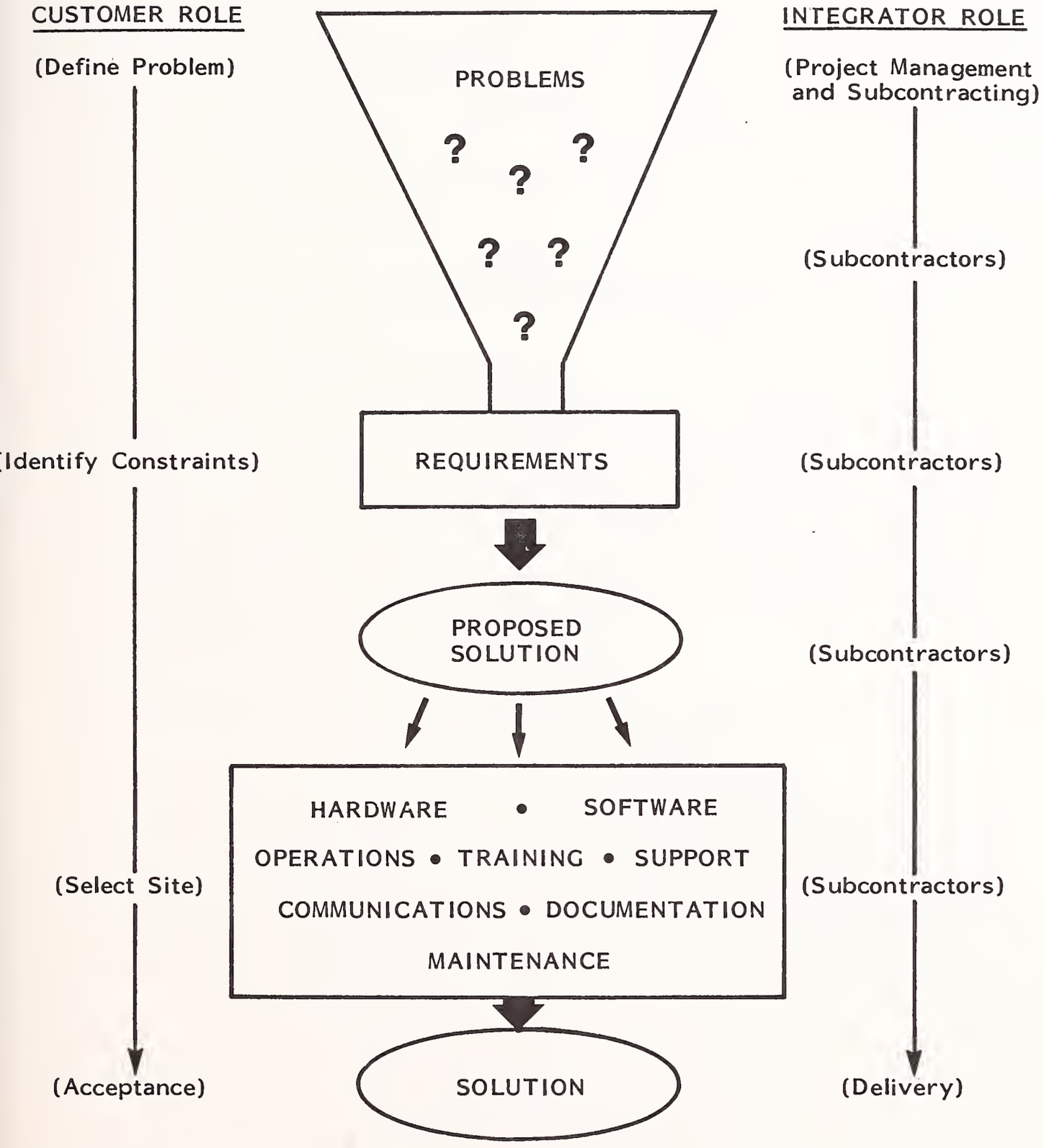
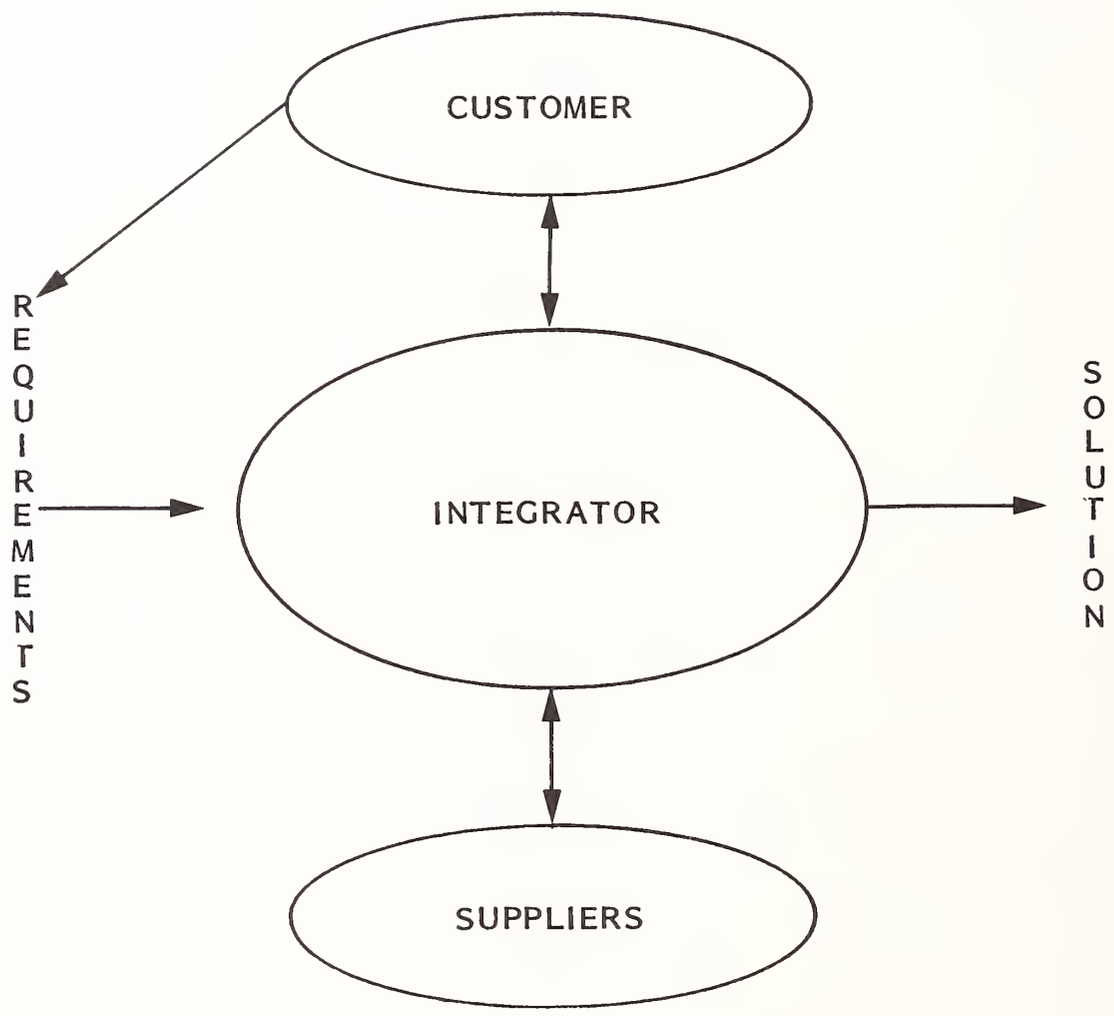


EXHIBIT III-2

MODEL OF TYPICAL RELATIONSHIPS IN SYSTEMS INTEGRATON



- Selection/modification of applications software.
- Installation of hardware systems.
- Installation of software systems.
- Demonstration and test.
- Documentation.
- Client staff training.
- Operation and maintenance of hardware/software systems.
- Other customer support services.

- The integrator's role in actually providing products/services that comprise the solution is secondary to this complex project management role. However, a key revenue stream for the integrator is from being the provider directly or acting as a third-party provider. From a purely conceptual point of view, the integrator can, at the same time, be the advocate and the prime contractor or subcontractor to another prime contractor.

2. THE RISE OF SYSTEMS INTEGRATION IN THE FEDERAL GOVERNMENT

- The federal government has increasingly relied on systems integrators to develop, upgrade, and replace automatic data processing (ADP) systems. As the leading buyer of SI, the government provides a rich example to both define the activities of integrators and explain some of the underlying causes for the emergence of SI in commercial markets.

- Not too many years ago, the federal government met most of its ADP needs for major new or replacement systems by using prime contractors. The contractor was usually a hardware manufacturer who essentially ran a turnkey business, supplying the architecture, engineering, implementation, and post-implementation support. Like the mythological innkeeper Procrustes who stretched guests' bodies or cut of their legs to fit guests into his beds, the contractor generally ignored the need for other vendors and tried to fit only his products/services to the solution. The contractor acted as the single source and all too often focused on getting the system installed, not solving the customer's ADP problems.

- Since the government's ADP problems were not always adequately solved by these single-vendor approaches, the agencies assumed the responsibilities of a "general" contractor on major ADP projects. They established project management offices to monitor major acquisitions and used in-house talent or vaious subcontractors to benchmark equipment and test new systems against requirements. Products and services needed for the solution were acquired from a variety of vendors who contracted directly with the government.

- The problem with this approach was that the government assumed the major responsibility for the success or failure of the project. The acquired system was the architectural handiwork of the project management office or a consultant with no implementation responsibility. When the desired solution was not achieved by the new system within budget and schedule, the blame was squarely on the government with little possible recourse against the vendor(s).

- With budget reductions cutting into staff levels, increasing the difficulty of hiring technology-sophisticated personnel at government salary levels, and with a need to pass the risks to or at least share them with vendors, the government began contracting for vendors to provide complex project management in the role of systems integrators. Vendors were contracted for various degrees of involvement from architect to supplier to implementer, but

in all major acquisitions, the movement was away from a single prime vendor to multiple vendors--not one of whom was charged with the ultimate responsibility of delivering the desired solution.

- While many small acquisitions ($10-20 million) by the federal government are still performed by a single turnkey-type vendor, many of the current larger projects call for the professional services of systems integrators.

3. SYSTEMS INTEGRATION IN COMMERCIAL MARKETS

- Concerns similar to those in the federal government have prompted the use of systems integrators by corporate America. While the embryonic state of commercial SI precludes corporate customers from well-defined statements of either the kind or quality of the integrator's activities, customers' expectations of the "ideal" integrator include a vendor who will:

  - Quickly analyze the corporate MIS situation and identify the critical issues against a backdrop of corporate business and MIS support directions and strategies.

  - Design an acceptable solution that takes advantage of appropriate technology within the constraints of the integration project (current MIS resources, financial resources, political realities, etc.).

  - Effect relationships with third-party vendors that ensure the acquisition and implementation of components of the solution which are cost-effective.

  - Provide project management skills that will result in a successful integration of these components on time and within budget.

  - Provide or cause to be provided other support services that may be required, including technical consulting, documentation, testing, training, operations management, etc.

- Maintain a near-constant dialog with corporate management, keeping them informed of decisions, progress of the project, and, above all, potential problems.

- As depicted in Exhibit III-3, these expectations generally translate into selection criteria that values the vendor's specific experience with similar projects, related experiences, and the extent of the vendor's offerings that may be made available in the course of the systems integration project.

B. KEY FACTORS INFLUENCING COMMERCIAL SI

- The growth of the commercial SI market has been and will continue to be based on several objectives (see Exhibit III-4). To the extent these factors continue to influence information services acquisitions, systems integration opportunities should increase in number and size. These factors also tend to characterize corporate prospects for SI since corporations more subject to these factors are the current and future buyers of SI services. To be sure, there is not a one-to-one relationship between the presence of a factor in a corporation and the need for SI. These factors represent a necessary, but not sufficient, condition of SI contracting.

1. MEET BUSINESS OBJECTIVES RAPIDLY

- Many corporations are finding that information systems are at the heart of corporate strategies for new or existing businesses. More than a support structure, management information service has come to represent the competitive edge, even the product/service, of companies who have not previously thought of themselves as being in the information industry.

EXHIBIT III-3

RELATIVE IMPORTANCE OF SI VENDOR SELECTION CRITERIA

CRITERIA	IMPORTANCE
Application Knowledge	High
Integration Experience	High
Project Management Skill	High
Network Design and Implementation	Medium
Industry Experience	Medium
Support Reputation	Medium
Breadth of Offerings	Medium
Vendor Hardware/Software Offerings	Low

EXHIBIT III-4

CUSTOMER OBJECTIVES DRIVING SYSTEMS INTEGRATION

- Meet Business Objectives Rapidly
- Reduce Risk of IS Development
- Integrate Fragmented Systems
- Save Costs Over Internal IS Solution
- Achieve Performance Gains Through New Technology

- Where the IS expenditure is high (financial services, manufacturing) or where technical changes require support (CAD/CAM, electronic funds transfer, robotics), efficiency in IS is a key competitive weapon. Airlines, pharmaceuticals, and even courier services now consider IS among their chief strategies.

  . Federal Express, as one example, built its business around IS, not trucks, airplaines, or people as one might expect.

  . American Airlines, as another example, now relies on its reservation system as a significant revenue generator not only for the seats sold on American flights, but for those sold on competitive carriers as well.

- Other IS applications that may be critical to a business include such exemplary functions as:

  . Core business applications--retail, international, or corporate banking; merchandising or retail store operation; freight distribution; and manufacturing.

  . Support applications--human resources and payroll, third-party health administration, and purchasing.

  . Technology-oriented applications--credit card-related systems such as ATM and POS, CAD/CAM, and bar code-based systems.

- Corporations that may have a need for systems integration vendors have placed a central importance on computing that makes IS visible operationally, tactically, and strategically. These corporations know the value of having a capable IS function and the business risks of having unmet IS needs. So important is IS that it receives executive attention, and, more than likley, overall IS strategies and plans are in place to provide a framework for the direction of computer systems acquisition and usage.

- To survive, these corporations must remain on a par with their competitors in the employment of information technology. This does not mean that corporate MIS will blindly accept technological innovations. Rather, corporations are assessing new solutions in terms of their own strategic plans for IS. This activity, in itself, is a major issue of strategic planning and may call for outside systems integrators who will assist in establishing long-range strategic IS plans.

2. RISK CONTAINMENT

- Like the federal government, corporations are finding that internal development of IS capability is risky for several reasons.

  - The IS staff may not have the expertise in all areas of the proposed solution.

  - Even if they do have the required expertise, their attention to the current IS needs outweighs a long-range view and reduces the time available for designing and implementing new solutions.

  - Internal IS may be too inclined to preconceived solutions based both on the current configuration and limited exposure to newer technologies.

  - There is a risk in implementing a "closed" system with no prospect of modification to accept newer technology without replacing the system.

- Accordingly, when corporations do take on a large systems upgrade effort, it tends to be done through task groups that, while raising the level of expertise by pooling talent, slow the decision-making process and drag it out.

- Corporations are also caught in the vendor selection bind. Vendors now offer such a wide range of packaged applications that users may not be aware of

available offerings. In these cases, users convert more software rather than identify commercial packages that meet or nearly meet the need. In other cases, users have tended to make acquisitions based on "vendor comfort" criteria (familiarity with the vendor, vendor financial stability) rather than on the congruence between the corporate IS need and the vendor's product/service offerings. In general, this results in limited bid competition and limited benchmarking of systems. This also means that customers avoid software conversion by using packaged software and modifying the package to fit the need or, just as likely, modifying the need to fit the package.

- Attempts to contain risks are visible in the technical and funding approval cycles employed and the extent that SI vendor and third-party technical assistance is sought early in the approval cycles. Formal acquisition may involve:

  - Independent feasibility studies.

  - Vendor compliance phases in which vendors submit conceptual and technical solutions based on specified requirements.

  - Bid submission phases that may include both draft bids and "best and final" offers.

  - Early demonstration/benchmarking of critical portions of the proposed design.

- The formality of the vendor selection process seems to be dependent upon the financial commitment the customer is willing to make and the extent to which the customer is seeking new solutions, as opposed to upgrades or enhancements of current systems.

  - Systems integration projects that require large investments are typically more formally managed and more competitively awarded than

smaller projects. However, this formality is frequently offset by nontechnical aspects of the project and corporate management style.

  - As mentioned earlier, management may have requirements that preclude the "best" solution in favor of the most "expedient" one. The desire to retain a significant amount of current hardware/software or the desire to avoid massive systems changes motivates customers to have less formal--and less competitive--selection procedures.

  - As also mentioned earlier, a particular vendor may have an inside track to the award if the customer has decided to build the system around a particular type of hardware or software.

- In any case, the selection criteria remain generally the same. Exhibit III-5 lists these criteria and estimates their relative importance in selecting an SI vendor.

  - Sohisticated customers tend more toward adequacy of proposed solutions and less toward specific products and look carefully at proposed technical solutions and the vendor's ability to deliver the solution by gauging the vendor's reputation or evidence of established relationships with third-party vendors.

  - There remains a surprisingly large base of system acquisition clients who state a preference for specific hardware and/or software as a result of product experience or a desire to standardize corporatewide on a single brand for simplification of maintenance and interface.

  - Risk containment involves an evaluation of the vendor's track record for delivering acceptable solutions on time and within budget, experience of the proposed staff, project control procedures, and the type of contract proposed.

EXHIBIT III-5

RELATIVE IMPORTANCE OF BID SELECTION CRITERIA

CRITERIA	IMPORTANCE
Technical Solution	High
Risk Containment	High
Breadth of Alternative Product/Service Offerings	High
Cost	Medium
Vendor Experience	Medium
Contract Type	Medium
Project Management	Low

- The vendor's track record and project control may be evaluated by examination of vendor-supplied documentation and interviews with other clients for whom the integrator has performed similar work.

- The type of contract used may be selected by the customer or, if he chooses to refrain from stating a preference, by the vendor bidding on the project. Exhibit III-6 indicates the basic types of contracts, conditions when each is generally used, and the implicit statements each type makes about the belief of both parties that the SI assignment can be completed within a set financial structure.

3. RECRUITING AND RETAINING PERSONNEL

- The issues of recruitng and retaining data processing personnel are not as acute in the commercial sector as they are in the federal government (discussed earlier) since salary structures are more generous and flexible. However, the extent of data processing training--estimated by INPUT to be over a $900 million business in 1985 with an average annual growth rate through 1990 of 30%--suggest that talented personnel, especially managers, who are up to date on technology are hard to find. And with demand for personnel growing at a faster rate than salary structure increases, talented personnel tend to move frequently.

- These factors create a situation where the overall growth in corporate IS talent is increasing at a slower rate than the pace of change in IS requirements. In short, many corporations do not have just the right people required to meet new IS objectives.

- Since it is unlikely that corporations will solve these IS personnel issues in the short term, they will likely opt for one of two scenarios to meet their requirements.

EXHIBIT III-6

TYPES OF FINANCIAL CONTRACTS AND THEIR USES IN SI CONTRACTING

TYPE OF CONTRACT	USE
Fixed Price	New System Well Thought Out Vendor Believes He Can Contain Risks System Composed of Off-The-Shelf Hardware/ Software (No New Development)
Cost Plus Fixed Fee	New System Includes Unknowns Customer Assumes Risk Vendor Believes He Can Do It Only If Financial Reserves Are Unlimited
Fixed Fee Plus Incentive Fee	Same as Cost Plus Except Customer Provides Financial Incentive to Contain Overruns
Cost Plus Fixed Fee Plus Fixed Price	Same Conditions as Cost Plus Except Customer Limits Financial Resources Supplied to Vendor Vendor Assumes Risk

- They will slow the pace of change in systems development to a level congruent with capabilities.

- They will contract more of the new work out of house.

- Businesses that rely on IS support will undoubtedly follow the outside contractor route, unwilling to risk the results of an IS capability below the demands of the business or the costs associated with short-term technical employment.

4. INTEGRATE FRAGMENTED SYSTEMS

- The rapid rise in end-user computing coupled with the inability to plan long-range IS strategies in a changing technical environment has created fragmented systems that more resemble patchwork quilts than corporate comforters.

  - Outdated equipment, incompatible systems, development backlogs, productivity lapses, and security breaches are often characteristics of inadequately planned corporate IS.

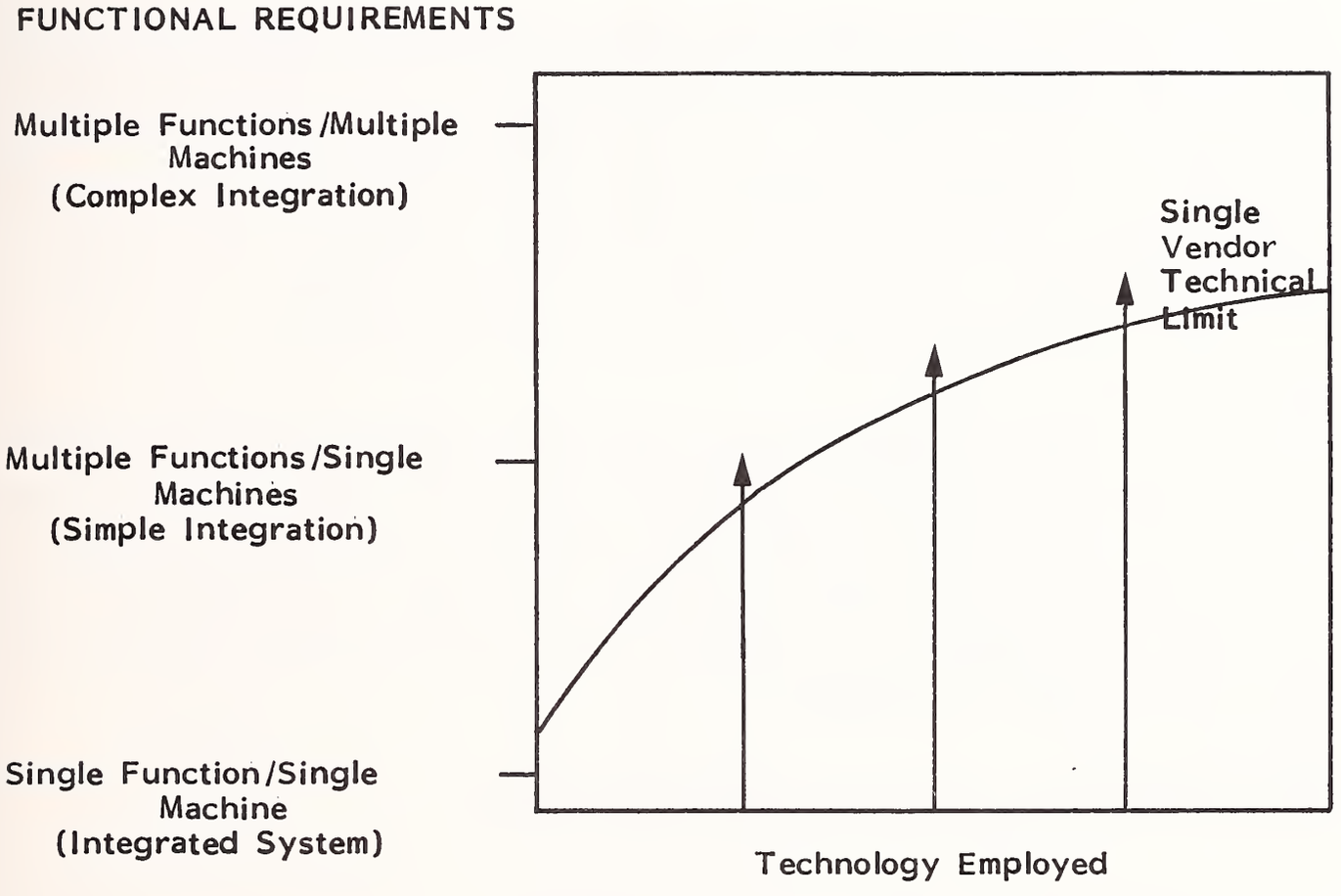
  - At the same time, there is an ever-rising sea of technological solutions that shows no signs of abating in the near future with nearly all areas of corporate IS affected.

- Corporate IS is caught between the functional dimension defined by user requirements and the technical dimension defined by advancing technology. As illustrated in Exhibit III-7, the resolution is typically to seek greater functionality with each advance in technology implemented.

  - Early uses of automatic data processing equipment were restricted to single functions (accounting for example) on single machines.

EXHIBIT III-7

FUNCTIONAL INTEGRATION AND CHANGING TECHNOLOGY
USER PERSPECTIVE



- As the advantages of automation were noted, other functions (payroll, personnel, purchasing, etc.) were added, often without the foresight of a long-range blueprint for evolving IS capability and capacity.

- Today, even though large central mainframes are available with over the 30 MIPS performance level, the demand for computational capabilities to support the end user population may exceed the increases anticipated in processor performance. In fact, new configurations may be required to offload mainframe work to superminis, minis, and intelligent workstations, allowing the large mainframes to become enormous data base machines and communications hubs.

- Such configurations would require more advanced workstations, flexible integrated telecommunications capabilities, systems software that extends virtual storage and I/O capabilities, more efficient and user-friendly applications packages, sophisticated data information- and knowledge-bases, and high capacity, high performance storage and retrieval technology.

5. SAVE COSTS OVER INTERNAL DEVELOPMENT

- The factors cited above are exerting pressure on corporations to buy the IS capabilities they need rather than build them. However, it is not at all clear how quickly corporations will embrace systems integrators who offer to manage the introduction of change.

- The positive side of the build versus buy with an integrator's help issue has at least three benefits:

  - The systems integrator assumes more of the risks and, if properly contracted to do so, will provide more assurance that the project will be successfully completed on time and within budget.

- Systems integrators smooth the interaction of multiple vendors, particularly with respect to hardware and software interaction and post-implementation maintenance requirements.

- Integrators may offer economies of scale in passing along discounts they receive from subcontractors they use for multiple projects or discounts received from vendors providing products through the integrator's distribution channels. Some discounts may be offered at the expense of the "best" solution, so corporations should carefully weigh these cost advantages against the risk of limiting the solution.

- On the negative side, contracting with an integrator is an additional expense for services that, on the surface, would seem to be manageable by an in-house executive with complex project management capabilities or, lacking that, a project task force. Corporate decision makers may not appreciate the time and expertise requirements of an integrator role and may be reluctant to hire outside help when, intuitively, it seems that such a job should rightfully be assigned to in-house staff. Such a parochial attitude appeared--and still appears--in facilities management and may be slow to change. A middle ground may be to offset outside expenses by assigning some tasks of the project (conversion, development, training) to in-house staff.

- An SI approach has the additional disadvantage of limiting the day-to-day exposure of in-house staff, especially managers, to the design and implementation process. Without that exposure, the new system may not be fully understood and any knowledge to be gained ends when the contrctor leaves.

C. MARKET FORECAST

1. FORECAST ASSUMPTIONS

- The embryonic state of the systems integration market in the commercial sector dictates the employment of several interrelated assumptions as a foundation for a market forecast. These assumptions relate to changes in the data processing industry and the rapidity with which these changes will be embraced by users.

- Exhibit III-8 lists some of the issues in the data processing environment that could influence the direction of SI.

  - Part of the impetus for enhancing data processing capabilities stems from the inherent requirements of end user support. In general, these requirements call for a ubiquitious--and transparent--system. Creating this environment out of the current limited, incapable subsystems requires a sophisticated integration effort.

  - The technology-related factors reflect potential increases in corporate capabilities through advancing technology. As corporations focus on the underlying problems each of these addresses and begin to implement these changes, systems integrators may be called upon to manage the many complexities that such an undertaking requires.

- It is not at all clear how corporations will choose to address these growing demands and technological solutions. Piecemeal changes, even with a long-range plan, will not require a systems integrator. However, where budgets are less restricted, the expansion of automation is central to revenue generation, and management is willing to turn to outside help, the importance of a systems integrator role will be recognized.

EXHIBIT III-8

FACTORS IMPACTING THE SI MARKET

User Environment-Related Factors

- Intelligent Workstation Availability
- Software Standardization
- End User Literacy
- Support Staff Availability and Capability
- End User Connectivity

Technology-Related Factors

- Distributed Data Processing
- Electronic Data Interchange
- Expanding, Cost-Effective Networks
- Expert Systems and Artificial Intelligence
- Inter-System Capability

- One approach to quantifying the number of corporations that might contract with a systems integrator is to consider the dollar size of integration assignments.

- The dollar size of SI projects varies along the same functional/technical dimensions discussed earlier and also with the thoroughness of the overall design and the extent to which unknown factors are present. In the commercial market, the total dollar size of projects may roughly be categorized as follows:

  - Small--$200,000 to $1 million.

  - Medium--$1 million to $10 million.

  - Large--over $10 million.

- Exhibit III-9 provides characteristics of each of these size ranges. Exhibit III-10 provides the benchmarks used for estimating the number of jobs and SI revenue that may be available in each size range.

2. MARKET FORECAST

- This market forecast covers only vendor revenue derived from the assumption of responsibility for providing the products and services which results in a comprehensive solution to an information systems problem. In essence, the task is one of complex project management and includes such activities as:

  - Technical counseling.

  - Configuration management.

  - Subcontractor negotiations.

EXHIBIT III-9

CHARACTERISTICS OF SI PROJECTS BY DOLLAR SIZE OF SOLUTION

CHARACTERISTIC	DOLLAR SIZE		
	Small (<$1 Million)	Medium ($1-10 Million)	Large (>$10 Million)
Customer Size	Fortune 2000	Fortune 1000	Fortune 500
Industry/Application Orientation	Primarily Application	Primarily Industry	Both CPFF-CPFF+
Range of Services	Limited	Wide	Widest Range
Technical Complexity	Limited	Moderate	Great
Networking Requirements	Limited	Moderate	Extensive
Number of Subcontractors	Few	Limited	Several
Type of Contract	FP-FF	FP+IF-CPFF/ IF+FP	CPFF/IF- CPFF/IF+FP

EXHIBIT III-10

ESTIMATE OF THE SI OPPORTUNITIES BY SIZE OF SOLUTION

FACTOR	YEAR	DOLLAR SIZE		
		Small	Medium	Large
Number of Companies In Base	1985	1,000	500	500
	1990	1,000	500	500
Number of SI Opportunities	1985	30	25	50
	1990	100	50	50
Average Size of Total Project ($ Millions)	1985	$.5	$5	$10
	1990	$.6	$7.5	$15
Proportion of Total $ for SI (Percent)	1985	10%	10%	10%
	1990	10%	10%	10%

- Master scheduling.

- Reporting.

- Operations management.

- Customer support.

- This forecast excludes revenue derived from:

  - Turnkey systems, whether custom-developed or off the shelf and whether sole-source or including a number of vendors.

  - Second-party sales of the systems integrator for products/services called for by the design of the solution. Among other activities, this might include design, engineering, programming and analysis, etc.

  - Other revenue realized by the integrator from VAD, VAR, or other distribution relationships from third-party subcontractors.

  - Federal government SI assignments.

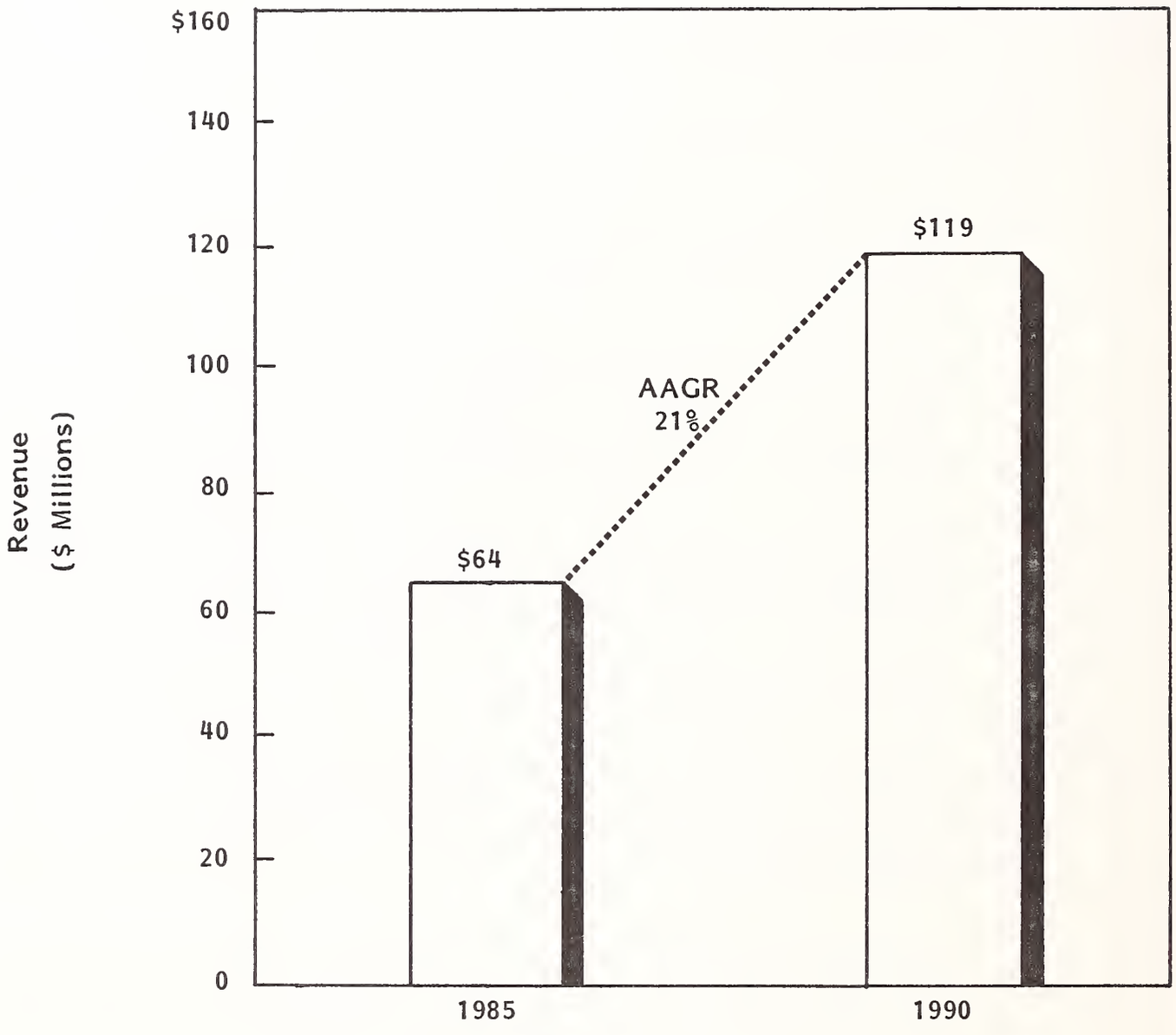
- INPUT estimates that the market for systems integration will generate SI revenue of $64 million in 1985 and grow by 21% annually to $119 million in 1990 (see Exhibit III-11).

  - Much of this revenue will come from America's largest corporations. Companies ranked in the Fortune 500-2000 will contribute proportionately less, and companies outside this range unlikely to employ systems integrators.

- As indicated earlier, this revenue is allocated for the vendor's role as an integrator. Since this amount is generally less than 10% of the total dollar

EXHIBIT III-11

SYSTEMS INTEGRATION MARKET FORECAST, 1985-1990



size of SI projects and since integrators may receive revenue from supplying other products/services required in the course of the project, the total size of SI-related revenue is considerably larger.

- Major opportunities should be realized from customer requirements for:
  - Large-scale integration within selected industries where data processing is critical to the success of the business.
  - Medium-scale integration in an industry or application area to effect an organized and cost-effective DP function.
  - Electronic data interchange.
- Additional opportunities should emerge as:
  - Corporations move from a hardware to a functional orientation.
  - Rapid technical changes reduce the capabilities of the internal staff to stay current.
  - Project management capabilities of in-house staffs replace technical capabilities.
  - More corporations look at data processing as a core business strategy rather than as a business support function.

IV COMPETITIVE ENVIRONMENT

IV COMPETITIVE ENVIRONMENT

- Any market in its embryonic stages invites vendor activity in the form of product/service (re)definition, self-assessment vis-a-vis market requirements, and some form of risk-benefit analysis. This report section explores some of these activities and forecasts the likely competitive environment for systems integration.

A. VENDORS' INTEGRATION OFFERINGS

- Information services vendors have not been oblivious to the trend toward systems integration contracting. As depicted in Exhibit IV-1, it is not unusual for some vendors to offer a variety of products/services from both their own in-house sources as well as from other vendors.

- Vendors have responded to the need for integration through their own offerings. The extent of in-house product integration varies both in terms of the number of specific tasks integrated within an application and the number of applications integrated across hardware/software boundaries. Exhibit IV-2 provides an exemplary list of integrated product offerings.

- In the context of functional requirements, however, vendors have more often advanced along the technical dimension rather than the functional (see Exhibit IV-3). Currently, vendors are able to provide total solutions for complex

EXHIBIT IV-1

TYPES OF OFFERINGS BY VENDORS

PRODUCTS/SERVICES OFFERED	TYPE OF VENDOR			
	Hardware	Software	Professional Services	Turnkey Systems
Custom Design				
Hardware System	X (L)	-	X	X (L)
Communications System	X (L)	-	X	-
Software System	X (L)	X (L)	X	X (L)
Sell Own Off-the-Shelf				
Hardware	X	-	-	-
Communications	X	-	-	-
Software	X	X	X (L)	-
Custom Develop/Modify				
Hardware	X (L)	-	-	X (L)
Communications	X (L)	-	X	X (L)
Software	X (L)	X	X	X (L)
Select and/or Modify Other Vendors' Products				
Hardware	-	-	X	X
Communications	-	-	X	X
Software	X (L)	X (L)	X	X
Implement/Maintain				
Hardware	X	-	X	X
Communications	X	-	X	X
Software	X	X	X	X

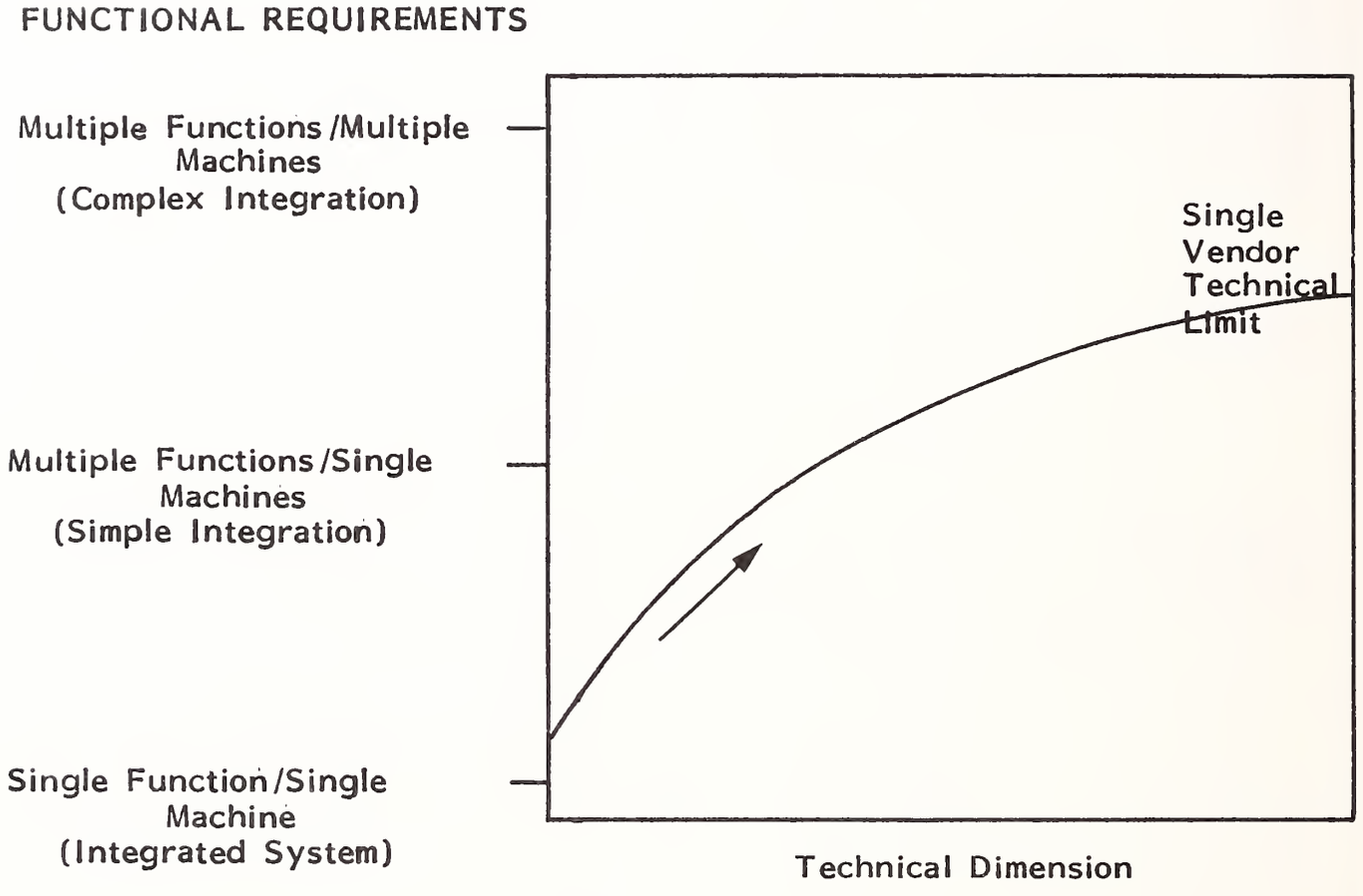
EXHIBIT IV-2

EXEMPLARY LIST OF VENDORS OFFERING INTEGRATED APPLICATIONS

TYPE OF VENDOR	NAME	APPLICATION AREA
Hardware	Data General	Various
	IBM	Various
Software	Hogan	Banking
	InSci	Human Resources
	Uccel	Banking
Professional Services	CGA/TSS	Construction
	CAP Information	Banking, Brokerage
	GEISCO	Banking, Manufacturing
	McAuto	Travel, Manufacturing
	System and Computer Technology	Education, Local Government
Turnkey Systems	Computer Consoles	Directory Assistance
	Intergraph	CAD/CAM
	Tera	Utilities, Petrochemicals, Food Service
Others	EDS	Various
	Systematics	Various

EXHIBIT IV-3

FUNCTIONAL INTEGRATION AND CHANGING TECHNOLOGY
VENDOR PERSPECTIVE



integration requirements only in very restricted environments. Instead, vendor specialties now include:

- Hardware.

- Software.

- Hardware systems that integrate hardware and systems software.

- Turnkey systems that integrate hardware, systems software, and specific applications software.

- System houses that acquire, assemble, and integrate hardware and software as a total system or with interface electronics and controllers for the CPU, peripherals, and ancillary subsystems that will be part of the total system.

- The extent to which another vendor's offerings are included has been dependent upon several interrelated factors.

  - The willingness of a vendor to recognize the opportunities in offering products/services of other vendors, and the obverse, the willingness to have a vendor's own products/services offered by another, otherwise competitor vendor.

  - The vigor with which a vendor has developed supporting role relationships with other vendors.

  - The corporate view of their own capabilities in being a successful single source vendor.

- In 1984 and 1985 many of the old "brand X" views of the competition have given way to a vision of new opportunities through partnering, multiple distri-

bution channels, VAD and VAR relationships, and subcontracting to other vendors. Some recent notable relationships include:

- DEC--Comtex.
- FleetBank--Health Care Application Group.
- IBM--Merrill Lynch.
- IBM--Sears.

- While initial vendor activity involving integration has not specifically been directed at the professional services opportunities of systems integration as defined in this report, these SI opportunities have caught vendors' eyes nonetheless.

- Vendors appear to be interested in systems integration for several reasons.
  - As noted previously, vendors see a need to address the growing user requirement for systems integration. In some market segments SI is not only an opportunity for additional revenue, but also a necessary additional service to be offered to remain competitive.
  - New vendor distribution relationships expand product offerings and bring the vendor closer to the SI capabilities being required. At the same time, SI is seen as a "door opener" for wider distribution of these new offerings.
  - These distribution relationships, particularly when linked to SI projects, offer opportunities for vendors to increase their margins. Typical margins in SI are:
  - Hardware: 30-50%.
  - Systems design and programming: 5-10%.

- Consulting: 15-20%.

- Packaged applications software: 40-60%.

B. ON BECOMING A SYSTEMS INTEGRATOR

- Systems integration solutions entail activities not generally required by either turnkey systems or prime/subcontractor relationships. Exhibit IV-4 places these differences along the dimensions of functional requirements and sophistication of the technology employed.

  - It is generally the case that as user requirements expand and technology changes, no single vendor is able to provide the total solution required from internal resources.

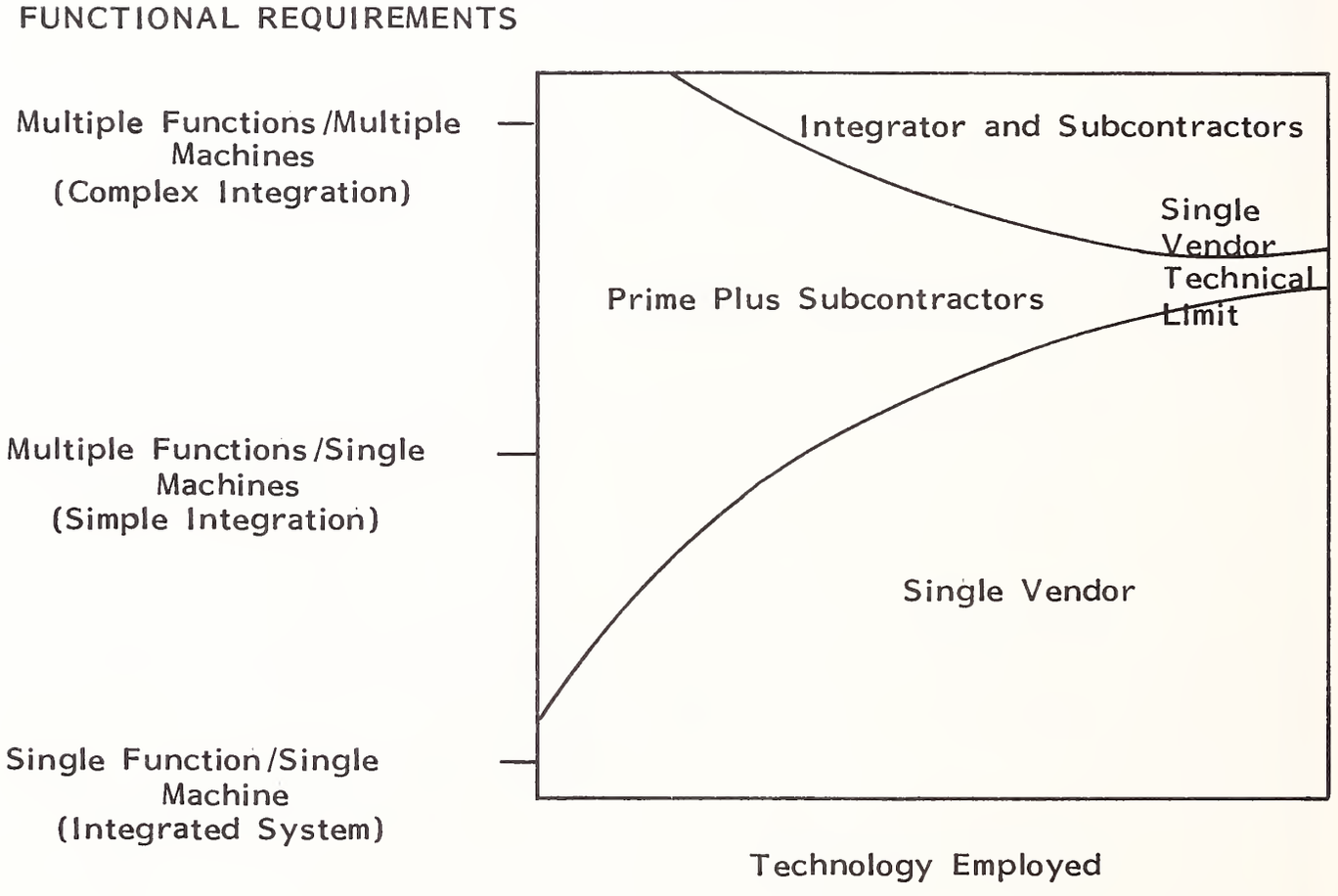
  - Some vendors, by themselves or with the assistance of subcontractors, are capable of delivering the products/services required when the solution is limited technologically.

  - When the requirements are complex and the necessary technology is elaborate, products and services of multiple vendors may be required. In such cases, a systems integrator may be necessary. The requirement for electronic data interchange, for example, generally calls for expertise in hardware, communications, systems software, applications software, and customer support (training, documentation, operations, and maintenance) which may not be possessed by a single vendor.

- The current status of many vendors, then, suggests that they are not positioned well to exploit SI opportunities. Some of the current limitations are listed below.

EXHIBIT IV-4

FUNCTIONAL INTEGRATION AND CHANGING TECHNOLOGY
SI PERSPECTIVE



- A vendor's expertise in an industry or application area may not be recognized either because that expertise is overshadowed by another, recognized capability or because the vendor's successes have not been properly advertised.

- Some vendors' approaches appear to the user community to be too restricted with respect to the requirements of SI. This usually occurs because of the above and because vendor-vendor relationships that would support SI assignments have not been established or are not widely known. The impact of establishing and advertising these relationships can be dramatic. IBM, for example, while recognized as an "iron" vendor, has carefully cultivated relationships that build the perception that IBM can deliver solutions other than their own.

- Vendors may be financially or managerially unable to shoulder the inherent risks associated with delivering an acceptable SI solution.

- Corporations, unlike the federal government, have no requirement that a certain portion of projects must go to small business. A vendor's financial stability may be a key selection criterion in complex SI.

- Most vendors that are not in the federal market are unaccustomed to the rigor involved in bidding SI projects. This is particularly true in the absence of an in-house team that understands the strategies of the likely competition and is able to prepare a simulated bid to compare to the vendor's actual bid.

- SI projects may entail a vendor management structure that provides the project manager with near-total authority to commit the vendor. The absence of this authority in favor of the top executive approach for everything almost guarantees project cost overruns and missed schedules.

- While the management issues cited above must be left to individual vendors to resolve, there are strategies that vendors are employing to enhance their SI capabilities. Exhibit IV-5 ranks the most likely expansion avenues by type of vendor.

  - Each strategy draws upon the vendor's current strengths as a base for expansion and also targets related issues that may be limiting factors. Thus, in INPUT's view, it is more advantageous for vendors to "grow" their SI capabilities by shoring up their weaker links in areas of strength than by covering areas of vulnerability.

  - This strategy reduces, but does not eliminate, the risks of expansion. INPUT's estimate of the risks of various SI expansion strategies are more fully depicted in Exhibit IV-6. While strategic partnering and acquisitions are expedient strategies, they do not seem to conform to a notion of "high risk/high reward" in this market unless the partner or acquiree is already an SI vendor or adds significantly to the complex project management capabilities of the partner/acquirer. A better strategy, since it is intuitively in line with the user's requirement for a broad range of product/service offerings, would seem to be the establishment of multiple distribution agreements.

- In expanding their SI capabilities through these strategies, vendors must also be mindful of the impact of technology changes. As noted in Exhibit IV-7, the extent of the impact varies both by the size of the vendor and the extent of the change.

  - Smaller changes are more readily turned to an advantage by smaller SI vendors who are able to react more quickly than their larger competitors.

  - Larger changes negatively impact all vendors, but larger integrators typically have more resources to allow them to recover from any

EXHIBIT IV-5

RANKING OF LIKELY SI CAPABILITY DEVELOPMENT BY TYPE OF VENDOR

EXPANSION STRATEGY	TYPE OF VENDOR			
	Hardware	Software	Professional Services	Turnkey Systems
Wider Integration of Products	2	1	3	2
Development or Acquisition of More Software	1	2	-	3
Expand Distribution Rights	3	3	1	-
Expand Current Custom	-	-	2	1

EXHIBIT IV-6

RISK LEVELS OF SI EXPANSION STRATEGIES

EXPANSION STRATEGY	INVESTMENT RISK LEVEL
Vendor "Encouragement"	Low
Internal Development	Medium
Distribution Arguments	Medium
Joint Ventures	Medium
Strategic Partners	High
Acquisition	High

EXHIBIT IV-7

IMPACT OF TECHNOLOGY CHANGE ON SI CAPABILITY

TYPE OF TECHNOLOGY CHANGE	SIZE OF SI VENDOR		
	Small	Medium	Large
New Concept or Product Feature	Fast, Internal Development. Use to Promote Business.	Negative Impact. May Need Strategy to Cover Limitations.	Absorb Change in Current Capabilities.
New Product	Encourages New Competition.	See Above.	Establish Relationship With Vendor or Absorb Change.
New Type of Product	May Eliminate Vendor as a Potential Integrator.	Must Commit Resources to Develop Interfaces with Product or Product's Vendor.	

disadvantage. Resources may include available personnel that develop means to absorb the change or investment dollars to develop relationships (distribution rights, partners, joint ventures, acquisition) with the new product's vendor.

- All changes seem to impact medium-sized vendors who are too large to react quickly via in-house development and too small to have unused resources to respond via new vendor relationships.

C. THE VENDOR COMMUNITY

1. CURRENT AND FUTURE SI VENDORS

- While few vendors are currently well positioned in the SI market, there are many who, in INPUT's opinion, have material or conceptual assets that could be leveraged to profitably exploit the opportunities in the commercial systems integration market. Current and prospective vendors are listed below according to categories of products or services from which vendors are most likely to expand their SI business. Vendors may appear in more than one category, denoting multiple foundations.

a. Federal Government SI Vendors

- These vendors have established their capabilities in the federal market and may transport those skills to commercial markets. INPUT's list of for-profit vendors ranked by federal dollar volume follows.

  - Electronic Data Systems.

  - Martin Marietta.

- Sperry.
- Scientific Applications.
- Control Data.
- Computer Sciences.
- International Business Machines.
- BDM.
- Planning Research.
- Ford Aerospace.

- Other vendors who have been active in the federal SI market include:
  - Boeing.
  - GTE.
  - Harris.
  - Informatics.
  - Lockheed.
  - RCA.
  - Syscon.
  - TRW.

- These lists exclude many small systems design and engineering firms that also could leverage their federal experience.

b. Computer Hardware Vendors

- With a significant portion of the expenditure for systems integration going to hardware, it is not surprising that users look to hardware vendors as the prime contractor and, therefore, the "integrator." These vendors may leverage their "iron" against the user requirements of inter-system integration. These vendors include (or may include):

  - International Business Machines.
  - Data General.
  - Sperry.
  - Digital Equipment.
  - Gould (SEL).
  - Harris.
  - Hewlett Packard.
  - Burroughs.
  - NCR.
  - Tandem.

c. Specialized Integrators

- Vendors who have developed expertise with turnkey systems could move from the custom arena to the general SI market. Exemplary vendors with foundations in turnkey include:

  - ASK.
  - Autotrol.
  - C3.
  - Computer Consoles.
  - Control Data.
  - Computer Sciences.
  - Electronic Data Systems.
  - Gould.
  - Honeywell.
  - International Business Machines.
  - Intergraph.
  - Planning Research.
  - Sperry.
  - Tera.

d. Accounting Firms

- The "Big 8" have sharpened their information service skills and now possess capabilities with large systems integration that extend beyond their most noted applications in financial systems. Also, some of these vendors have been awarded federal integration jobs that will further expand their SI experiences.

  - Arthur Andersen.
  - Coopers & Lybrand.
  - Deloitte, Haskins & Sells.
  - Ernest & Whinney.
  - Peat, Marwick & Mitchell.
  - Arthur Young.

e. Management Services Firms

- Leveraging skills in large project management, these firms potentially offer capabilities on the management side of SI requirements.

  - American Management Systems.
  - Bolt, Beranek and Newman.
  - Booz, Allan, Hamilton.

f. Vendors Noted For Specific Application Expertise

- Some vendors have developed significant capabilities in specific applications. These vendors are recognized for these capabilities and may find that to be a significant asset in SI competition.

  - Cullinet (cross-industry DBMS).

  - GEISCO (banking and manufacturing).

  - McAuto (international, banking, travel, and manufacturing).

  - Systems and Computer Technology (education and local government).

  - Computer Task Group (state government).

  - AT&T (communications).

2. FUTURE CHANGES IN THE VENDOR COMMUNITY

- As noted above, many vendors currently possess the base assets on which to build a significant revenue stream from systems integration. In the long run, however, a few large vendors will dominate both large- and medium-sized opportunities.

  - These vendors will have made commitments to both establishing vendor-vendor relationships and developing or acquiring complex project management expertise, and as they grow they will attract even more vendors with distribution or subcontacting opportunities, further expanding their ability to claim the breadth of product/service offerings required by the SI customer.

- The major issue will be whether these larger vendors can overcome limitations in applications and industry experience that may accrue as they expand their base of experience.

- The remaining SI vendors should find opportunities in related SI applications or industries as they focus on areas of expertise. These vendors should also consider subcontracting to larger vendors or SI projects. This will be a competitive situation, however, as the larger vendors will be as attracted to new entrant vendors with advanced technical expertise as they are to current vendors with application or industry expertise.

V RECOMMENDATIONS

V RECOMMENDATIONS

- The unknowns inherent in the early market growth of systems integration should not limit vendors' exploration of its potential. To exploit opportunities, vendors should establish specific action agendas that include identifying and understanding specific SI project objectives, analyzing the risks involved, and leveraging capabilities and vendor relationships that enhance the viability of the SI vendor.

A. IDENTIFYING AND UNDERSTANDING SPECIFIC SI PROJECTS

- The nature of SI projects, as defined in this report, indicates that they will be limited in number. Vendors may not readily find potential projects unless they really search. In addition to a thorough analysis of potential within the vendor's own client base, a search of other prospects should be undertaken.

  - Analyze the lines of business of major corporations for criticality of data processing to revenue generation.

  - Identify corporations and subsidiaries that have centralized management but dispersed operations.

  - Track recent major purchases of both CPU and workstation hardware.

- Track major purchases of integrated software products.

- Identify companies with elaborate but dated (older) information centers.

- Identify companies that are (could be) developing a distributed data processing capability.

- Treating these companies that are identified by these several methods as sets and then merging the sets a la Venn diagram should result in a list of "suspects." Another pass based on user characteristics provided in this report should bring a list of higher potential prospects.

- Selling prospects on the benefits of the SI approach to a solution and the capability of the vendor to delivery that solution is considerably harder.

  - Some prospects will not have considered SI, requiring an amount of "missionary" work that the vendor may not have planned to perform.

  - Other prospects will have extensive objections regarding additional cost, assurances of the viability of the best solution as opposed to solutions other vendors seem capable of delivering, the vendor's experiences in the application area or industry, and the need for outside support in light of perceived in-house capability restrictions.

- Vendors must know the company's current data processing environment, its strategic directions with respect to DP, and the factors that potentially limit a company from achieving its DP objectives. In short, the vendor must see the company as the prospect does and then tailor the proposed SI approach to its needs and concerns.

- One selling approach used successfully in the federal government is the development of a checklist of all major tasks involved in typical large-scale

integration projects or, if known, in the project being contemplated by the prospect. Walking the prospect through a thorough list tends to reveal unconsidered tasks, the level of expertise required, and the time that could be involved.

- Since prospects in the early stages of this market will be skeptical of the ultimate intentions of the vendor (i.e., providing a solution versus selling the vendor's products), it will be extremely important for vendors to focus on the technical consulting and project management roles of systems integration rather than the vendor's own potential products/services or products/services of other vendors for which the prospective integrator may have distribution rights.

  - Hardware vendors, in particular, must be willing to be flexible in meeting the hardware requirement, even if the requirement is for vendor-vendor compatibility, and must be willing and able to service all hardware, not just their own products.

- The approach should be to solve the problems, not sell the solution.

B. MANAGING THE RISKS

- The SI requirement for the vendor to share or assume the responsibility for the implementation of a satisfactory solution brings with it a great deal of risk. If this risk is not properly identified, contained, and managed, the vendor stands to lose a great deal of reputation as well as money.

- Vendors need to make the effort needed to understand the full extent of the customer's functional requirements and resource objectives and the criteria to be used in determining the acceptability of the solution.

- Vendors should then assess the feasibility of delivering the solution under the specified criteria.

  - Can the desired solution be delivered under the conditions imposed by the customer and/or the operational environment?

  - What subcontractors may be required?

  - How much new development does the solution entail and how much of that development is technologically advanced, even "undiscovered?"

  - What alternatives exist if the proposed solution does not work? If a subcontractor cannot deliver?

- The risks identified should be quantified and juxtaposed to the potential benefit to determine if the job is worth the risk and, in an iterative fashion, determine what solution would be worth the risk.

- Bid development may require the expenditure of extensive staff time that may result in a rejected bid. To manage this risk, vendors need to assess their chances of winning. A favorite approach to this assessment used by some federal contractors is to have an in-house team which knows the capabilities of likely competitors simulate their respective bids. Comparing them should reveal strengths and weaknesses that can then be enhanced or covered by the bidder.

- Various types of contracts, mentioned above, may be proposed. Among other things, these types offer vehicles for rejecting, sharing, or assuming the risk. In selecting a contract, vendors should also analyze the liabilities of each in terms of what the customer will find acceptable and what it implies about the vendor's own belief in his ability to do the job.

- Risk management as a part of project management has been a frequent topic in the literature and will not be discussed here except to advise that, in INPUT's opinion, an SI vendor must be willing to invest near-total authority in the project manager with litte more than oversight on the part of the executive. The results of the risks of assigning this responsibility to a single manager who can act quickly far outweigh the results of the risks of project delays and cost overruns.

C. ESTABLISH VENDOR-SUPPLIER RELATIONSHIPS

- A key to the systems integration market is the number and quality of relationships that the SI bidder has or could have with prospective subcontractors. These relationships are important both as a credential for being the integrator and as an additional source of revenue for the integrator.

- These relationships should, for the most part, be established before bidding a project or, under ideal circumstances, without respect to any project. Vendor-supplied relationships are very tenuous and require time to nurture and develop. These relationships need not be formal until a specific opportunity is at hand, but early, informal "acquaintances" will make the formal aspects happen faster and with more understanding of the risks.

- Vendors cannot, obviously, spend all their resources on establishing relationships, some of which may never be useful. Selections criteria should be developed based on discrepancies between expected user requirements and vendor capabilities. Some of the requirements to be considered include:

  - Systems integration experiences.

  - Ability to generate revenue.

- Financial stability.

- Position in industry with respect to competition.

- Knowedge of application or industry.

- Range of products/services.

- Flexibility of product line with respect to compatability, ability to add other functions, portability.

- Intra- and inter-system application integration.

D. CONCLUSION

- Systems integration opportunities will prove to be a small, risky, but very important market in the late 1990s. It will certainly not be a market for most vendors, and of the many who try it, few will succeed. However, vendors who build an SI capability should prosper with a growing demand, increasing recognition of the integrator's value, and limited competition.

APPENDIX A: DEFINITIONS

APPENDIX A: DEFINITIONS

- Since systems integration vendors propose on a wider range of systems and services than traditional vendors, the definitions include the hardware and telecommunications categories (see Exhibit A-1).

A. SERVICE MODES

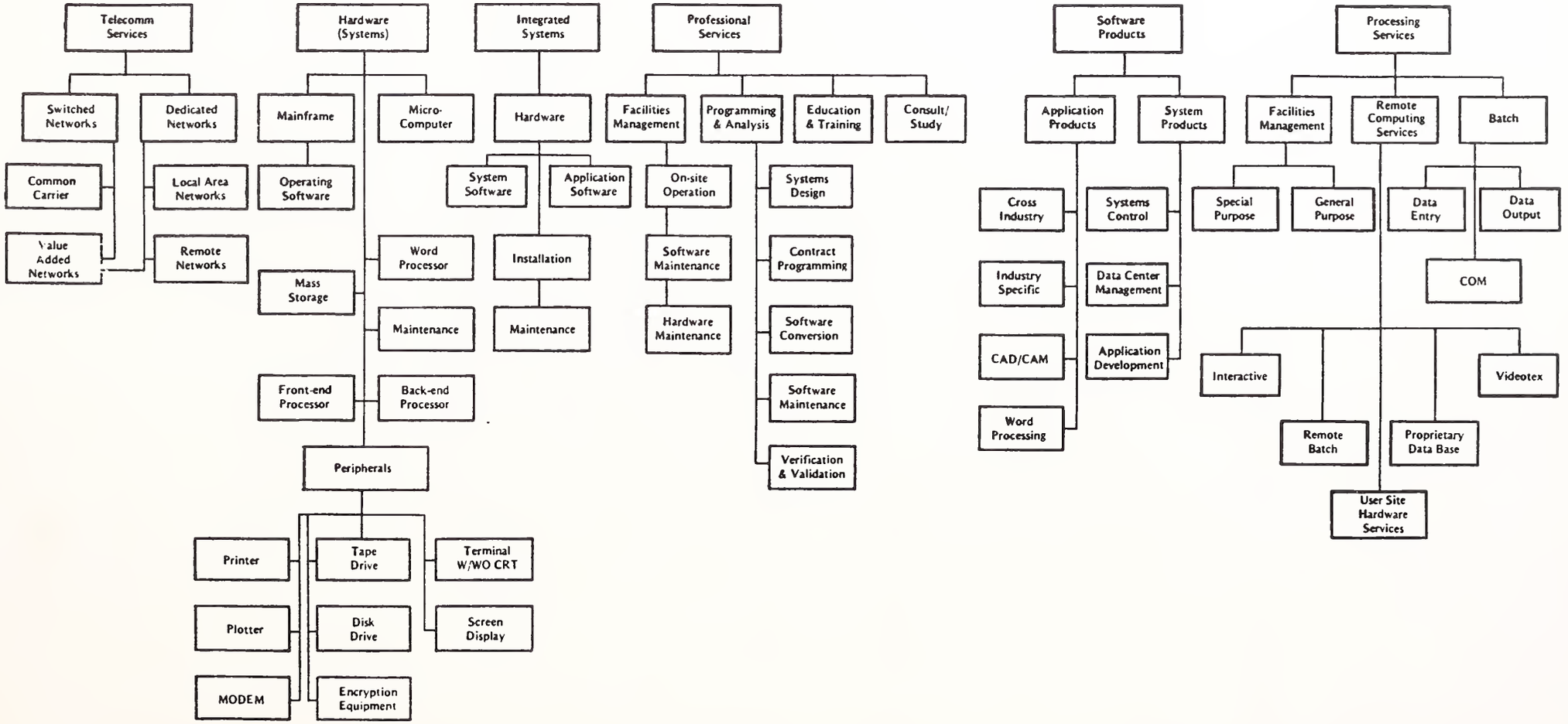
- PROCESSING SERVICES - Remote computing services, batch services, and processing facilities management.

  - REMOTE COMPUTING SERVICES (RCS) - Provision of data processing to a user by means of terminals at the user's site(s). Terminals are connected by a data communications network to the vendor's central computer. The most frequent contract vehicle for RCS in the federal government is GSA's TSP (Teleprocessing Services Program). There are four submodes of RCS:

    - INTERACTIVE (timesharing) - Characterized by the interaction of the user with the system, primarily for problem-solving timesharing, but also for data entry and transaction processing; the user is on-line to the program/files.

EXHIBIT A-1

SYSTEMS AND SERVICES MODES OF SYSTEMS INTEGRATION*



*Based on INPUT's Federal Information Systems and Services Program (FISSP)

- REMOTE BATCH - Where the user hands over control of a job to the vendor's computer, which schedules job execution according to priorities and resource requirements.

- PROPRIETARY DATA BASE - Characterized by the retrieval and processing of information from a vendor-maintained data base. The data base may be owned by the vendor or by a third party.

- USER SITE HARDWARE SERVICES (USHS) - These offerings provided by RCS vendors place programmable hardware on the user's site (rather than the EDP center). Some vendors in the federal government market provide this service under the label of Distributed Data Services. USHS offers:

  - Access to a communications network.

  - Access through the network to the RCS vendor's larger computers.

  - Local management (and storage) of a data base subset that will service local terminal users via the connection of a data base processor to the network.

  - Significant software as part of the service.

- BATCH SERVICES - These include data processing performed at vendors' sites for user programs and/or data that are physically transported (as opposed to transported electronically by telecommunications media) to and/or from those sites. Data entry and data output services, such as keypunching and computer output microfilm processing, are also included. Batch services include expenditures by users who take their data to a vendor site that has a terminal connected to a remote computer for the actual processing.

- PROCESSING FACILITIES MANAGEMENT (PFM) (also referred to as "Resource Management," "Systems Management," or "COCO" - contractor-owned/contractor-operated) - The management of all or part of a user's data processing functions under a long-term contract (not less than one year). This would include remote computing and batch services. To qualify as PFM, the contractor must directly plan, control, operate, and own the facility provided to the user, either on-site, through communications lines, or in a mixed mode.

- PROFESSIONAL SERVICES - Made up of services in the following categories:

  - CONSULTING SERVICES - Information systems and/or services management consulting, program assistance (technical and/or management), feasibility analyses, and cost/effectiveness trade-off studies.

  - EDUCATION/TRAINING SERVICES - Products and/or services related to ISS for the user, including CAI (computer-aided instruction), CBE (computer-based education), and vendor instruction of user personnel in operations, programming, and maintenance.

  - OPERATION AND MAINTENANCE (also referred to as O&M) - Contractor (vendor)-staffed support of client ADP/telecommunications equipment on-site (on government property), in cases where the vendor does not manage the complete facility and the equipment and initial software suite may not have been provided by the vendor.

  - MAINTENANCE (HARDWARE AND/OR SOFTWARE) - Vendor-furnished services provided after installation and acceptance by the user. These services may be part of a warranty or may be separately contracted; services may be provided by resident or on-call personnel of the vendor.

- PROGRAMMING AND ANALYSIS - Including system design, contract or custom programming, code conversion, independent verification and validation (also called "IV&V"), benchmarking, and software maintenance.

- PROFESSIONAL SERVICES FACILITIES MANAGEMENT (PSFM) (also referred to as GOCO - Government-Owned/Contractor-Operated) - The counterpart to processing facilities management, except that the computers are owned or leased by the government, not the PSFM vendor, and the vendor provides the staff to operate, maintain, and manage the government's facility.

- SYSTEMS INTEGRATION - Services associated with systems design, integration of computing components, installation, and government acceptance of ADP/telecommunications systems. System components may be furnished by separate vendors to the government (not as an integrated system by one vendor, called the prime contractor); services may be furnished by a vendor, by a not-for-profit organization, or by another government agency. Integration services may be provided with related engineering activities, such as SE&I (Systems Engineering and Integration) or SETA (Systems Engineering and Technical Assistance).

- THIRD-PARTY MAINTENANCE - Hardware/equipment maintenance sources, usually provided "on-call" by a vendor other than the original manufacturer.

- INTEGRATED SYSTEMS (also known as Turnkey Systems) - An integration of systems and applications software with hardware packaged as a single entity. The value added by the vendor is primarily in the software. Most CAD/CAM systems and many small business systems are integrated systems. This does not include specialized hardware systems such as word processors, cash registers, and process control systems.

- SOFTWARE PRODUCTS - This category includes user purchases of applications and systems packages for in-house computer systems. Included are lease and purchase expenditures, as well as expenditures for work performed by the vendor to implement and maintain the package at the user's sites. Expenditures for work performed by organizations other than the package vendor are counted in the category of professional services. There are several subcategories of software products, as indicated below and in detail in Exhibit A-2:

  - APPLICATIONS PRODUCTS - Software that performs processing that services user functions. The products are:

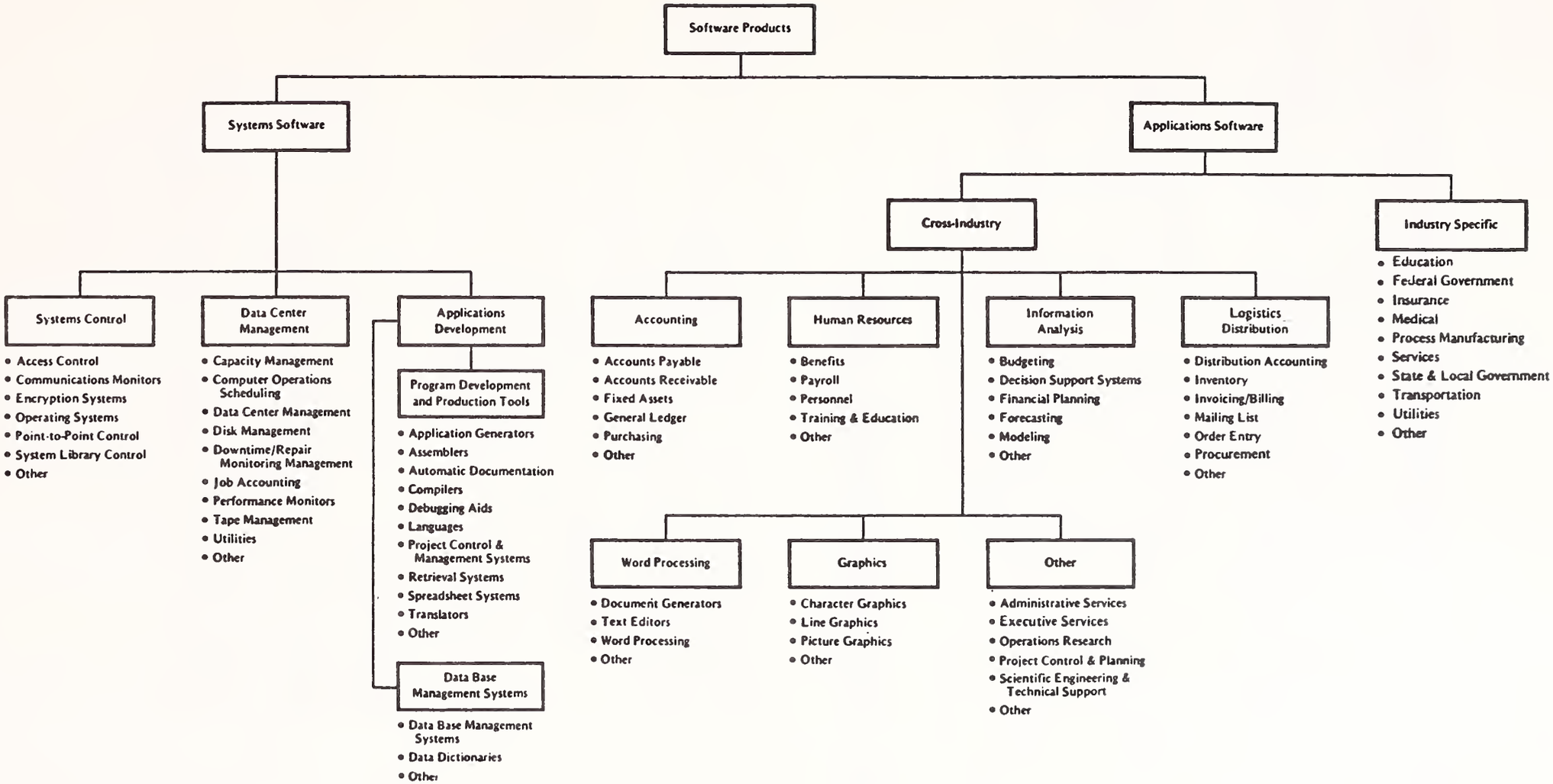
    . CROSS-INDUSTRY PRODUCTS - Used in multiple user industry applications as well as in federal government sectors. Examples are payroll, inventory control, and financial planning.

    . INDUSTRY-SPECIALIZED PRODUCTS - Used in the specific federal government sector, such as planning, resource utilization, aircraft flight planning, military personnel training, etc. May also include some products designed to work in an industry other than the federal government, but applicable to specific government-performed commercial/industrial services, such as hospital information, vehicular fleet scheduling, electric power generation and distribution, CAD/CAM, etc.

  - SYSTEMS PRODUCTS - Software that enables the computer/communications system to perform basic functions. They consist of:

    . SYSTEMS CONTROL PRODUCTS - Function during applications program execution to manage the computer system resource. Examples include operating systems, communication monitors, emulators, and spoolers.

SOFTWARE PRODUCTS



- DATA CENTER MANAGEMENT PRODUCTS - Used by operations personnel to manage the computer system resources and personnel more effectively. Examples include performance measurement, job accounting, computer operations scheduling, and utilities.

- APPLICATION DEVELOPMENT PRODUCTS - Used to prepare applications for execution by assisting in designing, programming, testing, and related functions. Examples include languages, sorts, productivity aids, compilers, data dictionaries, data base management systems, report writers, project control systems, and retrieval systems.

B. HARDWARE/HARDWARE SYSTEMS

- HARDWARE - Includes all ADP and telecommunications equipment that can be separately acquired by the government, with or without installation by the vendor, and not acquired as part of a system.

  - PERIPHERALS - Includes all input, output, communications, and storage devices, other than main memory, that can be locally connected to the main processor and generally cannot be included in other categories, such as terminals.

- INPUT DEVICES - Includes keyboards, numeric pads, card readers, bar-code readers, lightpens and trackballs, tape readers, position and motion sensors, and A-to-D (analog-to-digital) converters.

- OUTPUT DEVICES - Includes printers, CRTs, projection television screens, microfilm processors, digital graphics, and plotters.

- COMMUNICATION DEVICES - Modems, encryption equipment, special interfaces, and error control.

- STORAGE DEVICES - Includes magnetic tape (reel, cartridge, and cassette), floppy and hard disks, drums, solid state (integrated circuits), and bubble and optical memories.

  - TERMINALS - There are three types of terminals used in federal government systems:

    . USER PROGRAMMABLE (also called "intelligent terminals"):

      - Single-station or standalone.
      - Multistation-shared processor.
      - Teleprinter.
      - Remote batch.

    . USER NONPROGRAMMABLE:

      - Single-station.
      - Multistation-shared processor.
      - Teleprinter.

    . LIMITED FUNCTION - Originally developed for specific needs, such as POS (point of sale), inventory data collection, controlled access, etc.

- HARDWARE SYSTEMS - For the purposes of this report, hardware systems include all processors, from microcomputers to super (scientific) computers. Hardware systems require type- or model-unique operating software to be functional, but the category excludes applications software and peripheral devices other than main memory and processors or CPUs not provided as part of an integrated (turnkey) system.

  - MICROCOMPUTER - Combines all of the CPU, memory, and peripheral functions of an 8- or 16-bit computer on a chip, in the form of:

    . Integrated circuit package.

    . Plug-in board with more memory and peripheral circuits.

    . Console, including keyboard and interfacing connectors.

    . Personal computer with at least one external storage device directly addressable by CPU.

    . An embedded computer, which may take a number of shapes or configurations.

  - MINICOMPUTER - Usually a 12-, 16- or 32-bit computer, which may be provided with limited applications software and support and may represent a portion of a complete large system.

    . Personal business computer.

    . Small laboratory computer.

    . Nodal computer in a distributed data network, remote data collection network, connected to remote microcomputers.

- MIDICOMPUTER - Typically a 32- or 64-bit computer, with extensive applications software and a number of peripherals in standalone or multiple CPU configurations for business (administrative, personnel, and logistics) applications, also called a General-Purpose Computer.

- LARGE COMPUTER - Presently centered around storage controllers but likely to become bus-oriented and to consist of multiple processors (CPUs) or parallel processors; they are intended for structured mathematical and signal processing and are generally used with general-purpose von-Neumann-type processors for system control.

- SUPER COMPUTER - High-powered processors with numerical processing throughput that is significantly greater than the largest general-purpose computers, with capacities in the 10-50 MFLOPS (million floating point operations per second) range, in two categories:

  . REAL TIME - Generally used for signal processing in military applications.

  . NONREAL TIME - For scientific use, with maximum burst-mode (not sustained speed) capacities of up to 100 MFLOPS, in one of three configurations:

    - Parallel processors.

    - Pipeline processor.

    - Vector processor.

  . Newer super computers, with burst modes approaching 300 MFLOPS, main storage size up to 10 million words, and on-line storage in the one-to-three gigabyte class, are labelled Class IV to VI in agency long-range plans.

- EMBEDDED COMPUTER - Dedicated computer system designed and implemented as an integral part of a weapon, weapon system, or platform or that is critical to a military or intelligence mission, such as command and control, cryptological activities, or intelligence activities. Characterized by MIL SPEC (military specification) appearance and operation, limited but reprogrammable applications software, and permanent or semipermanent interfaces. May vary in capacity from microcomputers to parallel-processor computer systems.

C. TELECOMMUNICATIONS

- NETWORKS - Interconnection services between computing resources. Provided on a leased basis by a vendor to move data and/or textual information from one or more locations to one or more locations.

  - COMMON CARRIER NETWORKS (CCN) - Provided via conventional voice-grade circuits and through regular switching facilities (dial-up calling) with leased or user-owned modems (to convert digital information to voice-grade tones) for transfer rates between 150 and 1,200 baud.

  - VALUE-ADDED NETWORKS (VAN) - Provided by vendors through common carrier or special-purpose transmission facilities, with special features not available in the voice-grade switched public network:

    . DEDICATED NETWORK - Provides nonswitched interconnections between computing resources, such as:

      - Full-period, continuously connected communications interface, with machine-to-machine traffic flow.

- Message-switched text/data flow between specified CPUs or terminals, as determined by information included in the header (front-end) of the message or data block.

. PACKET-SWITCHED - Provides means for delivery of predetermined blocks of data/text through a common carrier-type switched network.

. MESSAGE-SWITCHED - Similar to the dedicated network in message delivery methods, but not restricted to a single user.

- LOCAL AREA NETWORK (LAN) - Restricted limited-access network between computing resources in a relatively small (but not necessarily contiguous) area, such as a building, complex of buildings, or buildings distributed within a metropolitan area. One of two types:

. BASEBAND - Voice bandwidth at voice frequencies (same as telephone, teletype system), limited to a single sender at any given moment and limited to speeds of 75 to 1,200 baud in serial mode.

. BROADBAND - Employs multiplexing techniques to increase carrier frequency between terminals, to provide:

  - Multiple (simultaneous) channels via FDM (Frequency Division Multiplexing).

  - Multiple (time-sequenced) channels via TDM (Time Division Multiplexing).

  - High-speed data transfer rate via parallel mode at rates of up to 96,000 baud (or higher, depending on media).

- TRANSMISSION MEDIA - Varies with the supplier (vendor) and with the distribution of the network and its access mode to the individual computing resource location.

  - MODE - may be either:

    . ANALOG - Typified by the predominantly voice-grade network of AT&T's DDD (Direct Distance Dialing) and by operating telephone company distribution systems.

    . DIGITAL - Where voice, data, and/or text are digitized into a binary stream.

  - MEDIA varies with distance, availability, and connectivity:

    . WIRE - Varies from earlier single-line teletype networks to two-wire standard telephone (twisted pair) and balanced line to four-wire full-duplex balanced lines.

    . CARRIER - Multiplexed signals on two-wire and four-wire networks to increase capacity by FDM.

    . COAXIAL CABLE - HF (High Frequency) and VHF (Very High Frequency), single frequency, or carrier-based system that requires frequent reamplification (repeaters) to carry the signal any distance.

    . MICROWAVE - UHF (Ultra High Frequency) multichannel, point-to-point, repeated radio transmission, also capable of wide frequency channels.

- OPTICAL FIBER - Local signal distribution systems employed in limited areas using light-transmitting glass fibers and using TDM for multichannel applications.

- SATELLITES - Synchronous earth-orbiting systems that provide point-to-point, two-way service over significant distances without intermediate amplification (repeaters), but requiring suitable groundstation facilities for up- and down-link operation.

- CELLULAR RADIO - Network of fixed, low-powered two-way radios that are linked by a computer system to track mobile phone/data set units; each radio serves a small area called a cell. The computer switches service connection to the mobile unit from cell to cell as the unit moves among the cells.

D. GENERAL DEFINITIONS

- BENCHMARK - Method of testing proposed ADP system solutions for a specified set of functions (applications) employing simulated or real data inputs under simulated operating conditions.

- BYTE - Approximately equivalent to the storage required for one alphanumeric character (i.e., one letter or number).

- CENTRAL PROCESSING UNIT (CPU) - The arithmetic and control portion of a computer, i.e., the circuits controlling the interpretation and execution of computer instructions.

- CONSTANT DOLLARS - Growth forecasts in constant dollars make no allowance for inflation or recession. Dollar value based on the year of the forecast unless otherwise indicated.

- COMPUTER SYSTEM - The combination of computing resources required to perform the designed functions, which may include one or more CPUs, machine room peripherals, storage systems, and/or applications software.

- CONUS - Locations within the geographical limits of the CONtinental United States.

- CURRENT DOLLARS - Estimates or values expressed in current-year dollars, which, for forecasts, would include allowance for inflation.

- DATA ENCRYPTION STANDARD (DES) - A specified encryption algorithm implemented by hardware design and used to protect data when stored in or transmitted between user locations.

- DISTRIBUTED DATA PROCESSING - Distributed processing is the deployment of programmable intelligence in order to perform a data processing function where it can be accomplished most effectively through computers and terminals arranged in a telecommunications network adapted to the user's characteristics.

- EMBEDDED COMPUTER - Computer system that is an integral part of a weapon, weapon system, or platform, or is critical to the direct fulfillment of a military or intelligence mission.

- ENCRYPTION - Electrical, code-based conversion of transmitted data to provide security and/or privacy of data between authorized access points.

- END USER - One who is using a product or service to accomplish his/her own functions. The end user may buy a system from the hardware supplier(s) and do his/her own programming, interfacing, and installation. Alternately, the end user may buy a turnkey system from a systems house or hardware integrator or may buy a service from an in-house department or external vendor.

- ENGINEERING CHANGE NOTICE (ECN) - Product changes to improve the product after it has been released to production.

- ENGINEERING CHANGE ORDER (ECO) The follow-up to ECNs. They include parts and a bill of material to effect the change in hardware.

- EQUIPMENT OPERATORS - Individuals operating computer control consoles and/or peripheral equipment (BLS definition).

- FIELD ENGINEER (FE) - Field engineer, customer engineer, serviceperson, and maintenance person are used interchangeably and refer to the individual who responds to a user's service call to repair a device or system.

- GENERAL-PURPOSE COMPUTER SYSTEM - A computer designed to handle a wide variety of problems; includes machine room peripherals, systems software, and small business systems.

- HARDWARE INTEGRATOR - Develops system interface electronics and controllers for the CPU, sensors, peripherals, and all other ancillary hardware components. The hardware integrator may also develop control system software, in addition to installing the entire system at the end-user site.

- INDEPENDENT SUPPLIERS - Suppliers of machine room peripherals; usually do not supply general-purpose computer systems.

- INFORMATION PROCESSING - Data processing as a whole, including use of business and scientific computers.

- INSTALLED BASE - Cumulative number or value (cost when new) of computers in use.

- KEYPUNCH OPERATORS - Individuals operating keypunch machines (similar in operation to electric typewriters) to transcribe data from source material onto punch cards.

- MACHINE REPAIRERS - Individuals who install and periodically service computer systems.

- MACHINE ROOM PERIPHERALS - Peripheral equipment that is generally located close to the central processing unit.

- MAINFRAME - The central processing unit (CPU or units in a parallel processor) of a computer that interprets and executes computer (software) instructions.

- MEAN TIME TO REPAIR - The mean of the elapsed times from the arrival of the field engineer on the user's site until the device is repaired and returned to the user.

- MEAN TIME TO RESPOND - The mean of elapsed times between when the user calls for service and when the field engineer arrives at the user's location.

- MESSAGE - A communication intended to be read by a person. The quality of the received document does not have to be high, only readable; graphic materials are not included.

- MODEM - A device that encodes information into electronically transmittable form (MOdulator) and restores it to original form (DEModulator).

- NETWORK - Electronic interconnection between a central computer site and remote locations; it may incorporate switching and/or regional data processing nodes.

- NODE - Connection point of three or more independent transmission points, which may provide switching or data collection.

- OFF-LINE - Pertaining to equipment or devices that can function without direct control of the central processing unit.

- ON-LINE - Pertaining to equipment or devices under direct control of the central processing unit.

- OVERSEAS - Not within the geographical limits of the continental United States, Alaska, Hawaii, and U.S. possessions.

- PERIPHERALS - Any unit of input/output equipment in a computer system, exclusive of the central processing unit.

- PROGRAMMERS - Persons mainly involved in designing, writing, and testing of computer software programs.

- PROTOCOLS - Digitally encoded instructions for computer-controlled digital switches in digital (data/text) networks that define treatment and identify sender and receiver.

- SCIENTIFIC COMPUTER SYSTEM - A computer system designed to process structured mathematics, such as Fast Fourier Transforms, and complex, highly redundant information, such as seismic data, sonar data, and radar, with large on-line memories and very high capacity throughput.

- SECURITY - Physical, electrical, and computer (digital) coding procedures to protect the contents of computer files and data transmission from inadvertent or unauthorized disclosure, to meet the requirements of the Privacy Act and national classified information regulations.

- SOFTWARE - Computer programs.

- SUPPLIES - Includes materials associated with the use or operation of computer systems, such as print-out paper, keypunch cards, diskette packs, etc.

- SYSTEMS ANALYST - Individual who analyzes problems to be converted to a programmable form for application to computer systems.

- SYSTEMS HOUSE - Vendor that acquires, assembles, and integrates hardware and software into a total turnkey system to satisfy the data processing requirements of the end user. The vendor may also develop system software products for license to end users. The systems house vendor does not manufacture mainframes.

- SYSTEMS INTEGRATOR - Systems house vendor that develops systems interface electronics, applications software, and controllers for the CPU, peripherals, and ancillary subsystems that may have been provided by a contractor or the government (GFE). This vendor may either supervise or perform the installation and acceptance testing of the completed system.

- TURNKEY SYSTEM - System composed of hardware and software integrated into a total system designed to fulfill the processing requirements of a single application completely.

- VERIFICATION AND VALIDATION - Process for examining and testing applications (and special systems) software to verify that it operates on the target CPU and performs all of the functions specified by the user.

E. OTHER CONSIDERATIONS

- When questions arise as to the proper place to count certain user expenditures, INPUT addresses the questions from the user viewpoint. Expenditures are then categorized according to what the users perceive they are buying.

APPENDIX B: RELATED INPUT REPORTS

APPENDIX B: RELATED INPUT REPORTS

A. ANNUAL REPORTS

	Year
• U.S. Information Services Markets, 1984-1989 Volume I - Industry-Specific Markets	1984

B. INDUSTRY SURVEYS

• Information Services Industry Annual Report	1985
• Eighteenth Annual ADAPSO Survey of the Computer Services Industry	1984
• Sixteenth Annual ADAPSO Survey of the Computer Services Industry	1982
• Directory of Leading U.S. Information Services Vendors	1983

C. MARKET REPORTS

• Federal Systems Integration Market, 1985-1990	1985
• New Generation of Integrated Software	1985
• New Professional Services Opportunities	1985
• Market Analysis: Data Base Management Systems	1985
• Large System Vendor Competitive Analysis	1983
• Management, Technology, and Strategy for Large Systems	1983
• Relational Data Base Management Developments	1983
• Software Productivity Tools: Update and Outlook	1983
• Impact of Upcoming Optical Memory Systems	1983
• New Directions in Operating Systems, Communications, and DBMS	1982

About INPUT

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

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

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

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

Offices

NORTH AMERICA

Headquarters
1943 Landings Drive
Mountain View, CA 94043
(415) 960-3990
Telex 171407

New York
Parsippany Place Corp. Center
Suite 201
959 Route 46 East
Parsippany, NJ 07054
(201) 299-6999
Telex 134630

Washington, D.C.
11820 Parklawn Drive
Suite 201
Rockville, MD 20852
(301) 231-7350

EUROPE

United Kingdom
INPUT
41 Dover Street
London W1X 3RB
England
01-493-9335
Telex 27113

Italy
Nomos Sistema SRL
20127 Milano
Via Soperga 36
Italy
Milan 284-2850
Telex 321137

Sweden
Athena Konsult AB
Box 22232
S-104 22 Stockholm
Sweden
08-542025
Telex 17041

ASIA

Japan
ODS Corporation
Dai-ni Kuyo Bldg.
5-10-2, Minami-Aoyama
Minato-ku,
Tokyo 107
Japan
(03) 400-7090
Telex 26487

INPUT®
Planning Services For Management