Incidental Paper

Users' Needs for Systems Integration and Evaluation of Systems Integrators' Capabilities

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Executive Summary

- In this paper, we seek to build a framework for the following questions. Why is systems integration being required today by user firms? And, in what ways can users evaluate the potential capabilities of systems integrators to help them in developing such systems, especially in the U.S.?

- When we use the term "systems integration," we really are referring to two kinds of systems. One is the integration of business systems, and the other is the integration of information systems. These two types of systems are closely related. The integration of business systems has become a core strategy in some firms' competitive strategies, and the integration of information systems is one of the important supporting substrategies to accomplish that strategy. We point out the importance of strategic information systems, the downsizing of computers, the growth of distributed information processing, the need for improved software and hardware compatibility, and growing requirements for organizational flexibility and response speed as some reasons for the need for integration of information systems.

- Every systems integration project involves a process, consisting of several sequential steps, to ensure effective integration. In this paper, we compare the steps cited by the Yankee Group – Identifying Needs/Specifying Requirements, Planning, Design and Specification, Custom Development, Implementation, and Post-Integration – and TFS – Application Selection and/or Development, Procurement Management, Integration and Test, Documentation, and Training – to illustrate the scope of these processes.

- During systems integration projects, various groups in the firms (the president, management members, project manager, project team, information systems department, end user department) and sometimes outside systems integrators must tackle this task collectively. Each of these stakeholders will have its own interests at heart. A key job of the project manager is, with the support of senior management, to manage effectively the various stakeholders' interests and their interfaces with their own, and other, information systems.

- What criteria should users employ to select a systems integrator? This paper provides a framework to help users determine which type of systems integrators would best suit their needs. We selected three systems integrators, EDS, IBM, and Arthur Andersen – each representing a class of providers – and examined them in terms of our criteria. Users can judge each candidate's level of expertise in the same terms – that is, in each step of systems integration, library of applications, project management skills, source of responsibility, credibility, creativity, and, as this paper discusses at length to exemplify this process, their objectivity.

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CHAPTER ONE

INTRODUCTION

For firms to adapt to rapidly changing business environments, making use of information systems to support business strategies has become increasingly important. For this to be accomplished effectively, some believe that the integration of information systems in firms has become a necessity.

Numerous computer applications have been developed in most firms, but, typically, these applications have been incompatible with one another. Third-party commercial applications purchased by companies also have been, in many cases, incompatible because they originally were intended to be used on different kinds or models of computers with different specifications. Therefore, a new task in many firms today is to make these incompatible applications work together.[1] In other words, "logically integrating their total computing and communications resources into a corporate Integrated Information System (IIS)" is desired by increasing numbers of user organizations.[2]

But, to integrate an information system effectively into an organization, many questions must be answered. First, how should we view the necessity of the integration of information systems from the standpoint of business strategies? Second, how does the progress of information technologies, and the pattern of use of these technologies by specific organizations, affect systems integration? For example, in many areas where computers are used, so-called "downsizing" in the construction of systems has been proceeding rapidly in recent years. How does this relate to systems integration? Also, how does the tendency of making more use of standard hardware and software "platforms" relate to long-term systems integration?

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[1] Arthur D. Little, *Forecast on Information Technology Productivity*, 1991, 5.

[2] Ibid., 1.

Third, when executing systems integration in firms, what organizational problems could occur? Objections and resistance to the execution of systems integration from various departments, or from people with different interests, are likely to arise. How does one get the job done while dealing with such concerns? And who should play the leading role in resolving these matters?

Fourth, when firms find it difficult to complete systems integration by themselves, they may want to make use of systems integrators. Do existing systems integrators have enough capabilities to answer the new demands of users?

The task of integrating information systems in a company as a whole usually is beyond the authority and ability of the information department, so top management should be fully conscious of the importance of this move and should, in fact, lead it. But is top management conscious of the strategic importance of systems integration? Do differences exist in the levels of this consciousness between managers in the U.S. and Japan? And what can we learn by understanding these differences better?

As for the expenditure pattern for information technologies, it has been pointed out that U.S. businesses spend a lot of money on personal computers and workstations (this being a part of the "downsizing" that has been taking place in U.S. companies), as well as on packaged software. In contrast, Japan spends much more on large-scale systems and custom software, and less on packaged software.[3] This difference is perhaps revealed in the way the U.S. and Japan deal with systems integration and user-integrator relationships.

With these questions in mind, we need to start building a framework for answering these further questions. Why is systems integration being

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[3] Cane, Alan, "Soft Market for Hardware," *Financial Times Survey* (October 16, 1990), 1.

required today by user firms? And, in what ways can users evaluate the potential capabilities of systems integrators, especially in the U.S.?

To start the framework-building process, we first define what we mean by systems integration (Chapter 2), and then investigate the sources that proclaim its necessity (Chapter 3), the processes that compose it (Chapter 4), and the organizational roles involved in its execution (Chapter 5).

We then discuss users' requirements for systems integrators in connection with the process of systems integration, and from what viewpoints a user can evaluate the capabilities of prospective systems integrators (Chapter 6).

In Chapter 7, we examine the size of the systems integration market, and evaluate the capabilities of some systems integrators using the evaluation criteria formed in Chapter 6.

CHAPTER TWO

SYSTEMS INTEGRATION DEFINED

"Systems integration" is, in many cases, defined as the integration of information systems from the position of the suppliers. International Data Corporation (IDC), for example, defines systems integration as "a service by which vendors provide a comprehensive information processing solution through a unique combination of professional services and expertise in hardware, software and communications technologies."[4] However, since the requirements for systems integration are dictated by user firms, a definition based on their requirements is more appropriate.

Moreover, the immediate purpose of any systems integration is likely to be the construction of what amounts to a new information system. But since information systems are one of the means by which business systems are supported, systems integration basically should be thought of as a form of integration of business systems.

We use this viewpoint in this paper, and our definition is based on one provided by the Yankee Group: "Systems integration is the *process* of providing information *and* material flow between disparate operations of an industrial organization."[5] This definition clearly is based on business systems that exist in user firms – the "disparate operations of an industrial organization."

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[4] "Vendors Turn to Services to Augment Slowing Hardware Sales, Customer-Support Growth," *Computer Industry Report* 25, no. 23 (July 6, 1990), 4.

[5] The Yankee Group, *Systems Integration*, vol. 1, *The User Initiative/Manufacturing Automation Planning Service*, 1988, 2.

CHAPTER THREE

THE SOURCES OF NECESSITY FOR SYSTEMS INTEGRATION IN USER FIRMS

When we use the term systems integration, we really are referring to two kinds of systems. One is the integration of business systems, and the other is the integration of information systems. These two systems are closely related, as we discuss later in this chapter.

3.1 Integration of Business Systems

When we refer to the integration of business systems, we really are talking about a complex system, an example of which is represented by **Figure 3-1**.

A business system has a structure that consists of subordinate systems such as these: organization, production/marketing, personnel, and finance. The organization subsystem is a core subordinate system that integrates other subordinate systems. And the process of decision making in the organization subordinate system should be investigated.[6] Therefore, our starting point is a business system designed to facilitate making business decisions.

Business decisions can be classified into two categories: strategic and tactical. A *strategic* decision helps the firm adapt to the changes of its external circumstances as a whole. Through this set of decisions, the firm's objectives, and the business strategies to accomplish these objectives, are established. Among the decisions we have to make, a major example involves the problem of establishing the product-mix structure that the firm will produce and market in the future. This is product-market strategy. While the firm is devising and implementing a new product-market strategy, however, it must maintain its competitive advantages in the present product areas. So,

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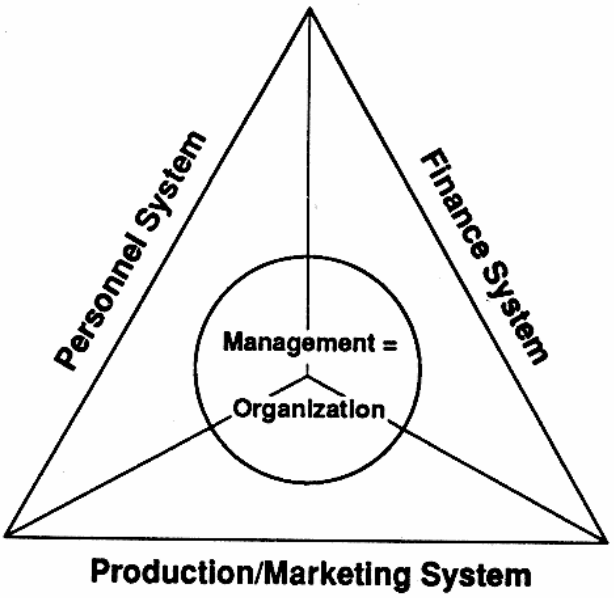
[6] Urabe, Kuniyoshi, *Kieigaku Souron*, Hakutou Shobou, 1973, 88-90.



Source: Kuniyoshi Urabe, *Keiegaku Souron*, Hakutou Shobou, 1973, 89.

Figure 3-1

Structure of Business Systems

the firm also needs a strategy to compete in its current markets. In competitive strategy, efforts are concentrated in those product areas where the firm has, or can develop, a demonstrable market strength. These are core strategies. Resources can be used efficiently by concentrating them on implementing these core strategies. And there are various supporting strategies to assist the core strategies.

In contrast, a *tactical* decision is used to allocate resources efficiently to effect current daily business operations.[7]

In recognition of these two types of business decisions, the Yankee Group classifies systems integration into two categories: strategic and tactical.

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[7] Chandler, A.D., *Strategy and Structure*, 1962, 9-11; Ansoff, H.I., *Corporate Strategy*, 1965, 3-6.

> *Strategic integration* is either a relatively large-scale (i.e., plant-wide) or long-term process (i.e., phased) aimed at increasing a manufacturing firm's competitive position through the meshing of what may not be interrelated business activities.
>
> . . . *Tactical integration*, on the other hand, is any small-scale project that in itself does not change the competitive performance of the company, but nonetheless improves one aspect of the entire operation.[8]

In other words, *strategic* integration is systems integration that is related to the processes of making strategic decisions and establishing the general approach for carrying them out. And *tactical* integration is systems integration intended to support tactical decisions and their implementation. For these types of integration (particularly strategic integration) to be successful, good planning is critical.

> Planning for integration requires a top-level decision based on a long-term assessment of the company's business goals and its environment. The goal of this planning is to determine whether integration or automation is appropriate or if some other form of improvement would be more effective. If so, this planning process should determine which operations have the highest priority to be integrated.[9]

Once the strategic decisions on what to integrate are made, further decisions are required on the details of how this integration will be accomplished and who will perform it.[10] These steps are a form of tactical decisions.

Thus, we can say that the integration of business systems has become a potential core strategy in competitive strategy to attain the company's business goals, because the meshing of what now may not be interrelated business activities can strengthen a firm's competitive

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[8] The Yankee Group, *The User Initiative/Manufacturing Automation Planning Service*, 15.

[9] Ibid., 16.

[10] Ibid., 25.

position. Examples of business activities that could be integrated are those 1) within a subordinate system, 2) between subordinate systems, and 3) between firms.

Once the core strategy is established, tactics concerning how to and who will perform it must be formulated. Two common methods of accomplishing this are to use in-house expertise, or to use systems integrator(s) for some or all of the work.

3.2 Integration of Information Systems

We define "information systems" as systems that support business decisions by the provision of data and information, and of information technologies and analytical tools.

As is the case with business decisions, information systems can be classified into two categories: strategic and tactical. *Strategic* information systems support strategic decisions; they are included as a component of the corporate strategy because they can perform an important competitive support function. *Tactical* information systems support tactical decisions.

In fact, the construction of information systems sometimes is thought to be a means or tool for a firm to attain competitive advantages.[11] And today, information systems generally have become much more important as a key supporting means for accomplishing this objective.

The operation of computer-based information systems originally was confined to information systems departments. But, today, these systems are dispersed among various departments (the end user departments of a firm), with each department using them in a unique manner. As information systems disperse, and end user departments seek to construct their own systems, serious problems can arise. For example, one typical

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[11] Suematsu, Chihiro, *Open Systems Renovation*, Daiyamondo sha, 1990, 30.

problem is the growing difficulty in achieving common use of hardware and software, and of critical corporate data. Integrating information systems throughout the company as a whole, with the goal of increasing common use of hardware, software, and data resources as a means to enhance overall efficiency, can become increasingly necessary.[12]

More broadly, the following reasons illustrate why firms should integrate information systems.

The importance of strategic information systems. Recently, the focus of computer systems development and implementation activity has been shifting from tactical information systems to strategic information systems. Information systems have become much more of a strategic factor for maintaining a firm's competitive advantages.

> [W]ith more and more companies and government agencies proving that information systems can be revenue enhancing or strategic tools – as opposed to cost displacement devices – the pressure to integrate systems to fit daily business practices increases.[13]

We believe that the integration of information systems is one of the supporting strategies to assist the core strategy – the integration of business systems.

Improved software and hardware compatibility. As previously mentioned, integrating information systems throughout a company as a whole can lead to the improved common use of hardware, software, and data resources. The importance of this benefit is being intensified by the pattern of progress in information technologies.

First, the number of connectable devices and connectivity choices is increasing (see **Table 3-1**), as is the frequency with which multiple devices are used in performing individual tasks.

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[12] Ibid., 58.

[13] TFS, Inc., *Systems Integrator Databook,* 1988, 13.

Table 3-1

Pressure for Systems Integration: More Connectivity Choices

Connectivity Choices: 1985	Connectivity Choices: 1991
PC to PC	PC to PC PC to 3270 PC to Workstation LANS Terminal Networks
Electronic Mail	Electronic Mail Packet Message Electronic Data Interchange X.400
SNA	SNA DECNET Multiuser PCs DISOSS/DIA/DCA
Tandem Switching	PBX as LAN Centrex to PBX T1 Mux Control Centrex LAN ISDN Hybrid Networks SDN/VPN
Fax to Fax	Fax to PC Fax to Laser Printer
Data Dictionary	Data Dictionary
Module Patches	Integrated Modules 4GL, SQL AI Subroutines Structured Interfaces
Homegrown Software	More Homegrown Software

Source: TFS, Inc., *Systems Integrator Databook*, 1988, 15.

Second, downsizing may enhance the necessity of systems integration. Many of the applications that were implemented on mainframes have been implemented on workstations, minicomputers, and personal computer networks. By virtue of downsizing, the shift from mainframe-based system construction to workstation-based dispersed system construction

has become possible. However, to assume common use of sharable data and software, a considerable degree of integration is likely to be needed.

Third, the development of open systems has made it easier to enhance overall efficiency through the integration of information systems.[14] With open systems, since standard specifications are made open to the public, users can select hardware freely from vendors.

> The *push for system-level software standards* (UNIX, MAP, SQL) will make the multi-vendor environment somewhat easier for users to manage in the future, lessening the importance of a particular vendor's hardware, proprietary or otherwise.[15]

With open systems, vendors provide systems environments that are easy to interconnect; that is, functions can be dispersed among equipment sets in a network, but each piece of equipment and every resource coexisting in the network can be accessed effectively. Thus, integration is made more practical.

Fourth, integrated applications permit users to access a common core of data when they need it. So, progress in building and using database management systems (DBMS) has also helped to create both the need for and the practicality of systems integration.

> [DBMS] . . . enables users to store, maintain, and generate information in ways that satisfy the needs of different operations, as well as serving as the *actual point of integration* between different organizations.[16]

Growing flexibility and response need. Behind all this lies the need for growing flexibility and response speed on the part of all organizations that must face global competition. The past decade has shown that survival depends on the ease with which disparate departments

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[14] Suematsu, *Open Systems Renovation,* 161-206.

[15] The Yankee Group, *Systems Integration,* vol. 2, *A Market Perspective,* 1988, 59.

[16] The Yankee Group, *The User Initiative/Manufacturing Automation Planning Service,* 6.

can work together, and the speed with which new products can be designed and brought to market. Integrated systems can support all the classes of decisions needed to achieve these organizational attributes.

3.3 Integration of Business Systems As They Relate to Integration of Information Systems

The relationship between the integration of business systems and the integration of information systems is shown in **Figure 3-2**. Most of the items shown have been mentioned previously:

- If management cannot attain its business goals by performing environmental analysis (assessing whether available resources are adequate to attain the business goals), firms must develop competitive strategies, and the integration of business systems should become a core strategy in competitive strategies. Examples of business activities that could be integrated are those 1) within a subordinate system, 2) between subordinate systems, and 3) between firms.

- Once the core strategy is established, tactics concerning how to and who will perform it must be formulated. Two common methods of achieving this are to use in-house expertise, or to use systems integrator(s) for some or all of the work.

- To implement the core strategy, one of the steps may include the integration of information systems. This supporting strategy would then assist the effectiveness of the core strategy.

In all of these systems efforts, the distinction between interfaces and integration is important.

> [T]he Yankee Group believes that there is an important distinction between interfaced *systems* (a numerical controller communicating with a sheet metal cutting machine) and integrated *applications*. Interfaced systems permit limited data sharing by file transfer. By contrast, integrated applications permit users *to access a common core of data as and when they need it*. As a consequence, users should view integration as a way of connecting business disciplines, not simply linking technologies.[17]

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[17] Ibid., 4.

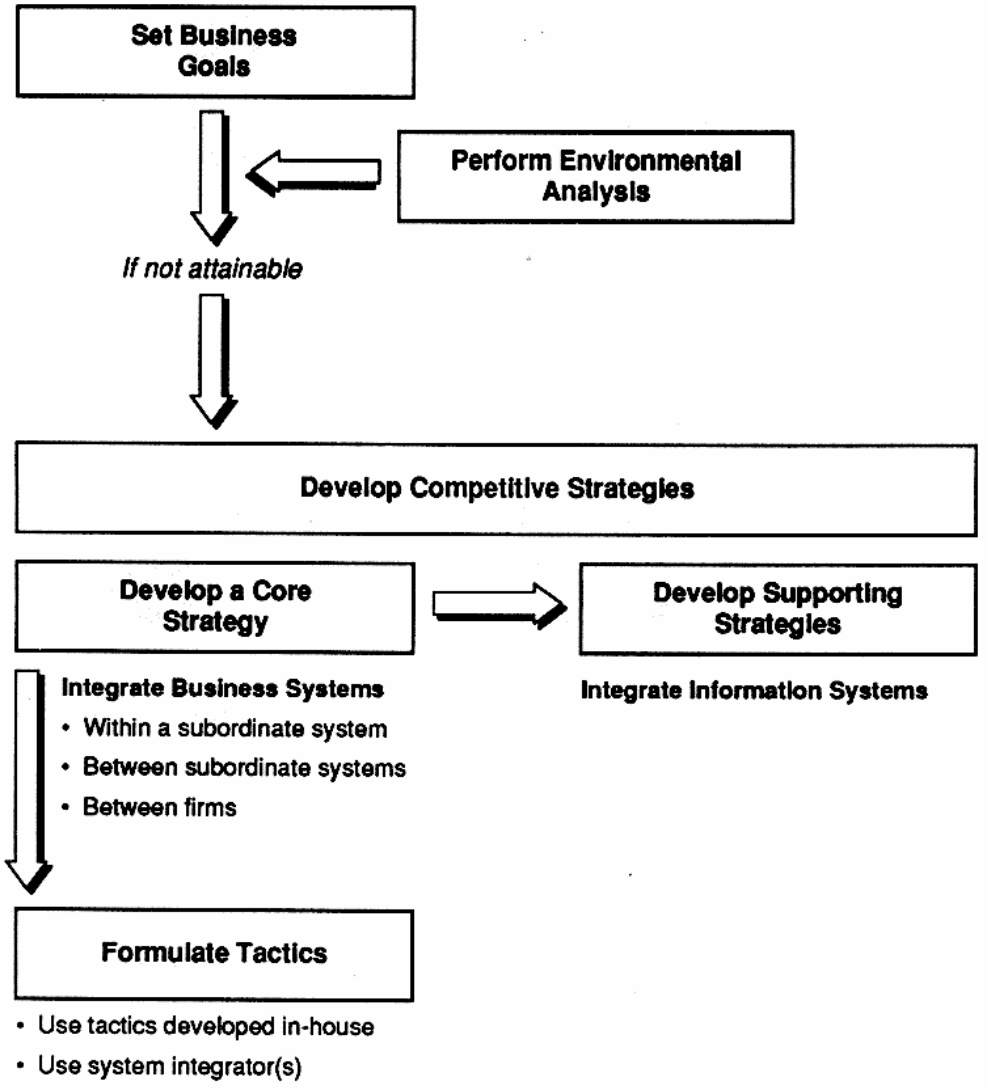

Figure 3-2

Relationship between the Integration of Business Systems and the Integration of Information Systems

Thus, interfaced systems are characteristic of current information systems, while integrated applications are critical to the integration of business systems. Therefore, a key problem could be the gap between existing information systems (largely local interfaced systems) and the integration of business systems (requiring integrated applications). For example, John Gantz points out this problem:

> Much of the talk centered on the gap between what technical integration makes possible and what companies can expect to implement. One of the speakers, Howard Frank, former president of Continental Information Systems and founder of Network Analysis Corp., put it this way: "The dilemma is that integrated systems should be integrated around applications, and that requires organizational integration. But as soon as you try to reach organizational integration, you start to attack vested interests."[18]

Notwithstanding the views expressed above, it is my judgment that the best integrated systems make use of deliberate and carefully designed interfaces. These can operate as buffers, so changes on one side won't cause unforeseeable effects on the other. A tightly integrated system is a monster to change. So, some qualification is desirable.

Also, since business systems and information systems are related to each other, any effective integration plan must deal with the continuum between business functions involved and the technology function that must be employed (**Figure** 3-3). In particular, within this continuum firms must decide, for each zone of the systems integration process, what roles they will keep for themselves, and what areas are appropriate for seeking help from outside.

For example, most information systems managers tend to be unwilling to use outside providers in areas such as strategic planning and needs assessment. One reason for their reluctance is that using commercial integrators might be seen as a sign of internal weakness on the part of the information systems organization.[19] Even firms that use outside providers might want to control the areas of business strategies, while contracting for other aspects of the information systems. The limits of the zones may differ from one project to another.

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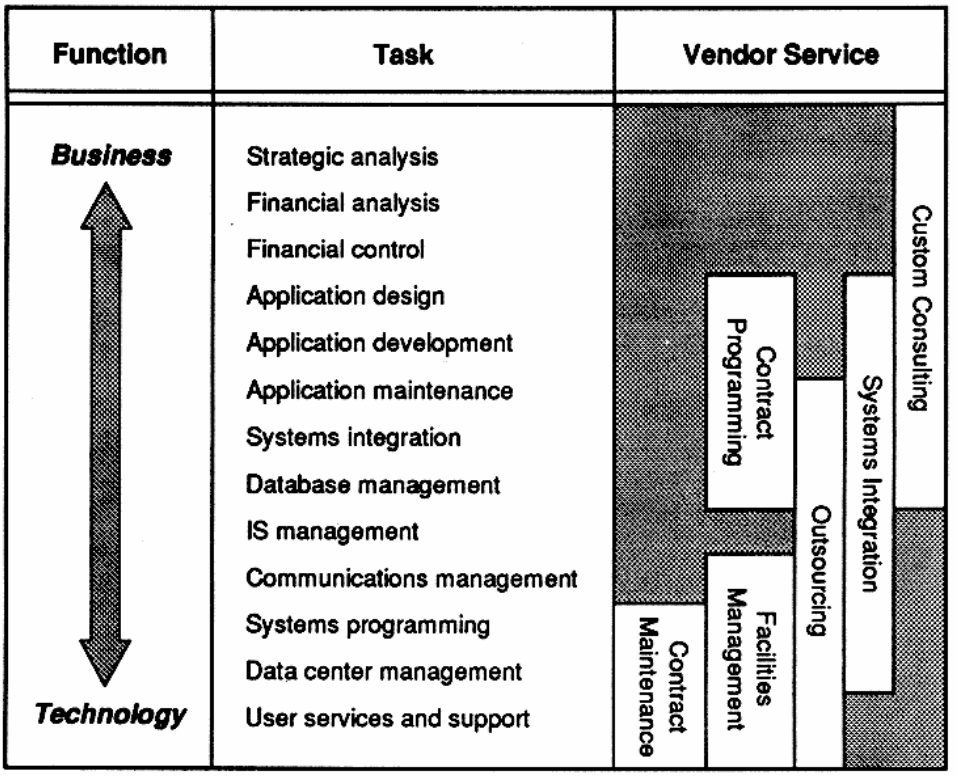
[18] Gantz, John, "Systems Integration: Living in a House of Our Own Making," *White Paper to Management*, 1987, 47, in *Telecommunications Product & Technology*, May 1987.

[19] Zottola, Lory, "Do It Your Way, but Quickly," *Computerworld* (December 24, 1990/January 1, 1991), 23.



Source: International Data Corporation, "The Outsourcing Debate: Effective Management with Multiple MIS Suppliers, or Letting the Fox Guard the Hen House?" *Computer Industry Report* 25, no. 11 (January 30, 1990), 4.

Figure 3-3

Computer Industry Services:
Drawing the Business Strategy/Information Technology Distinction

CHAPTER FOUR

THE PROCESSES OF SYSTEMS INTEGRATION

Every systems integration project involves a process consisting of several sequential steps. In this paper, we compare the processes cited by the Yankee Group and TFS to get a better understanding of what must be covered for effective integration.

To begin, the process cited by the Yankee Group is composed of six steps[20]:

1. Identifying Needs/Specifying Requirements
2. Planning
3. Design and Specification
4. Custom Development
5. Implementation
6. Post-Integration

4.1 Identifying Needs/Specifying Requirements

Users' management must identify the needs and specify the requirements of any project to guide its implementation as well as integrator selection.

4.2 Planning

Planning has two levels: strategic planning and specific project planning. *Strategic* planning is a means by which strategic integration is executed rationally, and systems integration is investigated from an understanding of corporate objectives and competitive strategy. Strategic planning may result in

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[20] The Yankee Group, *The User Initiative/Manufacturing Automation Planning Service*, 17-24.

- A *rethinking* of the corporate strategy;
- A *definition* of short- and long-term objectives;
- *Identification of critical success factors, systems, and technologies* (including high-priority targets for tactical integration); and
- Development of *program and implementation plans* required for the integration project.[21]

4.3 Design and Specification

In this step, the integration design process, and the identification of functional and technical specifications, must be described in detail.

> Functional specifications are the specific tasks, functions, and objectives that the system is being designed to perform. Technical specifications indicate the available technologies capable of meeting those functional specifications,... Technical specifications may also include vendor selection.[22]

4.4 Custom Development

Users must balance the benefits and costs between using "custom" developed solutions versus packaged products with modifications to meet their special needs.

4.5 Implementation

Implementation is the actual production and installation of all components into a working system. Ideally, the entire system and its subsystems should be put together off-site to test against the system's original specifications. Next, the components should be installed and

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[21] Ibid., 21.

[22] Ibid., 23.

started up on-site, connecting this new equipment with existing systems. This step includes training organization members to operate the system.

4.6 Post-Integration

During the post-integration phase of systems integration, users are responsible for three activities: maintenance, upgrade/enhancement, and post-audit assessment.

Steps 1-6 above can be compared to the process of systems integration cited by TFS (see **Figure** 4-1). The scope of systems integration here includes the following steps: application selection and/or development, procurement management, integration and test, documentation, and training. TFS regards systems integration, using this definition, as part of a larger activity. By adding at the front end competitive assessment and requirements analysis steps, they have what they call information management services.

Two factors concerning these two viewpoints deserve mention. First, TFS's steps in **Figure** 4-1 are very similar to the Yankee Group's steps after Design and Specification. Second, in spite of these differences, Identification of Needs/Specifying Requirements and Planning are recognized as needed activities in any systems integration.

We now can put these processes side by side (see **Table** 4-1). In general, we favor the Yankee Group's viewpoint because it is far more complete than that of TFS, and it places emphasis on vital elements that are too easily ignored:

> The integration process is more than simply linking technology. The Yankee Group has observed that every project, no matter how small, must be part of a larger strategic plan that meets the needs of the business.[23]

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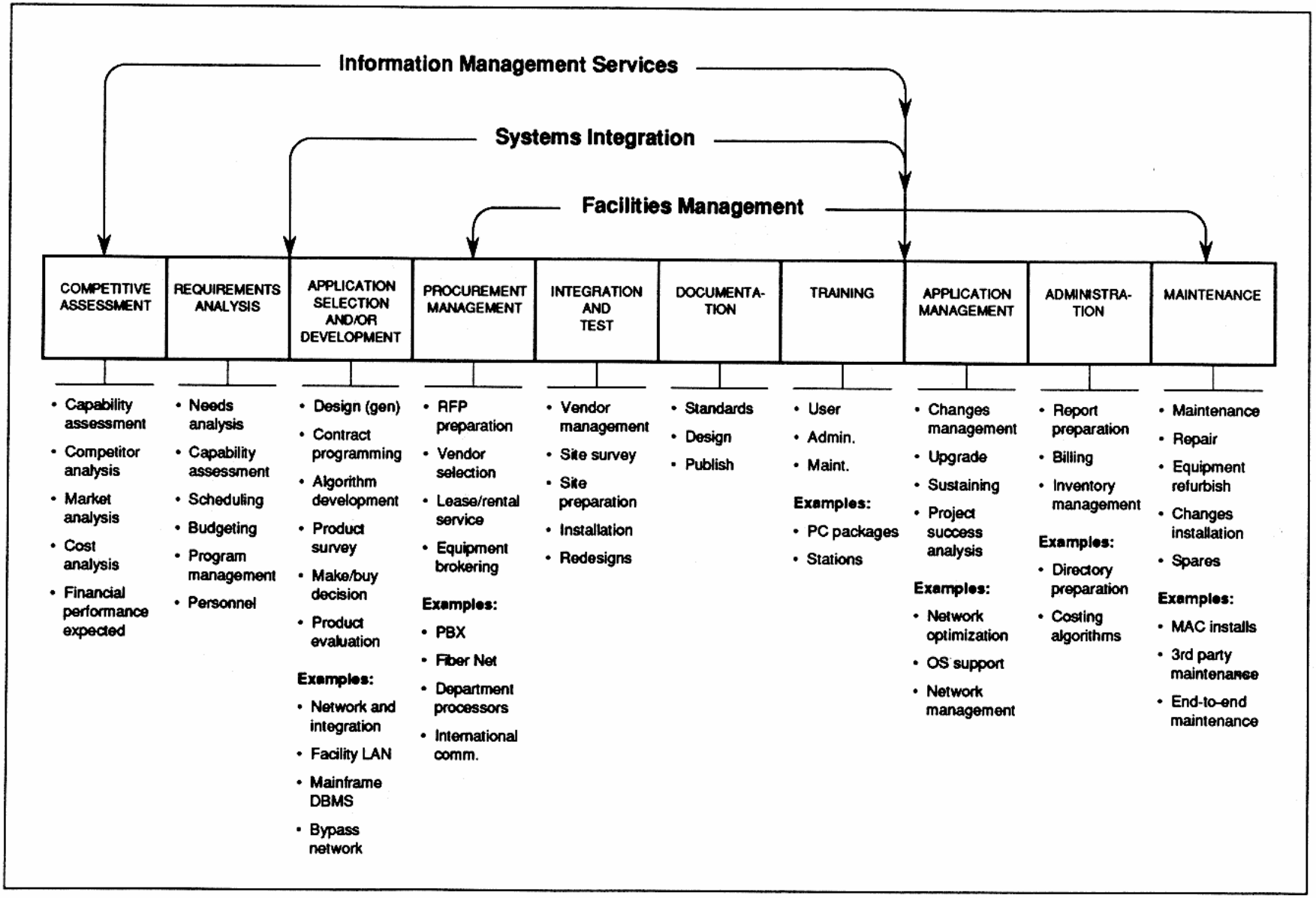
[23] The Yankee Group, *The User Initiative/Manufacturing Automation Planning Service*, ii.



Source: TFS, Inc., *Systems Integrator Databook*, 1988, 8.

Figure 4-1

Functional Integration: Level Two View

Table 4-1

Systems Integration: A Comparison of the Yankee Group and TFS

Steps of Systems Integration	Yankee Group	TFS
Identification of needs/specification of requirements	✓	
Planning ▪ Strategic integration planning ▪ Specific project planning	✓	
Design and Specification ▪ System design ▪ Functional specification ▪ Technical specification	✓	✓
Custom Development ▪ Procurement management ▪ Hardware ▪ Software	✓	✓
Implementation ▪ Assembly/test ▪ Debug ▪ Installation/start-up ▪ Training	✓	✓
Documentation		✓
Post-Integration ▪ Support ▪ Maintenance ▪ Upgrade/enhancement ▪ Post-audit	✓	

Thus, the project manager should be very familiar with business objectives and strategies. And project teams must have time to focus on

the business objectives underlying the specifications and the business strategies motivating the systems development.[24]

[24] Goldstein, Michael, and John Hagel, "Systems Discontinuity: Roadblock to Strategic Change," *Datamation* (October 15, 1988), 36.

CHAPTER FIVE

ORGANIZATIONAL ROLES DURING SYSTEMS INTEGRATION

In Chapter 4 we examined the general process of systems integration. Next, we must ask, *Who* executes systems integration projects in a firm?

Let's consider, for example, the case of Mr. Suemoto, president of Advanced Consulting Network in Tokyo, who proposes the following steps for what he terms a "renovation." In this sense, renovation means a way to resolve the various problems of having dispersed information systems in a company. Since renovation of this type has the same goals as systems integration, we'll refer to it for examples of the needed organizational roles.[25]

Ideally, the first step in a renovation is carried out by the Chief Information Officer (CIO), who, as a proposer and a promoter, prepares a blueprint of the renovation, presents it to the firm's president, and enlists overall cooperation from him. (We believe that the CIO should be a member of senior management, who participates in the strategic decision-making process, and also supervises the information department.)

In the second step, the CIO should help other members of senior management to understand the importance of renovation because, for the successful execution of the renovation, participation by all departments of the company is needed. It is also necessary to educate members of the information system department and information resources management center because they also will become promoters of renovation and assistants to the CIO.

The third step is the reformation of the consciousness (that is, the attitudes) in various end user departments, the improvement of their information handling ability, and the construction, modification and/or extension of their information systems. The work on these systems might

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[25] Suematsu, *Open Systems Renovation*, 126-33.

be done by the information systems department, but the renovation process calls for the cooperation of all members of the various end user departments; these departments have the best understanding of the strengths and weaknesses of the company, and of their customers' needs.

Finally, the use of outside resources, including systems integrators, should be investigated. Reviewing these steps, we can note that certain organizational roles should be observed when implementing systems integration.

First, one person is needed to be responsible for the entire process of systems integration. In the case of implementing a renovation, this should be performed by the CIO, but here we will call him the project manager, or project champion.

> An in-house manufacturing expert is essential, not only to leverage the company's superior understanding of its own process, but also to compensate for the technical disparity between users and third parties that often impedes project progress. After being officially empowered, the champion becomes the single point of responsibility within the company for the project. The champion must be able to translate the user's objectives into clear specifications for vendors and integrators.[26]

Second, the systems integration project must be supported actively by the firm's president. Also, every member of management should understand the goals and the significance of the planned systems integration.

Third, a project team that implements systems integration concretely must be organized. The purpose of this team is to decide how the integration will be accomplished and, under the supervision of project manager, select any systems integrators that will be employed.

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[26] The Yankee Group, *The User Initiative/Manufacturing Automation Planning Service*, 53.

> The team should perform the research, planning, and selection of integration partners, as well as maintain communication among top management, manufacturing operations, and third parties.[27]

The project team should be organized to include members from the information systems department as well as members of end user departments of the company.

Finally, if the company tries to complete systems integration by itself, but finds this task difficult or uneconomical to complete the systems integration itself, it should be prepared to make use of systems integrators. **Figure 5-1** illustrates the organizational roles described above.

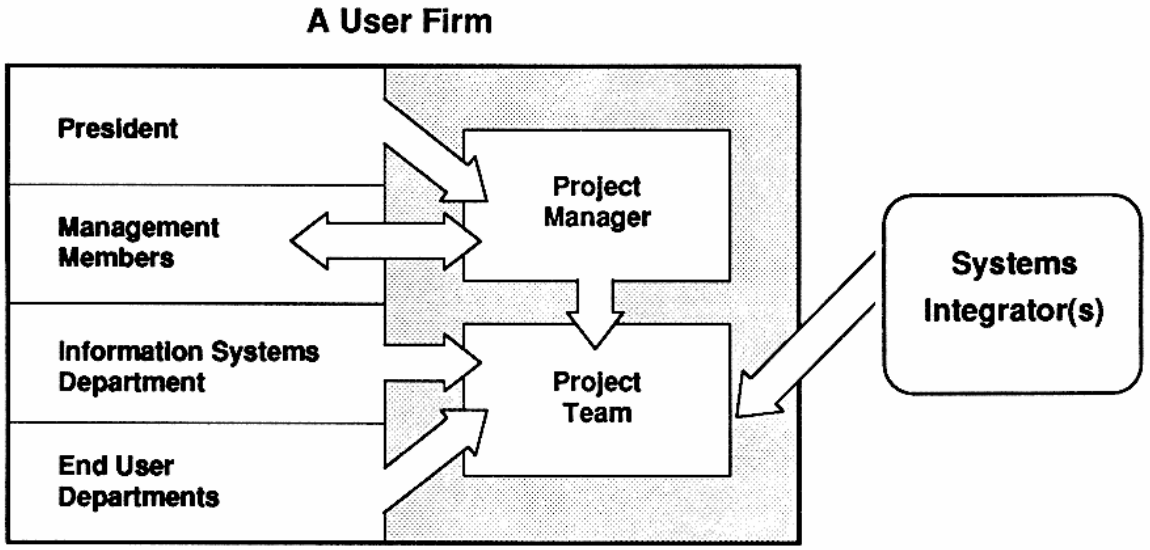

Figure 5-1

Organizational Roles during Systems Integration

Every project for systems integration should be based on business strategies to accomplish business goals. So, some stakeholders who

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[27] Ibid.

center on business strategies must be involved with the project team. This means that many viewpoints would be involved: viewpoints of the president, management members, project manager, project team, information systems department, end user departments, and outside systems integrators. Each stakeholder has its own views and stakes in the outcome of SI, and the likelihood of conflict should be anticipated. A key job of the project manager, therefore, is the management of these stakeholders. These groups might attempt to insist on complete sectionalism (maintaining their own subsystem) in order to conceal information. When information systems are integrated under such circumstances, the integrated information system runs the risk of being useless for adequate decision making.

CHAPTER SIX

USERS' NEEDS FOR SYSTEMS INTEGRATORS AND EVALUATION CRITERIA OF SYSTEMS INTEGRATORS' CAPABILITIES

6.1 Users' Needs for Systems Integrators

To successfully integrate the information systems of a company, a variety of needs must be met, each of which may require a different type of external resource.

If a firm runs well but cannot develop all the programs needed, it does not require systems integrators; rather, the firm simply needs to enlist the services of a software house. If the firm requires help to select hardware, it could enlist the services of a hardware consultant. Systems integrators are required only when the user has extensive needs across the spectrum of required functions. What kinds of needs, then, are these?

As we noted in Chapter 5, a company normally makes use of systems integrators when it finds it difficult or uneconomical to complete the systems integration itself. Often, but not always, the main reason behind this roadblock is that the company wants to obtain some special expertise for specific aspects of systems integration.[28] If so, what kinds of expertise are required? We will investigate this problem from

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[28] The Yankee Group cites three groups of factors that affect how users will determine how much use they would make of a systems integrator. This decision is thought to be a tactical decision. The Yankee Group, *The User Initiative/Manufacturing Automation Planning Service*, 29-34.

1. User Characteristics: Availability of expertise, availability of personnel, organizational factors

2. Key Project Aspects: Project size, technological complexity, available time, cost, risk

3. Integrator Characteristics: Objectivity, single source of responsibility, creativity, a library of applications, credibility

the point of view of the systems integration processes that we discussed in Chapter 4.

Having examined each step of the processes in Chapter 4, we determined that to successfully implement systems integration in an organization, the following expertise would be required:

- Step 1, Identifying Needs/Specifying Requirements: The ability to analyze the situation and to propose a general approach
- Step 2, Planning: Strategic planning ability and an understanding of current tactical activities. (As we discussed in Chapter 4, step 2 will comprise both strategic planning and specific project planning. As mentioned previously, in the strategic planning stage, systems integration is investigated as a means to help achieve corporate objectives and competitive strategy. The competitive strategy includes improving capability to maintain and strengthen competitive advantages in the present product areas)
- Step 3, Design and Specification: Systems design ability (in recent years, network design ability has become important because of the growing importance of network and communications architectures and products in the area of systems integration)
- Step 4, Custom Development: Knowledge of existing available applications software, and systems development to use, modify, or substitute such software as needed
- Step 5, Implementation: System construction ability
- Step 6, Post-Integration: System utilization and maintenance ability.

User firms normally identify those areas where the company has a lack of adequate expertise. But in systems integration, even if the suitable expertise is provided for each step, this may not be sufficient. The whole process must be completed within a single, unified methodology; without this unity, information systems cannot be integrated throughout a company. Therefore, the project manager must coordinate the project from beginning to end. The ability of this manager is, thus, a major factor that determines the completion of the project, within a set budget and schedule, through effective coordination of the various expertise and manpower being employed. Therefore, it is desirable that systems integration be executed in one control line. When systems

integrators are employed, the problem that commonly arises is this: *Who* has this responsibility? The power relationship between the user and the systems integrator may depend on who holds the authority of project management, and how well and strongly it is exercised.

> One way to manage the relationship is to have the user take on project management responsibilities. The user then assumes the role of a prime contractor, rather than delegating this responsibility to a systems house.[29]

But there are some cases where systems integrators have the key responsibilities.

6.2 Users' Evaluation Criteria of Systems Integrators' Capabilities

When a user has extensive requirements of the type mentioned above, from what viewpoints does a user evaluate the capabilities of systems integrators? We consider this point next.

We begin by examining some evaluation criteria developed by combining TFS's "critical success factors"[30] and Yankee Group's "characteristics of the integrator." Does the integrator

- Have the expertise required for each of the six steps of the systems integration process?
- Have a strong library of applications?[31]
- Have adequate project management expertise? Does his record show a history of completing projects within a set budget and schedule?
- Offer a single source of responsibility? Is he prepared to act as the prime contractor for us?[32]

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[29] Ibid., 25.

[30] TFS, *Systems Integrator Databook*, 25-26.

[31] The Yankee Group, *The User Initiative/Manufacturing Automation Planning Service*, 34.

[32] Ibid., 33.

- Possess objectivity? Would he develop a solution determined not by a particular equipment or software vendor's offerings, but by the user's problem?[33]

- Have credibility? Does he have a good record of project experiences?[34]

- Possess creativity? Does he have the ability to propose and generate innovative solutions to users' increasingly complex problems?[35]

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[33] Ibid.

[34] Ibid., 34.

[35] Ibid., 33.

CHAPTER SEVEN

SYSTEMS INTEGRATION MARKET AND EVALUATION OF SYSTEMS INTEGRATORS' CAPABILITIES

To meet the users' needs for systems integration, as described in Chapter 6, systems integrators are competing with each other.

> Today, one of the main value-added features that a systems integrator provides is the ability to develop a solution connecting multiple technologies, applications and data structures.[36]

In this chapter, we discuss two issues. First, how large is the systems integration market? And second, what kinds of competitors are serving as systems integrators, and how can they be evaluated by users?

7.1 Systems Integration Market

The systems integration market is a subset of computer professional services,[37] which is positioned in information services.[38]

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[36] Litell, Norman G., and Richard Munn, "Service Providers Expand Their Horizons," *Datamation* (June 15, 1990), 196.

[37] TFS also regards systems integration in the commercial sector as a market that is "a subset of a much larger market for professional services." TFS estimates the professional services market by function: software development (50%); consulting (20%); education training (20%); facilities management, client owned, (5%); integration program management (5%). TFS, *Systems Integrator Databook*, 44.

[38] According to the standard industrial classification (SIC), information services include the following services:

data processing services
- SIC 7374 computer processing and data preparation and processing services
- SIC 7376 computer facilities management services

computer professional services
- SIC 7371 computer programming services
- SIC 7373 computer integrated systems design
- SIC 7379 computer related services,n.e.c.
- SIC 8243 data processing schools

electronic information services and videotex
- SIC 7375 information retrieval services

In functional terms, computer professional services companies offer the following services:

- Contract programming and design services
- Consulting (providing advice on problems such as the design and selection of computers and peripherals systems, computer and telecommunications interfaces and linkages, and systems and network management)
- Education and training in the use of computer systems, software, and combined computer and telecommunications networks.[39]

Such services are among those required for each step of the systems integration process.

Further, in marketing terms, most computer professional services companies seek to provide "solutions to business problems."[40] This, obviously, is what users really require in their systems integration projects.

For an estimate by TFS of the market size of systems integration in 1987 and 1988, see **Table 7-1**.

Table 7-2 classifies into several groups those firms that offer systems integration; it also shows the market share of each firm included in each group. From the market share point of view, EDS and IBM are the big systems integrators.

7.2 Evaluation of Systems Integrators' Capabilities

There are several competing groups of systems integrators, each with a different background:

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[39] U.S. Department of Commerce, Information Services, *1990 U.S. Industrial Outlook*, January 1990, 29-4.

[40] Ibid.

Table 7-1

Market Size of Systems Integration in the United States

	1987 ($ Billion)	1988 ($ Billion)
Government	$2.3	$2.8
Commercial	$1.3	$1.5
Total	$3.6	$4.3

Source: TFS, Inc., *Systems Integrator Databook*, 1988, 17.

A. Software/Services Firms[41]
   A-1. The Industrial Giants
   A-2. Independent Systems Houses
   A-3. Industrial Control Vendors

B. Communications Vendors

C. Computer Vendors

D. Big Eight (Consulting Firms)

Let us choose EDS (group A), IBM (group C), and Arthur Andersen (group D) as examples. These are the biggest firms in their groups (see **Table 7-2**). Using the evaluation criteria formed in Chapter 6, we illustrate how the Yankee Group and TFS evaluate them (see **Table 7-3**).

In **Table 7-3**, we illustrate the claim by both the Yankee Group and TFS that a problem exists with IBM's objectivity:

> IBM's immediate integration challenge continues to be resolving the issue of multiple operating systems.[42]

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[41] A-1, A-2, and A-3 are competitor groups defined by the Yankee Group. They might be included under TFS's Software/Services Firms. The Yankee Group, *A Market Perspective*, Chapters 2-6.

[42] The Yankee Group, *A Market Perspective*, 77.

Table 7-2

Worldwide Systems Integration Market Shares
($ millions)

Company	1987 Government ($ Million)	1987 Commercial ($ Million)	1987 Total ($ Million)	1988 Total ($ Million)	Confidence Level*
SOFTWARE/SERVICES					
EDS	500	640	1140	1400	1
Martin Marietta	140	10	150	175	1
CSC	130	10	140	165	1
McDonnell Douglas	100	60	160	170	1
SHL Systemhouse Inc.	70	65	135	160	1
Boeing	75	—	75	90	2
Computer Task Group	—	60	60	70	2
Emhart	50	10	60	70	2
TRW	50	—	50	60	3
Fed Data	40	—	40	45	3
General Electric	20	10	30	35	3
Hughes	20	—	20	25	3
Grumman	20	—	20	25	2
Tisoft	20	—	20	30	1
COMMUNICATIONS					
US West (ACI)	—	10	10	15	2
Bell Atlantic	—	5	5	10	2
NYNEX (BIS)	—	5	5	10	3
Ameritech	—	0	0	10	2
Pacific Telesis	—	0	0	0	3
BellSouth	—	0	0	5	3
AT&T	40	10	50	75	3
Contel	10	10	20	20	3
GTE	10	—	10	15	3
HARDWARE					
IBM	625	225	850	980	1
CDC	70	70	140	150	3
Unisys/SDC	100	—	100	115	3
DEC	30	10	40	75	2
BIG EIGHT					
Arthur Andersen	50	—	50	55	2
Touche Ross	10	—	10	10	2
Peat, Marwick and Main	10	—	10	10	2
Cooper & Lybrand	10	—	10	10	2
Arthur Young	10	—	10	15	2
Deloitte Haskins & Sells	5	—	5	5	2
Ernst & Whinney	5	—	5	5	2
Price Waterhouse	5	—	5	5	2
OTHERS	100	100	200	230	2
TOTAL	2325	1310	3635	4345	

*Level of confidence in revenue estimates: 1 = high level; 2 = moderate level; 3 = low level

Source: TFS, Inc., *Systems Integrator Databook*, 1988, 20.

System Integrators' Capabilities*	Arthur Andersen	
	The YaGroup*	TFS**
Level of expertise in each step of systems integration	Strong in everparticularly • Planning: T approach to imurers in services (50) integration • Design and Shows considecify systems designts for specification (101) • Software Dotation (101) skilled in supe software deve • Networking wide-area net integration wi suppliers (52)	Particularly strong in planning and analysis (6)
Library of applications	Has develope of applications • Can access applications d in-house (51) • Works with but potentially applications s industrial mar	Has developed an extensive library of applications • Is strong in applications development (1)
Project management expertise		Good (2)
Source of responsibility	sponsibility prime	
Objectivity	oblem r	Objectivity is not a problem • Is not tied to any one hardware supplier (7)
Credibility		Credibility is good • Maintains a very strong position in manufacturing (7)

*Creativity, another important capability (discu

Sources for page numbers: *The Yankee Gro Harvard College. Program on Information Resources Policy.
**TFS, Inc., *System*

> Users must gauge how committed IBM is beyond the word of their IBM marketing rep, to supporting standards (UNIX, MAP) and multi-vendor environments on the factory floor and in design. SAA, while helping one IBM box talk to another, will not provide connectivity to other vendors' products.[43]

> The only substantial obstacle to an even greater IBM presence in SI is one facing every hardware vendor: a perceived lack of independence. Users have been trained over the years to believe that all IBM's actions are motivated by one guiding principle; push iron, the more the better.[44]

It might be said that U.S. business management is usually suspicious if computer vendors – as systems integrators – sell hardware to customers rather than to solve their hardware and software needs. This situation has also been seen in Japanese business management.

In Japan, the cases for customers to contract not with computer makers but with independent systems integration vendors (including information service firms, software houses, and consulting firms) recently have increased gradually for these reasons:

- Customers want to select neutral independent SI vendors to help them establish a multivendor environment (hardware vendors have not been eager to help their customers provide such an environment)
- Independent SI vendors sometimes are superior to hardware vendors in their knowledge of operating businesses.[45]

Therefore, we believe that downsizing in the construction of computer systems and the development of open systems could put SI vendors in a stronger position than computer vendors, both in the U.S. and Japan.

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[43] Ibid., 78.

[44] TFS, Inc., *Systems Integrator Databook*, 14.

[45] Tanaka, Katsumi, "Predominant Systems Integration Vendors Competing with Mainframe Manufacturers," *Nikkei Computer* (May 20, 1991), 76–92.

CHAPTER EIGHT

CONCLUSION

The integration of business systems has become a core strategy in firms' competitive strategies, and the integration of information systems is one of the important supporting strategies to accomplish that core strategy.

The progress of information technologies (for example, downsizing and the development of open systems) has helped to accelerate the compatibility of software and hardware.

During systems integration projects, various groups in the firms must tackle this task collectively. Each has its own interests at heart. While systems integration is being implemented in a firm, a key job of the project manager is to manage these stakeholders.

What systems integrators can meet the users' needs for systems integration? This paper provides a framework to help users determine which type of systems integrator would best suit their needs. In Table 7-3, we took previous evaluations by the Yankee Group and TFS of three systems integrators – EDS, IBM, and Arthur Andersen – and placed them in each of our categories. Users can judge their level of expertise in each step of systems integration, library of applications, project management skills, source of responsibility, credibility, and, as this paper discusses at length to exemplify this process, their objectivity.

As for the differences between the U.S. and Japan in dealing with systems integration and user-integrator relationships, certain observations can be made.

In American companies, the necessity for systems integration seems to be high. Because personnel turnover rates are high and career paths are highly specialized, workers typically do not hold common values, tasks, and information. Therefore, management must standardize the workers' tasks and introduce various packaged software or third-party commercial

applications as much as possible. But since such software and applications could be incompatible, management must ensure they work together.

In Japanese companies, however, workers experience various jobs in a lifetime employment system and are promoted slowly, so they hold common values, tasks, and information. These factors may help explain why the occurrence of systems integration in Japanese companies is less than that in American companies. Also, Japanese companies tend to develop important technologies in-house, rather than buy packaged software. But, lately, as the business environment becomes increasingly uncertain, and information for adequate decision making and information-related professional knowledge is in greater demand, Japanese companies are beginning to rely on outside vendors more.