The Business Case for Connectivity

Rudy Hirschheim, *University of Houston*

Abstract

Information systems that provide competitive advantages to organizations can be broadly classified into those that improve the effectiveness of a business function and those that improve the reach of information in the organization. The latter, organizational connectivity systems, can be categorized as intra-organizational and interorganizational systems. Intraorganizational systems provide connectivity to functional areas within the business, while interorganizational systems support the exchange of business data between independent business units. These systems are not confined to a single entity but span organizational boundaries which can be national or international in scope.

A series of case studies was undertaken in an effort to better understand the issues and problems associated with providing an increased flow of information within and outside of an organization. Ten issues emerged from this study. In summary, it is necessary for firms to first consider how effective their internal communications systems are before launching projects that tie the organization to external systems.

The Business Case for Connectivity

by

Dennis Adams

Rudy Hirschheim*

Information Systems Research Center
University of Houston
College of Business Administration
Houston, Texas 77204-6282

(713) 749-6763

October 1990

*To whom all correspondence should be directed. This research was supported by the University of Houston's Information Systems Research Center.

The Business Case for Connectivity

Abstract

Information systems that provide competitive advantages to organizations can be broadly classified into those that improve the effectiveness of a business function and those that improve the reach of information in the organization. The latter, organizational connectivity systems can be categorized as intraorganizational and interorganizational systems. Intraorganizational systems provide connectivity to functional areas within the business, while interorganizational systems support the exchange of business data between independent business units. These systems are not confined to a single entity but span organizational boundaries which can be national or international in scope.

A series of case studies was undertaken in an effort to better understand the issues and problems associated with providing an increased flow of information within and outside of an organization. Ten issues emerged from this study. In summary, it is necessary for firms to first consider how effective their internal communications systems are before launching projects that tie the organization to external systems.

THE BUSINESS CASE FOR CONNECTIVITY

Dennis Adams Rudy Hirschheim

Information Systems Research Center
College of Business Administration
University of Houston

INTRODUCTION

Information systems that provide competitive advantages can be broadly classified into those that improve the effectiveness of a business function and those that improve the reach of information in the organization. Examples of the former include American Express' credit authorization system, Authorizer's Assistant, and United Services Automobile Association's call distribution and document imaging system embodied in their Vision 2000 plan. The advantage gained through these applications is a result of automating (or simply codifying) human expertise. Advantages of this type are most difficult for a competitor to neutralize if this expertise is rare.

The well known examples of the latter include General Motor's EDI system, American Hospital Supply's ASAP system and American Airlines' SABRE reservation system. These competitive applications often have one thing in common: they are interorganizational systems that involve linking one or more companies together. This connectivity is a difficult issue because the mere interconnection of communication systems can be costly and inherently provides no advantage to anyone. In

addition, advantages gained by the interconnection of systems can be easily copied if there are no economies of scale advantages attained by early adopters. One may well ask whether these connectivity applications are worth the effort.

The purpose of this paper is to discuss the business case for connectivity. Because so many of the successful uses of information systems for competitive advantage incorporate communication systems, it is worthwhile to understand the capabilities, issues and prospects associated with this strategy.

CONNECTIVITY

Connectivity can be defined as the effective joining of two systems for the purpose of resource sharing. This definition can be interpreted in several ways. For example, to the user, a successful connectivity application would be one where the user does not know or care where the data is stored, where it is processed or how it is transported. To the application programmer, connectivity might be implemented by the use of standard compilers or common network interfaces or data formats. The systems programmer is concerned with the transportability of operating systems while the data communications specialist worries about the compatibilities of various network protocols. To the manager, connectivity implies multiple platform access to corporate information resources and confidence that future software and equipment purchases will disrupt organizational

information processing as little as possible--that functionality drives purchase rather than the reverse.

As can be seen, the operationalization of connectivity encompasses many aspects of information systems. In addition, connectivity is a matter of degree. All systems are "connectable"; the purchaser must decide whether the connection is worth the expense and the designer must ascertain whether the effort is worth the connection. Some elements of the information systems architecture have higher connectivity "payoffs" than others. For example, selecting a common network protocol (say, X.25) may be easier than writing software to convert machine instructions from different architectures. On the other hand, if a network protocol is already in place, developing multiarchitecture applications using a common user interface may be more appealing.

Connectivity can be accomplished from various points of view. More specifically, connectivity can be thought of as a function of operating systems and system environments, connectivity applications such as file transfer methods, user interfaces, programming languages, network protocols, data formats and physical connections. These various connectivity strategies have evolved through five phases. First, telephone and telegraph systems provided organizational connectivity that forever changed the way business was conducted and the relationships between workers, consumers and producers. The second phase, circa 1965, focused on providing connections

between similar, typically mainframe, systems within a single organization. Next, as firms began acquiring more information processing equipment, attention turned to connecting dissimilar, yet centrally located systems, still within a single organization. As the price of computing hardware began to fall in the late 1970s, providing connections between distributed, possibly heterogeneous systems was needed. Proprietary and nonproprietary connectivity solutions began appearing and users became more aware of the need for improved, serviceable access to data. The explosive growth of the personal workstation in the early 1980s exacerbated the problem. For many organizations, this represents their state of connectivity. However, the interorganizational sharing of data is a phase of connectivity that will dramatically change the way in which organizations collect and process data. Electronic Funds Transfer (EFT) and Electronic Data Interchange (EDI) are important examples of interorganizational information sharing. The fifth phase of connectivity solutions can be termed "Information Logistics".

Information logistics is more a concept than a product. The basic tenet is that of information delivery--to deliver the right information in the right format to the right decision maker at the right time. Conversely, the decision maker need not know where the data is stored, how it is transmitted, how to format it for use, or how much effort it will take to acquire it. The focus of information logistics is not how to delivery the data, but how to <u>best</u> deliver the data. Traditional data

communications systems simply provide a conduit between the user and the application. This view is much too narrow to effectively incorporate interorganizational systems into the information systems portfolio because the very interaction has been elevated to a competitive level that requires more than moving data from one place to another. In fact, each data element stored in an organization's information systems, from the viewpoint of information logistics, would be associated with the set of potential users (as opposed to uses) of that information and would be managed accordingly. There is no limitation concerning who these users are or where they will be when they use the data or even to what purpose the data will be put.

As organizations move toward the information logistics phase, connectivity solutions will become more complicated as they become more important. Of course, the issue of connectivity has been a problem confronting organizations for decades, and is clearly not confined to interorganizational systems. Organizations have been struggling to get various pieces of hardware and software to talk to one another since computers were first introduced. The problem is just exacerbated when the linkage has to extend across organizational boundaries. But the rewards of successful connectivity are legendary.

CONNECTIVITY TYPES

Organizational connectivity systems can be broadly categorized as intraorganizational and interorganizational

systems. Intraorganizational systems provide connectivity to functional areas within the business. These applications can provide new, cross-functional information to decision makers. From electronic mail to document imaging systems, the increased flow of information increases management's awareness of organizational activity.

Interorganizational systems support the exchange of business data between independent business units. These systems are not confined to a single entity but span organizational boundaries which can be national or international in scope. These boundaries can be arbitrary. In a conglomerate, systems that span the organizational chart can be thought of as interorganizational even though they reside within a single parent company. The popular corporate sponsored credit card is an example of interorganizational systems that span industries. For example, earning American Airlines frequent flyer mileage by using a Citibank credit card.

Interestingly, when an interorganizational system is implemented, it is in reality a cross-functional system (or a set of systems) that spans organizational boundaries. Consequently, the distinction between intraorganizational and interorganizational systems is not as clear as it might be, because as cross-functional systems that span organizational boundaries become more common, it may not be at all clear which part of the system (or what portion of the data) is internal or external. In addition, some intraorganization, cross-functional

systems are international. Texas Instruments is an example. The design of a computer chip can be produced in Japan and electronically shipped to Lubbock, Texas where the components are manufactured. This product is shipped to Malaysia for testing and integration. The status of the design, manufacture, shipping, testing and customer delivery are maintained in a database accessible throughout the organization. It is expected that as more TI customers and suppliers build EDI systems, the EDI transactions will also be reflected in this enormous cross functional system.

CASE STUDIES

Because of the desire to understand more about the issue of connectivity, the University of Houston's Information Systems Research Center sponsored a series of case studies to support ongoing research in the area of organizational connectivity. Eight large firms with operations scattered around the globe agreed to participate. In each case, managers familiar with the strategy and operation of the information and communications systems were interviewed in an attempt to understand the hardware, software and organizational systems involved in the intraorganizational and interorganizational systems. The findings of this investigation were compared with the experiences of a number of well known connectivity solutions such as American Hospital Supply's ASAP and Xerox's integrated manufacturing and office systems.

Of course, numerous other examples exist where the use of telecommunications was critical for the development of strategic systems, but what is often glossed over in such descriptions, is the substantial technical problems associated with connecting the disparate technologies together. The linking of such widely different technologies as personal computers, telephones, and phototypesetters, has proven to be difficult, but not impossible. While the costs associated with connectivity are generally high, the benefits can be quite astonishing. Those organizations who are successful in connecting the myriad of information technologies together and using them in meaningful applications, stand a good chance of obtaining (and retaining) a competitive edge. Therefore, it becomes clear that the business case for connectivity is "doing business better". Whether that means in a less costly fashion, doing it differently and distinguishing oneself, or distributing better information throughout the organization and giving employees and management a chance to do their jobs better, the bottom line is connectivity makes good business sense.

Connectivity is a broad issue. It has proven to be a complex issue: one which virtually every organization has to come to grips with, yet one whose resolution is highly elusive. It involves more than simply connecting bits of technology together. Connectivity is showing itself to be a strategic issue, one which can only be ignored at an organization's peril. Moreover, it is more than just intraorganizational systems. Much

of the future appears to lie in interorganizational systems, and for these to become a reality, the issue of connectivity has to be resolved. Organizations will simply not be able to effectively compete with those who successfully employ systems which span their customers and suppliers. These interorganizational systems will become the lifeblood for organizational competitiveness. What emerged from this investigation was ten truisms or lessons that may be applied elsewhere.

LESSONS LEARNED

There are a number of lessons learned which emerge from these connectivity-related cases. Some are fairly obvious, such as the need for senior management support, others are more serendipitous. Many of the more interesting ones arise from interorganizational data exchange arising from EDI and are discussed in the first five points below. The next six points relate to connectivity in a more general sense, and we attempt to suggest how these lessons might be used in the development of an organizational connectivity strategy.

Penetration of Connectivity into Business Processes. The combined effect of decreased costs to provide organizational connectivity and the increasing capabilities of the computer systems to process the data internally, appears to result in a broader range of applications. The prevention of redundant encoding of data makes information readily accessible, and the

savings of time and money favor intra- and interorganizational data exchange.

Formal Cost/Benefit Analysis is not Done. Most connectivity applications are not justified in the traditional cost/benefit fashion as hard dollar figures are hard to come by. For example, most organizations implement EDI because it is perceived as a strategic necessity. Environmental forces and strategic motivation made EDI a must for the organization. For example, joint interest billing in the oil industry was developed because oil drilling is done by a consortium of oil companies since it is too expensive for any one company to drill all of its own wells. Because this is a group venture, there is a need to apportion costs to the appropriate oil company partners. Joint interest billing is this apportioning and involves the lead partner in the consortium sending out monthly itemized billing statement listing each partner's costs for that particular well. It is reported that this activity which traditionally took hundreds of hours per week, takes only minutes with EDI. What makes this EDI application all the more interesting, is the fact that the participants are all fierce competitors forced to trust one another in order to gain the common economic benefits from EDI. All participating organizations realized the value of cooperation through EDI; there was little need to perform a formal justification.

Connectivity as a Vehicle for Rethinking Business Functions. With connectivity systems, starts a new analysis for business

opportunities, which can result in the connection of new functions. More generally, this communication has the potential to permeate the whole organizational domain, with the potential to connect many internal information flows; for example integrating EDI with just-in-time inventory scheduling. Finally, a continued analysis of information flows could help to uncover not just what does flow, but what could flow. It could open the opportunity for a new type of communication that deals with process improvements rather than with solving problems to improve processes. This clearly is seen to be true in the joint interest billing case where the participating oil companies see opportunities for new communication afforded through EDI.

Competitive Advantage through Connectivity. In the strategic arena, the benefits of connectivity are most visible in the improved perceived effectiveness by the end customer, whose requests can be complied with in a predictable and fast manner. Potential increases in market share can then help to sustain or even increase the competitive advantage. In this way, the connection can alter the bargaining power among buyers and suppliers.

As business competition continues to intensify, more and more companies are concentrating on their core competencies; this leaves open the possibility of a migration of functions to a supporting supplier company. Connection-oriented systems appear as an essential ingredient for the successful coordination of these new tasks.

Connectivity Involves Supporting Human Communication. Contrary, perhaps, to expectation, connectivity is more effectively conceived as the means of supporting human communication not computer communication. While the latter is the focus of so much attention, it must not be forgotten that its raison d'etre is in support of the former. Computer communication exists to support human communication. Thus, an organization needs to consider the efficacy of its internal communication system: how well do people interact, how easy is it for them to interact, what procedures interfere with this interaction, how can the interactions be effectively supported, and so on.

It appears that no matter how good the computer connectivity is, it will have little real affect unless the human systems which it supports are working well. The old adage of: "computerization cannot help an organization that does not have its manual systems in order", appears doubly appropriate in the case of connectivity. So the first step in any strategy on connectivity is to critically analyze the organization's human communication systems. Do they work well, and if not, how can they be improved?

Flexibility of the IS Function is Critical for Success. As the IS function continues its inexorable trend of devolution, it is imperative that it maintains a high degree of flexibility. Although IS itself is centrally managed, more and more of its assets (such as data and computers) are being decentralized. The

environment is one where corporate IS sets the standards, and the other groups are implored to adhere to them. But this environment necessitates flexibility on the part of IS; no longer can it freely dictate IS policy. It needs to consider the myriad wants and wishes of sophisticated users. While it is true that IS takes into account the needs of its user communities, the proliferation of technology has led to the general dissemination of IS skills and talents throughout the organization. This creates new opportunities and challenges for IS, and it must be flexible to successfully deal with them. For example, organizational personnel may demand as their right the ability to hook up their PCs to each others and to the mainframe. IS policy must be flexible enough to accomplish their requests.

Connectivity is an Evolutionary Trend. Organizations need to think about connectivity in an evolutionary sense; it changes with time. Tools and techniques which are relevant today, may not be so tomorrow. Organizations need to position themselves in such a way that they are able to take advantage of emerging technologies - both planned and unplanned. This again relates back to the need for flexibility. Nothing in the field of information technology is ever permanent, and connectivity needs to be considered in light of this evolution. It is therefore important for organizations to develop a connectivity policy which allows for change, for it must be realized that change is the most ubiquitous aspect of the field.

Grand Connectivity Technology Plans are Likely to Fail. Following on from the previous point, an all-embracing connectivity plan is likely to fail simply because not all options can be planned for, new technologies will emerge which will need to be adopted, and business opportunities will emerge which will require substantive IS changes. In such an arena, it makes sense to start small, involve the organization in a variety of pilot projects obtaining as much knowledge and experience as possible during these pilots, and develop evolutionary policies to deal with connectivity. The most effective plan is likely to be one which is evolutionary, flexible, and proactive; one which concentrates more on what is to be accomplished, rather than how.

Plan Realistically. One of the major reasons for failure in the IS field is the development of plans which were unrealistic: unrealistic implementation time frames, unrealistic technological forecasts, unrealistic expectations, etc. Although it would be desirable to have a policy of connectivity in which every technology is linked to every other technology, such a plan is probably unworkable. If such a plan is made public, it would raise expectations to a level which could not be reached; failure would be inevitable. It is therefore prudent to consider the level of expertise on connectivity now available in the organization, consider the past experiences with technologies and user reactions, and such like, in developing a plan which is both sensible and operable. Sensible in the fact that it does not make erroneous assumptions (e.g. that vendors and standards work

in concert; in fact the two are in conflict with one another). Operable in sense of plans which have a realistic chance of success (e.g. not attempting linkages which are beyond the state-of-the-art, particularly if the firm has been relatively conservative in the past). The plan should focus on "solution" rather than "vendor", even though it may be tempting to follow one particular vendor for all connectivity decisions. Concentrating on "solution" generally focuses thinking on business functions and processes rather than the specific technologies of a particular vendor.

Senior Management Support is Critical for Success. Connectivity needs the support of top management. If they are not visibly supportive of the connectivity policies, it may be difficult to get the rest of the organization to adhere to them. The best way for such support to be obtained is to make the relationship between connectivity and the business plan visible. Senior management are more likely to both understand the need for connectivity policies and supportive of them if they understand their business implications. Thus, they should be linked, wherever possible, to the Corporate Plan - a linkage which should become easier and easier to make (i.e. more obvious) given the important role inter- and intraorganizational connectivity will play in a firm's survivability.

RECOMMENDATIONS

The issue of connectivity is, arguably, more a managerial topic than a technological one. This is not meant to belittle the importance of the technological dimension of connectivity, but to highlight the important **organizational** nature of the problem. We have sought to show why all organizations need to come to grips with connectivity, what is involved with such linkage, how some organizations have approached the task of connectivity, and suggested some lessons which emerge particularly in area of interorganizational connectivity. While it is not possible to offer an all-embracing action plan for connectivity, we would like to conclude with a broad list of recommendations which organizations might wish to consider in their attempt to manage connectivity.

Think Interorganizationally. While intraorganizational connectivity is vitally important for a firm's survivability, more and more corporations are looking to interorganizational systems as the wave of the future. The examples discussed above are indicative of the future: all the companies involved in EDI feel the only way they will be able to successfully compete in the long term, is with interorganizational systems. EDI is no longer a luxury. Organizations who ignore EDI do so at their peril. This means that firms need to start thinking about where EDI might be appropriate, with which other organizations, and take steps to get the ball rolling. This may mean through pilot projects with one other organization, or with a number of others. It is prudent to consider not simply supplier-buyer applications,

but also competitor-competitor applications such as joint interest billing in the oil industry. Quite often, the more complex the relationship, the greater the potential payoff. Such thinking does, of course, require a change in the thinking of corporate management. One can imagine the soul-searching that must have gone on in the various oil companies boardrooms when the issue of Joint Interest Billing through EDI was discussed.

Companies, because of the increasingly competitive environment brought about by the internationalization of industry, must constantly look for an edge. Technology, particularly through interorganizational systems, is increasingly being considered as the vehicle for providing that competitive edge.

Think Intraorganizationally. In order to effectively consider interorganizational applications, a firm needs to have its internal shop in order. Quite clearly, it would be difficult to deal with interorganizational standards if few existed inside. It is for this reason that organizations need also to consider their internal operation: what processing capabilities are available now, what network capacity is available, how much storage exists, what standards are adopted and to what degree are they followed, what architecture (if any) is in place to allow data interchange, is there a technological infrastructure in place which can be used to effectively develop current and future applications, what support is there from the board for information technology expenditure, is the IS plan in alignment

with the corporate plan, and is IS seen as a strategic resource of the company. Issues such as these need to be effectively dealt with in order for a firm to successfully compete in the future.

SUMMARY

Based on our understanding of the issues surrounding connectivity and the ways a number of organizations have approached the task of dealing with them, we feel that it is absolutely imperative that firms seriously consider this key area. Connectivity cannot be ignored. Yet, there are many, many different ways to deal with connectivity. It would be nice to have a "standard action plan" or "cookbook approach for organizational connectivity"; unfortunately, no such plan is possible. Organizations are too different to have one plan which would be appropriate for all. Nevertheless, the lessons learned should help direct discussion and research towards a general connectivity strategy which would be suitable in particular environments.

While intraorganizational connectivity is vitally important for a firm's survivability, more and more corporations are looking to interorganizational systems as the wave of the future. However, in order to effectively consider interorganizational applications, a firm needs to have its internal shop in order. It would be difficult to deal with interorganizational standards if few existed inside. Issues such as these need to be

effectively dealt with in order for a firm to successfully compete in the future.

Why the Interest in Connectivity?

- Internationalization
- Increased Competition
- Increased Visibility of Success Stories
  - American Airlines
  - McKesson's
  - Merrill Lynch
  - Avis

- Increased Awareness of the Benefits of Inter- and Intraorganizational Linkage
  - Interorganization
    - EDI
    - AHSC
  - Intraorganization
    - Image Processing
      - Diners Club
      - John Deere
    - Telecomms
      - Ryder Trucks
      - USA Today

Business Case for Connectivity

- The Business Case for connectivity is simply "doing business better". Connectivity makes good business sense.

- Connectivity is thus not just technical, but managerial.

Connectivity

The *effective* joining of two or more *systems* for the purpose of *resource sharing*.

All systems are "connectable"; the designer must determine whether the effort is worth the connection.

Lessons Learnt From Case Studies

1. Interorganizational Lessons

- Penetration into Business Processes
- No Formal Cost-Justification
- Vehicle for Rethinking Business Functions
- Competitive Advantage
- Altering Supplier-Buyer Relationships

2. General/Global Lessons

- Connectivity Involves Supporting Human Communication
- Flexibility of IS Function Critical
- Connectivity is an Evolutionary Trend
- Grand Connectivity Plan is Likely to Fail
- Plan Realistically
- Senior Management Support is Critical

Technology Infrastructure #1

- Network Capacity
  - integration of voice, text, image and data
  - high bandwidths needed --> fiber optic
- Workstations
  - need to handle mixed media
  - high resolution, bit-mapped displays
- Storage Devices
  - optical media to handle vast storage needs

Technology Infrastructure #2

- Standards
  - open rather than proprietary --> OSI
  - protocol converters a necessity
- Information Architecture
  - Hardware
    - three level consideration (individual, department, corporate)
  - Data
    - data structure (relational, network)
    - data sharing between different applications

Recommendations / Conclusion

- Think Interorganizationally
  - supplier-buyer
  - competitor-competitor
- Think Intraorganizationally
  - processing capabilities available
  - network capabilities available
  - storage capabilities
  - standards adoped and followed
  - architectures in place
  - technology infrastructure
  - alignment of IS plan with corporate plan
  - IS as a strategic resource