Adopters of Telecommunications Initiatives: A Profile of Progressive US Corporations

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The increasing pervasiveness and importance of telecommunications technologies is making it critical for organizations to make 'rational' choices regarding their adoption. This study identifies 15 telecommunications initiatives and examines the differences between adopters and non-adopters of these initiatives across a variety of factors. The results suggest different profiles for each technology initiative. However, more importantly, the results alert us to the diversity of factors that could potentially influence or be influenced by these technology decisions. While some initiatives are related to structural characteristics like centralization and integration, others relate to risk taking disposition and vendor interaction. The results provide descriptive insight into telecommunications initiatives and their use, as well as potential prescriptive insight into factors that could affect decision making processes regarding the initiatives. Potential future trends regarding these initiatives are also discussed.

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Introduction

The explosion of telecommunications over the past decade has forced organizations to make choices from a bewildering array of technologies.[1] These technologies are beginning to fundamentally change the way organizations interact with entities in the marketplace, facilitate competitive strategy, centralize or decentralize control structures, conduct meetings and disburse information. The flexibility offered by these technologies, coupled with their rapid convergence with computing technologies, is making their adoption and effective utilization a critical issue.

   We are evolving into an era where many organizations recognize that information technologies (ITs) serve more than a utility function. They can be viewed as resources that need to be proactively planned for and aligned with corporate strategy in order to be effectively utilized.[2] Classic examples abound where ITs have created and sustained a competitive advantage for their initiators. However, concurrent with this recognition is the harsh reality of increasing global competitiveness, sluggish economies and dwindling budgets. Organizational gatekeepers have to make choices about technological initiatives, many of which cannot be justified based on traditional economic measures that are palatable to executive management. The decisions made are then reflective of a variety of contingencies that characterize organizational contexts and the choices of technologies reflected in these decisions should be close to rational. If that is so, the profile of adopters of telecommunications initiatives should provide useful insight into factors influencing their adoption. We would argue that to the extent the

[1]STRAUB, D W AND WETHERBE, J C (1989) 'Information technologies for the 1990s: an organizational impact perspective' *Communications of the ACM* **32** 1328–1339
[2]CLEMONS, E K AND MCFARLAN, W F (1986) 'Telecom: hook up or lose out' *Harvard Business Review* **64** 91–97

choices made reflect the objective of improving organizational effectiveness, a comparison of adopters and non-adopters would offer prescriptive insight. It is toward this end, we present this study.

The paper is organized as follows. We first identify a set of telecommunications initiatives. We then identify factors that might tend to distinguish adopters from non-adopters across this set of telecommunications initiatives. This is followed by a description of the method of capturing data to accomplish our objectives. And finally, we present and discuss our results on the profiles of adopters of the various initiatives.

Identifying telecommunications initiatives

Telecommunications initiatives represent decisions made on the part of a firm to adopt telecommunications hardware, software or standards. These initiatives are generally proactive, since they are made with respect to a progressive set of technologies. To identify initially a representative set of initiatives, a review of books and papers dealing with telecommunications was conducted. The list, along with a brief description of each initiative was mailed to six experts for review. Three experts were actively involved in research on the impacts of telecommunications technologies. The other three were senior executives engaged in the management and implementation of telecommunication projects within their organizations. The panel added, combined and deleted initiatives from the list as they deemed necessary. The researchers then reconciled feedback from the panel into a set of 15 telecommunication initiatives that were used in a final questionnaire (see *Table 1*). It should be emphasized that these initiatives are not mutually exclusive. Clearly, network infrastructures are precursors to many network based applications (eg e-mail). However, the decision to develop an e-mail system is the prerogative of the firm and represents an important independent initiative on the part of the individual firm.

Given the fact that firms might or might not adopt these initiatives, based on their need, the question now becomes one of identifying factors that might influence a firm to take these initiatives. Below, potential factors that might influence the adoption of telecommunications initiatives are identified.

Potential factors distinguishing adopters from non-adopters

Five classes of factors are identified as potentially important in distinguishing adopters from non-adopters of telecommunications initiatives (see *Figure 1*). These are factors relating to (a) the environment, (b) organizational structure, (c) information infusion, (d) corporate orientation and (e) interaction of the information systems group.

The environment

The environment has been the subject of much study in the area of organizational innovation.[3] Many studies have found that increased environmental uncertainty facilitates a greater adoption of innovations by firms. In other words, uncertainty spurs the need to innovate. To the extent that telecommunications initiatives represent innovations, de-

[3] DAMANPOUR, F (1991) 'Organizational innovation: a meta-analysis of effects of determinants and moderators' *Academy of Management Journal* **34** 555–590

Table 1 *Fifteen telecommunications initiatives*

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1. *Intelligent mobile phones.* Cellular and associated wireless communication technologies that can and are carried within and external to the organization. Examples include executive mobile car phones, beepers, and service vehicle communications

2. *Voice/data PBX* (internal telephone system). The traditional telephone system used by industry to transfer data and voice across corporate sites and to support individual on-line communications. PBXs typically contain features that facilitate the management and cost control of the intra-organizational telephone system

3. *Voice oriented systems.* Technologies that combine the features of telephone conversations and postal mail: the spontaneity of picking up the phone and the time independence of a letter. The voice system, usually attached to the PBX, facilitates asynchronous interpersonal communication (eg voice mail)

4. *Integrated services digital network (ISDN).* An increasingly viable communications approach, requiring specialized hardware and software, enabling concurrent transmission of video, data, and voice media. End-to-end digital connectivity (as opposed to analog) and standardized network elements (line capacities, PBXs, switching facilities, etc) are the goals of ISDN. Currently being installed and operated on a regional and often trial basis by larger firms

5. *Local area networks (LAN).* Hardware and software installed to link individual and business unit computer workstations within a confined geographic region. Integration enables a variety of information flows including migration of data files, spreadsheets, mail, as well as common access to application and system software

6. *Wide area networks (WAN).* Communication technologies that link widely dispersed business units

7. *Facsimile (FAX).* Technology enabling transmission of documents electronically

8. *Electronic mail (e-mail).* Electronic messaging normally conducted on an asynchronous based on person to person(s) flow (compared with computer to computer communications)

9. *Videoconferencing.* Those technologies which facilitate business seminars and meetings across physical distances. Conference participants may both view and talk with each other interactively without being literally present

10. *Videotext.* Integration of video, text, and user intervention for multimedia exposure. Usually allows users with no training to access information, or graphics. This technology is often applied in educational and training environments

11. *Value added network (VAN).* Communication lines offered through common carriers that facilitate timely and accurate information flow. 'Value added' includes processing services such as error checking, re-transmission, and alternate routing in case of network node failure

12. *Access to commercial databases.* The capability to log-on to external databases (for a fee) for access to data to maintain and advance the competitive market position of a corporation

13. *Network management software.* Systems software to operate and monitor computer network communications activities. Examples of these activities include remote diagnosis, detection of link failure, dynamic online help/status facility, examination of network log to check parameters, etc

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Table 1 *Continued*

14. *Interorganizational communications links.* Bridging and conversion technologies that enable transmission and receipt of such items as documents, transactional data, functional information, and planning perspectives across organizational boundaries (eg with customers, suppliers)

15. *Corporate owned communication lines.* Corporate ownership of the communications medium (eg coaxial cable, fiber optic link, microwave link) as opposed to using links through a common carrier. This ownership implies that the company is totally responsible for the design, engineering, installation, operation and maintenance of the line

fined as new initiatives by the adopting organization, we would expect adopters to be in relatively more uncertain environments compared with non-adopters. Further, it has also been suggested that highly uncertain environments necessitate the need for more information and elaborate information technologies to cope with this information.[4] Therefore, environmental uncertainty is a potential factor of interest.

Organizational structure

The concept of structure involves relationship and communication patterns within an organization.[5] Studies in innovation suggest that organic structures (ie less centralized, informal, highly integrative) tend to promote the communication necessary to facilitate innovativeness.[6] From that standpoint, the organizational structure would influence the adoption of telecommunications initiatives. This direction of relationship has been called the 'organizational imperative'.[7] On the other hand, some studies have discussed the impact of telecommunications technologies on structural characteristics (technological imperative). These would imply that telecommunications technologies, like e-mail,

[4]HUBER, G P (1991) 'A theory of the effects of advanced information technologies on organizational design, intelligence, and decision making' *Academy of Management Review* **15** 47–71
[5]GALBRAITH, J R (1974) 'Organizational design: an information processing view' *Interfaces* **4** 1–9
[6]*Op cit*, Ref 3
[7]KING, J L (1983) 'Centralized versus decentralized computing: organizational considerations and management options' *ACM Computing Surveys* **15** 319–350
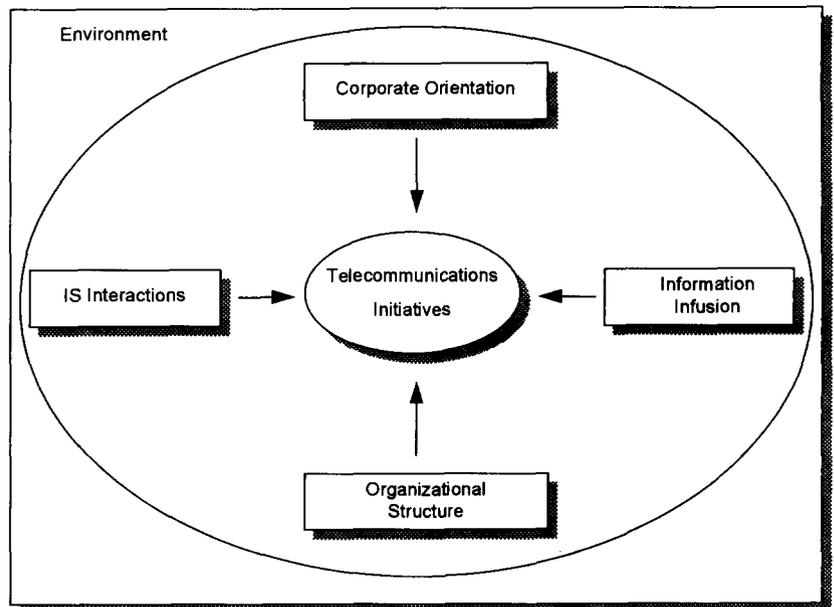

Figure 1 Classes of factors influencing telecommunications initiatives

local area networks (LANs), and videoconferencing tend to flatten and in many cases simplify organizational structures. In either case, the argument for inclusion of structural factors in our study is strong. Four factors that have received theoretical and managerial attention are defined below.

Centralization is the extent to which decision making responsibility is concentrated at the top levels of management. *Formalization* refers to the extent to which a firm uses rules and procedures for all situations. *Integration* represents the extent to which participative, cross-functional discussions characterize work on projects and decision making. *Complexity* refers to the number of different types of products/services marketed by the firm. Collectively, these four factors describe structural characteristics of an organization.

Information infusion

Information infusion is a term used to describe the extent to which information and information technologies are acquired and used by the firm.[8] Some companies either by their fundamental nature or by choice are involved in more information-related activities than others. The expanded use of information might necessitate telecommunications imperatives to move the information from one point to another. Two factors are used to capture this concept. The first factor, information intensity, indicates the extent to which information technologies are used for various activities of the firm. The second, information scanning, indicates the extent to which technological information is actively acquired by the firm.

Corporate orientation

Corporate orientation represents some general aspects on the overall posture of the firm. Technology initiatives are often championed by senior executives. In many cases aggressive postures taken by corporate management might result in more innovation and leading edge technology investment.[9] This aspect is captured in the factor called management risk taking. The second factor, called internationalism represents the international focus of the firm's operations. Given the importance of certain telecommunications initiatives in international communication, it was felt that this factor might potentially distinguish adopters from non-adopters.[10]

Information systems interaction

The interaction of the information systems (IS) group with various constituencies within or outside the firm might be key to adoption of telecommunications initiatives. These interactions could take place with corporate management, a much recommended manifestation that can facilitate alignment of information resources with corporate strategy.[11] Another major player, especially in the case of telecommunications technologies, is the vendor. Close vendor interaction could potentially enable rapid adoption of various complex technology initiatives. Finally, close interaction of information systems personnel with the firm's telecommunications group (which are not necessarily in the same department) might facilitate better understanding of the role of telecommunications as it relates to other information systems—and therefore the importance of bringing telecommunications initiatives into the

[8]SULLIVAN, C H (1985) 'Systems planning in the information age' *Sloan Management Review* **26** 39–44
[9]PORTER, M E AND MILLAR, V E (1985) 'How information gives you competitive advantage' *Harvard Business Review* **63** 149–160
[10]STEINBART, P J AND NATH, R (1992) 'Problems and issues in the management of international data communications networks: the experiences of American companies' *MIS Quarterly* **16** 55–76
[11]KEEN, P G W (1987) 'Telecommunications and organizational choice' *Communications Research* **14** 588–606

firm. Along these lines, three factors called IS-corporate alignment, vendor interaction and telecommunications-IS interaction were captured.

The next section briefly describes the methodology used to capture data on both the telecommunications initiatives and the factors described above.

Method of investigation

A questionnaire was carefully developed to capture the data for the study. The unit of analysis was the firm level and therefore it was important to have a senior informed respondent. Information systems executives were targeted since they are presumed to be the most informed about the technological infrastructure and organizational-level information. Responses were obtained from 165 senior IS executives from a variety of industries. Eighty-six per cent of the respondent companies had sales over over $100 million. About two-thirds of the respondents were at the Director or Vice-President levels, indicating an experienced and influential group with the ability to respond to questions regarding organization level factors.

The questionnaire included the list of 15 telecommunications initiatives described in *Table 1*. For each initiative, respondents were simply asked whether it had been adopted by the organization. All other measures were on Likert-type seven-point scales. All the measures are illustrated in *Table 2*. In most cases validated measures were used. Additional reliability (Chronbach's alphas) and validity testing (item–total correlations, factor analysis) was done to refine the measures. All the refined measures exhibited very high reliabilities and validities. The measures were then averaged to obtain a score for each factor. These scores were then examined for the adopters and non-adopters for each of the 15 initiatives. *T*-tests were used to test for significant differences between the various factors. The results are discussed below.

Results: adopters versus non-adopters

The 15 telecommunications initiatives were not uniformly adopted by responding organizations. Some technology initiatives were widely adopted, such as voice/data PBX (internal telephone system) and facsimile machines (FAX). Others were less pervasive, particularly integrated services digital network (ISDN), videoconferencing and videotext, which were each adopted by less than 37 per cent of the organizations surveyed. Based on the percentage of adopters, the 15 initiatives were segmented into category 1 (routine), category 2 (moderately widespread) and category 3 (not widespread) initiatives. These categories are illustrated in the first row of *Table 3*.[12]

Based on the results of the analysis adopters and non-adopters were compared for significant differences across the factors discussed. Only statistically significant differences are shown in *Table 3*. The two symbols used, indicated whether adopters or non-adopters were higher on a specific measure. It should be noted that while the results profile the differences between adopters and non-adopters of various technologies, they provide limited insight into causal directions. In other words, the questions of whether the technology initiative causes changes in

[12]GROVER, V AND GOSLAR, M (1993) 'Telecommunications technologies: patterns of usage' *Database* **24** 16–22

Table 2 *Factors and their measurement*

Category	Factor	Measures
Environment	Environmental uncertainty	Rate of obsolescence in industry; predictability of competitors actions; predictability of customers' demands and tastes; rate of technology change in industry; threat of price competition; threat of product quality competition; scarcity of labor/materials
Organizational structure	Centralization	Centralization of capital budgeting decisions; centralization of new product introduction decisions; centralization of decisions on entry into new markets; centralization of pricing of product line decisions; centralization of decisions on hiring and firing of staff
	Formalization	Procedures for all situations; rules and procedures in written form; constant check of employees for rule violations; strong penalties for rule violation
	Integration	Interdepartmental committees for joint decision making; task forces to facilitate interdepartmental collaboration; liaison personnel to coordinate several departments; participative, cross-functional discussions for: (1) product/service decisions, (2) capital budget decisions, (3) long-term strategies
	Complexity	Variety of products/services marketed; variety of technologies used for products/services; differences in marketing strategies used for products/services
Information infusion	Information intensity	Information technology used in: (1) raw material acquisition, (2) manufacturing, (3) product/service distribution, (4) marketing/selling, (5) maintenance of products/services
	Information scanning	Gathering of technological experiences of other companies; in-house library with extensive technological literature; employees encouraged to review trade publications; individuals assigned to keep abreast of new technologies; IS organization keeps abreast of technologies
Corporate orientation	Management risk taking	Willingness of top management to: (1) accept changes in organizational structures/work force, (2) absorb new technologies, (3) commit large investments in new applications
	Internationalism	Communication with businesses outside the country; dependence on international trade
IS interaction	IS-corporate interaction	IS managers' knowledge of business plans; top managements' knowledge of information technology; corporate planning inputs to IS planning; formalization of IS planning; involvement of top management in IS planning
	IS-vendor interaction	Time invested with vendors; number of vendors; active solicitation of information from vendors; employees dedicated to vendor relations; frequency of interaction after installation
	IS-telecommunications interaction	Joint planning for IS and telecommunications; common budget for both groups; liaison knowledgable in both areas; assignment of both groups to common projects

organizational structures (say) or is caused by structural factors is subject to interpretation.

Category 1 initiatives

Category 1 initiatives are widely followed. These include the now pervasive FAX technology and voice/data PBXs. *Table 3* indicates:

- Companies that adopt FAX are not different with regard to any of the factors than non-adopters.
- Companies with voice/data PBX tend to be in more uncertain environments and less formal organizations than non-adopters.

Table 3   *Profile of adopters versus non-adopters*

	Category 1					Category 2					Category 3				
	FAX	Voice /data	Database	E-mail	IOS	LAN	Network software	Voice oriented	WAN	ISDN	Video-conferencing	Video-text	VAN	Corporate lines	Mobile phone
Environment															
Uncertainty	✓	✓	✓		✓	✓			✓	✓	✓	✓	✓		
Organizational structure															
Integration		✓	✓	✓		✓			✓	✓	✓	✓			
Formalization	✗			✗					✗		✗	✗			
Centralization				✗					✗		✗	✗			
Complexity				✓	✓	✓		✓	✓	✓	✓				
Corporate orientation															
Internationalism					✓				✓	✓	✓	✓	✓		
Risk disposition												✓			
Information infusion															
Information intensity									✓			✓			
Scanning		✓	✓		✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
IS interactions															
Telecommunications						✓		✓	✓	✓		✓	✓	✓	
Vendor		✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
Top management							✓					✓			

✓ – Adopters higher on this measure than non-adopters.
✗ – Non-adopters higher on this measure than adopters.

These results clearly indicate that FAX technologies are being adopted by in all organizational contexts. It represents an inexpensive, low-tech solution to the need for rapid document transmission. The profile of PBX adopters is also by and large invariant to organizational contexts. Most larger organizations, which typically face higher degrees of environmental uncertainty (particularly due to the diversity of variables that need monitoring) would invest in an internal telephone management system regardless of other factors. Such systems are more economical for internal communication of voice and data. We would suspect that companies with sophisticated internal communication systems would have more direct, informal interaction among people. The relatively informal nature of adopters of PBXs indicated by the results might be reflective of this.

Category 2 initiatives

Category 2 initiatives are moderately pervasive in our sample. As shown in *Table 3*, these include external database access, e-mail, interorganizational systems (IOSs), LANs, wide area networks (WANs), voice systems and network software. The results indicate that:

● Companies that access external databases are in more uncertain environments, are more formalized, do greater information scanning and have more vendor interaction.
● Companies that use e-mail are more integrated, are less formalized, are more decentralized, are more complex and have more vendor interaction.
● Companies that have interorganizational systems are in more uncertain environments, are more complex, have an international orientation, have greater information intensity and more vendor interaction.
● Companies that use LANs are in more uncertain environments, are more integrated, are more complex, do greater information scanning, have more IS-telecommunication interaction and more vendor interaction.
● Companies that have WANs are in more uncertain environments, are more integrated, are less formalized, are more decentralized, are more complex, have an international orientation, have greater information intensity, do greater information scanning, have more IS-telecommunication interaction and more vendor interaction.
● Companies that use voice systems are more complex, do greater information scanning and more vendor interaction.
● Companies that use network management software do more information scanning, have more vendor interaction and more corporate-IS interaction.

While these results provide insight into potential factors influencing adoption or being influenced by telecommunications techologies, it is interesting to compare various initiatives. For instance, companies that adopt WANs tend to have the same profile as adopters of LANs but tend to also differ in that they are less formalized and more decentralized. In other words, decentralized decision making might create a need for a widely dispersed network. Interestingly, e-mail operators also tend to be less formalized and more decentralized. This might suggest that e-mail encourages informal interactions and is perceived as beneficial more so in dispersed environments (WANs) rather than local environments (LANs). IOSs which connect suppliers and customers to the firm

tend to occur in more complex firms with high information intensity and an international orientation. These systems are increasingly being integrated with internal manufacturing and marketing systems and the results could be indicative of this trend.[13] Access to external databases, which is typically done to access information useful for planning and competitive position, tend to occur in companies which do more scanning and are more formalized. This might indicate that access to external databases is a part of a formalized organization and planning system, in which structured access to periodic data is done routinely.

Interestingly, many of these Category 2, network based initiatives exhibit some very similar characteristics. They all tend to be adopted in relatively uncertain, complex environments where information scanning is higher. They all seem to necessitate (as do most telecommunication technologies) close vendor interaction.

Category 3 initiatives

Category 3 initiatives include ISDN, videoconferencing, videotext, value added network (VAN), corporate owned communication lines and mobile phones. Due to their unique nature and/or capital investment required, they are relatively less widespread. *Table 3* indicates:

- Companies using ISDN are in more uncertain environments, are more integrated, are more complex, have greater information intensity, tend to take more risks, have more IS-telecommunication interaction, more vendor interaction and more IS-corporate interaction.
- Companies using videoconferencing are in more uncertain environments, are more integrated, are less formalized, are more decentralized, are more complex, have an international orientation, have greater information intensity and have more vendor interaction.
- Companies using videotext are in more uncertain environments, are more integrated, are less formalized, are more decentralized, have an international orientation, tend to take more risks, have greater information intensity, do greater information scanning, have more IS-telecommunication interaction, more vendor interaction and more IS-corporate interaction.
- Companies using VANs are in more uncertain environments, are more decentralized, have an international orientation, do greater information scanning, have more IS-telecommunication interaction and more vendor interaction.
- Companies owning their own communication lines tend to be more complex, tend to take more risks, do greater information scanning, have greater information intensity and have more vendor interaction.
- Companies using mobile phones do greater information scanning and have more vendor interaction.

In general, adopters of Category 3 initiatives tend to be different across more factors. This would indicate that the decision-making processes involving the adoption of these initiatives tend to be more complex. The exception to this is the use of mobile phones. This technology is becoming increasingly inexpensive and consequently pervasive. However, the use of mobile phones while invariant across most factors, requires a certain type of business (ie one that involves much field work and communication from the field) to be useful.

Technologies such as videoconferencing and videotext are primarily

[13]GROVER, V (1993) 'An empirically derived model for the adoption of customer-based interorganizational systems' *Decision Sciences* **24** 603–640

used to enrich the communication channels, particularly for internal communication. These two technologies seem to be present in decentralized and less formal environments. This might indicate that similar to e-mail and WANs, these initiatives facilitate informal information flows. Videotext in particular stands out, since its adopters tend to differ across all categories of factors. This strongly suggests that videotext is a unique technology for US firms that requires careful evaluation with respect to the context. While the videotext concept has not been popular or successful in the USA, we suspect the results would be different in many European countries (particularly France and the UK) where the technology is more pervasive.[14] ISDN, a concept that has not gathered momentum, is also being adopted by a relatively specific set of firms. These firms are more aggressive regarding risk and tend to have close interaction between IS and telecommunications personnel, corporate management and vendors. The number of competing alternatives to ISDN (eg asynchronous transfer mode (ATM) and fiber distributed data interface (FDDI) and uncertainty regarding future standards might cause ISDN to be viewed as a risky venture which requires careful evaluation.[15]

Corporate ownership of communication lines is also viewed as risky as indicated by the fact that adopters had a greater risk-taking propensity. These companies are complex, have high information intensity and are willing to invest in infrastructure for complete control of communications. Given the power of leased lines that are easily available through common carriers, one would presume that security and control of a network infrastructure would be important to these firms (eg banks, airlines).

Further discussion

Whilst observing that the rows of *Table 3* provide insight into various initiatives, observation of columns can provide additional insights. Some general observations are itemized below.

(1) *Telecommunications initiatives are adopted in uncertain environments:* Most initiatives discussed above were adopted in environments characterized by greater uncertainty. This is indicative of the information demands placed on organizational units by the complexity and dynamism of the environment. Telecommunications technologies facilitate the capture, processing and movement of information required to cope with uncertainty. This is even supported by the complexity factor, which tended to be higher among adopters of most initiatives.

(2) *Internal communication initiatives facilitate integration:* The results suggest that initiatives such as e-mail, LAN, WAN, videoconferencing and videotext, tend to be related to higher levels of integration and lower levels of formalization within the organization. This is good in a time where competitiveness and responsiveness are critical. Flexible organizations need to have interdepartmental interaction rather than parochialism to enable responsiveness to market needs. There is also evidence to suggest that these internal initiatives might facilitate decentralized decision making, although the direction of causality could be interpreted either way.

(3) *Companies with international operations are more progressive:* Com-

[14]GROVER, V AND SABHERWAL, R (1989) 'The poor performance of videotex systems' *Journal of Systems Management* 31–37
[15]BRANCHEAU, J C AND NAUMANN, J D (1987) 'A manager's guide to integrated services digital network' *Database* 18 20–26

panies with a 'higher level' of international operations tended to be adopters of IOS, WAN, VAN, videoconferencing and videotext. The apparent need for coordination information flows across countries might necessitate more progressive use of telecommunications, as suggested by the results.

(4) *Companies with more information in general are more progressive:* The converging functionality of computing and communications technologies makes it difficult to isolate them. Companies with higher information intensity in various facets of their operations, tended to be users of Category 3 technologies. Intra- and inter-organizational networks and a plethora of sophisticated applications can be used to effectively transmit this information.

(5) *Technical scanning and vendor interaction are critical:* The most consistent results across initiatives were those relating to scanning and vendor interaction. Adopters of almost all Category 2 and Category 3 initiatives have higher levels of technical scanning and vendor interaction. The rapidly changing nature of these technologies, their expanding scope and functionality, the move toward convergence of international standards, the increasing importance of telecommunications for competitiveness, the lack of available expertise, etc make it imperative for companies to consistently scan the technical environment and keep abreast of developments.[16] Vendors are an important source of information and expertise, especially when implementing new telecommunications based systems. In fact, we suspect that in this area, companies are relying more and more on external expertise rather than cultivating it in-house.

In addition, certain initiatives require risk in the form of capital investment. Returns on these investments are not always easy to compute. Therefore, close interaction with available expertise in-house and outside (ie vendors) is necessary, particularly for the more complex initiatives (ie ISDN).

Concluding thoughts: looking towards the future

While this study does not represent a panacea for decision making on telecommunications initiatives, it does provide descriptive insights into the profile of companies adopting these important sets of initiatives. However, these results are reflective of today's environment. Even as we write, trends in miniaturization, integration and distribution of technologies are giving rise to an expanded set of options leading to a bewildering set of choices for organizations.[17] These technology initiatives are important and are changing. They are also influencing changes in organizational structures and strategies. Corporations have the potential to take these initiatives and proactively adapt them to the organizational imperative. Alternatively, they can deal with changes reactively, in response to technological drivers or other facets of the environment. These modes are illustrated in *Figure 2* which integrates the various components discussed earlier into a broad model for telecommunication technologies' adoption and impacts.

As can be seen in *Figure 2*, environmental uncertainty, which includes the complexity and dynamism faced by corporations, increases the need to process more information (information infusion) within the organiza-

[16]DONOVAN, J (1988) 'Beyond chief information officer to network manager' *Harvard Business Review* **66** 134–140

[17]BOWONDER, B, MIYAKE, T AND SINGH, T M (1993) 'Emerging trends in information technology: implications for developing countries' *International Journal of Information Management* **13** 183–204
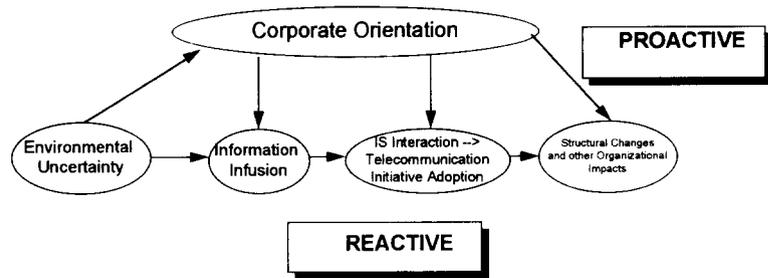
Figure 2 Adoption and impacts of telecommunication initiatives

tion to alleviate this uncertainty.[18] With a growing global marketplace, changing dynamics and intensity of competition, and the accelerating pace of technological development, environmental uncertainty will continue to increase. This gives rise to the need for adoption of information technologies, particularly telecommunications initiatives, in order to increase the information processing and dissemination capacity of the organization. In turn, this can lead to other organizational impacts, such as changes in structure, resource deployment and overall effectiveness. A proactive organization might seek to manage these changes through an analysis of organizational contingencies (eg international operations) and strategy. Such organizations can subsequently control their deployment of telecommunications initiatives and structural changes in order to best match corporate orientation. Many contemporary organizations are indeed attempting to restructure their fundamental business processes and structures in response to environmental pressures and doing it strategically through structures that can leverage the power of information technologies and contribute to customer oriented goals.[19]

In contrast, other organizations might fall in the lower half of *Figure 2*, where the environment might force them to adopt telecommunications initiatives due to the need to respond to competitive pressures or technological imperatives. Structural changes and other impacts then occur as a consequence of adoption, not of strategy. In other words corporations might be forced into adopting telecommunications initiatives in order to remain competitive. A purely reactive, without any coherent organization-wide consideration might lead to telecommunications solutions that satisfy parochial problems but are sub-optimal from a corporate perspective. Such corporations might survive in the short run, but will have to be able to achieve compatibility across systems and process and transmit information in an effective and efficient manner to remain viable in the information age.

Our data suggests that adopters of different telecommunications initiatives have varying profiles along these dimensions. This would imply that organizational contingencies are possibly being considered in making adoption decisions. We would like to believe that this is being done in a proactive, rational manner. In general the structural changes manifested by adopters to be more integrated, less centralized, less formalized and yet complex. These structures might reflect emergence of flexible adhocracies[20] and team based structures that can benefit from telecommunications initiatives. Other data might suggest a risk taking proactive orientation in adoption of Category 3 technologies and a general reliance on scanning and vendor interaction to alleviate uncer-

[18]*Op cit*, Ref 5
[19]DAVENPORT, T H AND SHORT, J E (1990) 'The new industrial engineering: information technology and business process redesign' *Sloan Management Review* **31** 11–27; GROVER, V, FIEDLER, K AND TENG, J (1993) 'Business process redesign: an integrated planning framework' *Omega: The International Journal of Management Science* **21** 433–447

tainty due to technological changes. Further observation suggests that some initiatives tend to be invariant across adopters and non-adopters (like FAX, PBX). These low-cost technological solutions have gained a critical mass to be economically feasible. The other more specialized applications tend to be more expensive, and might involve idiosyncratic protocols—and hence tend to be adopted under certain circumstances.

While speculating on the long term impacts of telecommunications might be highly presumptuous, given the short cycle times of new technologies, certain trends are inevitable. The most fundamental of these includes the broadening of bandwidths both in the air and on hardwire media. With universal accessibility to cellular communication on personal devices, complete corporate connectivity on the wide bandwidth 'information superhighway'[21] that can simulate the richness of face-to-face interaction, high speed end-to-end digital connectivity of voice, text, data, video and image, and a trend towards promoting competitiveness in the telecommunications industry, we might be facing a shift in paradigm regarding this family of technologies. When such infrastructural developments occur, the default model for corporations will tend towards a reactive mode for technologies related to fundamental structures and paths. In other words, the sheer magnitude of such changes will force organizations to adopt generic infrastructures. The achievement of critical mass on these infrastructures will greatly reduce costs, moving organizations away from the need to proactively plan for these developments. An analogy is today's telephone system (and even Category 1 technologies) that is a utility, and not a source of advantage. With such an infrastructure in place, technology initiatives like videoconferencing and mobile phones will be marginal cost add-ons on the infrastructure. This telecommunications utility will not be a source of competitiveness *per se* but will be an enabler of the content that traverses the infrastructure. This informational content in the form of text, video, numbers or pictures as leveraged by other unique organizational attributes will be the source of corporate advantage. The low cost of telecommunications initiatives will result in adoption decisions on specific applications and 'highway services' being made at a highly decentralized group or individual level. However, collectively managing this integrated myriad of information, services and applications on the infrastructure in a manner that does facilitate the corporate orientation will remain a challenge.[22] One statement will remain invariant over time: 'Winners will be those firms that can best match specific business needs into technology solutions in a cost effective manner'.

[20]MALONE, T AND ROCKART, J (1991) 'Computers, networks and the corporation' *Scientific American* September, 128–136

[21]GORE, A (1991) 'Infrastructure for the global village' *Scientific American* September, 150–153

[22]CHIDAMBRAM, L AND CHISMAR, W G (1993) 'Managing global communication networks: key challenges for the nineties' *International Journal of Information Management* **13** 167–182