

The Evolving Role of the CIO

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Title: *The Evolving Role of the CIO*

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Abstract: Despite a somewhat embattled history, the role of Chief Information Officer (CIO) has emerged as a critical executive position in most organizations. Increasingly, CIOs sit on firms' executive teams and help shape organizational strategy. Nonetheless, the future of the CIO role is unclear. This paper examines the forces that have historically shaped the CIO role in organizations to explain current responsibilities and to speculate as to how the role might evolve.

22 pages

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The Evolving Role of the CIO

Introduction

From humble beginnings in the back rooms of most large companies, information technology has emerged as a topic of considerable interest in many if not most corporate boardrooms. In 1999 executive teams were reviewing their companies' progress toward Y2K compliance; directing often massive IT infrastructure investments, such as ERP systems and pervasive intranets; and speculating about potential impacts of their own Internet and 'E-Commerce' initiatives as well as those of new 'information age' competitors. Over the years executive teams have experienced a high degree of discomfort in these discussions of IT-related topics. Consequently, the functional IT head has often been on the 'hot seat' to address persistent concerns about the firm's ability to identify opportunities presented by new technologies, respond to those opportunities in a timely fashion, and achieve demonstrable benefits from IT investments.

As business dependence on IT—both operationally and strategically—has grown, the IT Leader has increasingly gained acceptance as a member of the executive team. Since the mid-1980s this individual has typically been labeled the Chief Information Officer or CIO (Bock et al, 1986). But soon after this terminology came into use the signs of distress began to appear. CIOs have struggled with noticeably short tenures (e.g. Rothfeder & Driscoll, 1990), a lack of credibility within the executive team, and problematic relationships with their CEOs (Feeny et al, 1992).

More recently CIOs have felt the impact of the dramatic development of the IT services industry and increasingly computer-literate line managers. If all or most of IT activities are outsourced, what then is the role of the CIO (McFarlan & Nolan, 1995)? As line managers become comfortable assuming responsibility for their computing needs, do many of the CIO's responsibilities become redundant? Does the role of the CIO have a future? Or merely a problematic past? In this chapter we review the role of the CIO; taking a historical perspective on its evolution to better understand the potential sources of CIO value and their continuing relevance; and leading to further research questions which may help to illuminate the future of the role.

Glimpsing the Future through the Past: A Model of the CIO's Role

Clearly, dramatic technological changes have transformed computing from a backroom utility to a strategic organizational resource. This transformation has led to many changes in the use and management of information technology, including the reach and range of the technologies (Keen, 1991), the requisite skills and qualifications of the users of information technologies, the requisite skills and qualifications of IS professionals, the impacts—real and intended—of the technologies, and the amount of organizational spending on IT.

Changing technologies have also led to major changes in the responsibilities of the CIO. We would argue, however, that the effects of technology on the role of the CIO are not direct. Rather, the CIO's role has evolved through its interaction with three intermediate forces. Figure 1 depicts these forces in a model that we shall use to examine the evolution over time of the role

of the CIO. It suggests that changes in the role are related to wider changes in:

- (1) Existing and planned applications of technology in the host organization;
- (2) Attitudes of senior executives towards technology and its potential impacts and role; and
- (3) Characteristics of the principal vendors who deliver and service the technologies.

Forces Influencing the CIO Role

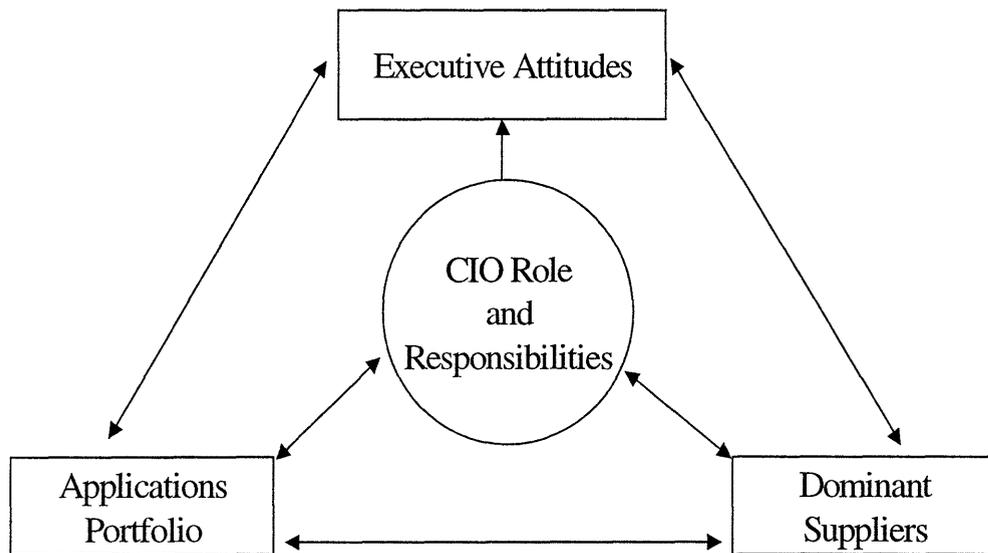


Figure 1

First, an organization's actual and planned *applications portfolio* influences the role of the CIO by establishing the extent to which the organization's operations and strategy are dependent upon IT, and the range of people within the business who are impacted by IT. Second, *business executives' attitudes* toward IT influence the role of the CIO by defining the level of investment available for IT, and the organization's predisposition to apply IT strategically. Third, *dominant IT suppliers* influence the role of the CIO by determining the range of technological architectures and solutions that are perceived to be reliably available, as well as the quality and extent of external resources and services that can be acquired to substitute for or complement internal resources.

We also note that these three forces interact with one another. Business executive attitudes toward IT help to shape the existing and anticipated applications portfolio; while the success (or otherwise) of that portfolio in action strongly influences the on-going attitudes of the executives.

The dominant suppliers of the day, because of their prominence, often gain access to senior business executives and use that access to further influence executive attitudes. Meanwhile, dominant suppliers become dominant by proactively influencing the applications portfolio of early adopter businesses, generating a momentum that convinces additional businesses of the importance of investments in their products and services.

Clearly, the CIO is not a passive pawn at the mercy of three surrounding forces. On the contrary, successful CIOs also influence their own roles in the organization and create further interactions among the elements of the model. We would argue that CIOs influence their roles by addressing the forces we have identified: through relationship building and education they influence the attitudes of key executives towards IT; by identifying and working with (both existing and emergent) dominant suppliers they shape their vendors' offerings and thus the services and technologies available to their firms; by successfully managing and extending the applications portfolio, they directly influence the strategic impact of IT in their organizations.

Finally we note that the model makes no specific mention of corporate strategy. We would argue that corporate strategy does have a pervasive impact on the role of the CIO but, like the technology itself, its impact is felt through the three intermediate forces. In particular, a firm's applications portfolio is a reflection of organizational strategic priorities. Similarly, executive attitudes toward IT investment and the status and role of the CIO defines how the firm has decided to position itself to shape and enact strategy through IT. Finally, the offerings of dominant suppliers reflect vendors' perceptions of the aggregate strategic imperatives of their existing and potential customers.

We will use the model to examine the changing role of the CIO across three technological eras:

- the *mainframe* era, covering roughly the 1960s into the early 1980s, during which time IT was largely synonymous with mainframe computers;
- the *distributed* era, starting at the end of the 1970s, during which corporate IT became characterized by integrated networks of workstation PCs, mini-computers and mainframes, connected through local and wide area networks;
- the *web-based* era, starting for most in the mid 1990s, with a rapidly growing emphasis on the use of internet and web protocols to drive both internally and externally oriented applications of IT.

Major Technical Eras

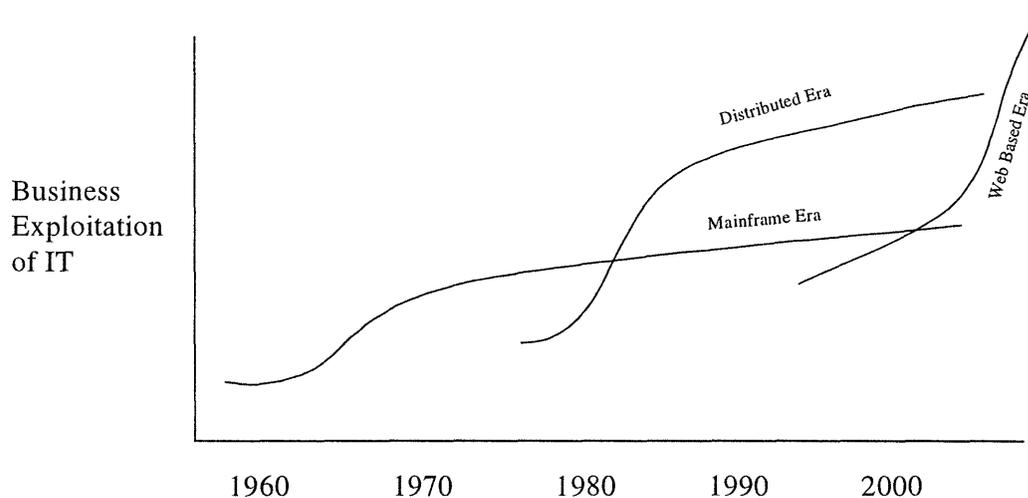


Figure 2

We distinguish between these eras because, as we shall demonstrate, there are clear discontinuities in the elements of our model as each new era becomes established. We can also chart more evolutionary change in the elements of the model as each era follows the S-shaped adoption curve first identified for the mainframe era by Gibson and Nolan (1974), and graphically illustrated in Figure 2. The eras are defined by major technological innovations, which provide vastly more powerful opportunities for business applications of IT than earlier technologies. The impacts of the innovations are realized gradually as the technologies mature and organizations learn how to apply them. Taken together, Figures 1 and 2 provide the platform for analysis of the changing role of the CIO.

Forces Influencing the Role of the CIO—The Mainframe Era

The introduction of mainframe computers into the back offices of business organizations in the late 1950s and 1960s represented the first application of computing to business. At the start of the mainframe era, firms recognized the potential of systems to cut time, cost, and human error from repetitive business tasks. Years later, computing had penetrated most functional areas, and the typical business had moved from pure cost-reduction objectives to recognizing the value of on-line data for organizational decision-making (Gibson and Nolan, 1974). Along the way, the 'data processing department' evolved into an 'information systems function' (Rockart et al, 1982). Although 'distributed' has long since supplanted 'mainframe' as the dominant paradigm, mainframe computers still retain an important role in many large organizations' computing environments. Indeed, migrating from or managing the 'legacy systems' created during the mainframe era still challenges many CIOs (and their host organizations).

Mainframe Era—Applications Portfolio. The applications of the mainframe era started with the automation of clerical tasks. Over time companies developed large-scale and highly efficient transaction processing capabilities. In most cases, electronic data processing (EDP) started in the accounting function, simplifying general ledger entries and account reconciliation. Shortly thereafter, firms took on production planning and control tasks, and began to make available on-line the data captured through their systems, until ultimately mainframe computing touched most organizational activities in the order-to-delivery value chain of large organizations.

Mainframe Era—Executive Attitudes. Business executives experienced a common pattern of attitudes toward, and expectations for, information systems as the mainframe era evolved (Gibson and Nolan, 1974). Initially, they viewed EDP as an accounting tool. Then they became enthusiastic about the range of tasks that systems could support. Later they became concerned about the cost of ongoing operations and run-away systems projects. Because business executives during the mainframe era viewed electronic data processing as a cost cutting tool, they typically based IS investment decisions on the expected ROI of new information systems. As they established information systems functions, business executives agonized over the gap between the information utopia they were promised and the reality of data labyrinths that they experienced (Ackoff, 1967; Zani, 1970; Rockart, 1979). Most often executives looked for an IS leader who could successfully manage large projects, contain IS costs, and respond effectively to their personal needs for information.

Mainframe Era—Dominant Suppliers. IBM was unquestionably the dominant supplier of computing products and services during the mainframe era. It sold and serviced the computers and accompanying operating systems. If the internal staff could not solve a technical problem, IBM could usually handle it for them. Through its System 360 series, IBM provided an evolutionary route for its customers to increase capacity and move to new technology while protecting their existing systems investment. It was easy for customers to grow with IBM; very difficult and expensive to move away from them. IBM became the safe choice. ‘Nobody gets fired for buying from IBM’ became a familiar mantra. User emphasis on the need for high reliability in increasingly pervasive transaction processing systems further reinforced a conservative approach to procurement. As a result, the ‘DP managers’ of the day rarely engaged in appraising technology innovations from new entrants, preferring to wait for IBM to market more reliable ‘industrial strength’ versions. IBM was also perceived to be adept at using their high profile to gain access to corporate business executives, further enhancing their ability to set expectations and influence the pace of evolution.

Mainframe Era—CIO Role and Responsibilities. From the above discussion, we can see that, during the mainframe era, the *role* of the DP/IS manager—precursor of the CIO—was predominately that of an operational manager, i.e., a ‘delivery’ orientation. With the dominant supplier nearly dictating the pace and direction of applications portfolio development and procurement strategy, the key *tasks* demanded of the IS leader were to develop new systems to time and budget, and to operate existing ones to a high level of reliability.

As the era evolved (Gibson and Nolan, 1974; Nolan, 1976), the IS leader became more visible and frequently more controversial, paralleling the evolution of systems development,

implementation, and use in the organization. IS departments took on large projects with big budgets and high expectations. Accordingly, applications backlogs grew, high-profile projects often experienced runaway costs, and firms felt the impacts of operational service failures. Those experiences led to rapidly growing IS staffs, introducing issues of internal organization and personnel management. Negative systems experiences also resulted in increased scrutiny of IS departments using the types of service and financial management measures applied elsewhere in their firms. Increasingly, the IS leader and IS department were expected to understand and be responsive to the context and needs of the business.

But while the level of challenge was increasing throughout the era, the nature of the role remained essentially that of operational manager in a specialist domain. Not surprisingly therefore, the *status* of the IS leader was that of senior or middle manager reporting to an established functional head—often the first applications champion—typically the chief financial officer or perhaps the director/vice-president of operations.

Arguably the biggest evolutionary change during this era was in the *skills* and abilities sought in the IS leader (Ives and Olson, 1981). Increasingly the emphasis moved from personal technical aptitude to ‘effective management’ and communication abilities. Towards the end of the era, some companies had begun to appoint as IS leaders proven managers from elsewhere in the business. Their mandate was to instill in the IS function the necessary performance orientation, processes, and disciplines.

Role of the CIO - The Distributed Era

By the early 1980s the distributed era was becoming well established (Withington, 1980). Departmental minicomputers (often installed as a reaction to a lack of responsiveness in the IS function) had liberated the computer from the back room and invited more decentralized control over organizational computing (King, 1983). Personal computers began to proliferate rapidly on the desks of corporate staff, also commonly representing acts of independence from central IS control. However, as the era progressed, its evolution was influenced by three further developments:

- rapid developments in telecommunications technologies brought the potential to link the distributed pieces together in local and wide area networks
- the ‘client/server’ concept argued convincingly that the various elements of computing should be seen to have complementary rather than competing roles in a distributed network
- business managers at all levels learned that direct business ownership and operation of computing did not result in cost efficient or effective computing; IS professional skills—from either a coherent corporate IS organization or the rapidly growing external market for IS services—were required to manage an effective distributed network which supported organization-wide goals

By the time the web era had started to emerge, most firms had re-centralized responsibility for a standardized and enterprise-wide IT infrastructure.

Distributed Era - Applications Portfolio. At the start of the distributed era business applications developed for minicomputers and personal computers were typically targeted at the needs of local knowledge workers. Consequently, distributed technologies initially resulted in “islands” of computing in organizations, and corporate needs were subjugated to the demands of local users

(McKenney and McFarlan, 1982). Desktop computers exacerbated the tension between corporate and local needs as users experienced the responsiveness and flexibility provided by personal productivity software. However, the emergence of networking technologies, and the reworking of applications and database software to operate in distributed environments, led to a new emphasis on integration. Indeed, IT increasingly began to be perceived as a tool for enabling new levels of integration and collaboration across the functions of the business (Rockart and Short, 1989).

In the mid-1980s a series of influential articles (e.g. McFarlan, 1984; Porter and Millar, 1985) took the argument further. IT, it was suggested, was now a competitive weapon: by using technology to link activity across firm boundaries, companies such as American Airlines, American Hospital Supply and Merrill Lynch had changed the basis of competition to their own advantage. Other companies then strove to innovate with applications that linked to customers, distribution channels or suppliers. While few were seen to emulate the business success of the referenced exemplars, many had established systems that reached out along the supply chain by the end of the distributed era.

The theme of using IT as an agent of integration became evident in two other contexts. The first was globalization. As large corporations sought to co-ordinate more closely their international operations, major investments were made in data networks to support EDI and electronic mail traffic, often subsuming the corporate voice communications network as well. The second quite different development was triggered by the idea of Business Process Re-engineering (Davenport and Short, 1990; Hammer and Champy, 1993). Rather than automate existing business processes which had been evolved within a functionally driven business structure, the firm should, it was argued, re-design its processes to take advantage of the capability of new technology.

Finally the applications portfolio of the distributed era was influenced by the emergence of packaged Enterprise Resource Planning (ERP) systems. ERP offered the ultimate in systems integration: the seamless operation of all required transaction processing systems across a distributed network. Frequently encouraged by the further need to have systems which were Y2K (millennium) compliant, firms committed huge sums to ERP rollout in the later stages of the distributed era.

Distributed Era—Executive attitudes. The espousal of IT as a new competitive weapon was a high profile wake-up call for business executives. Not only did Porter—the most prominent business strategy guru of the day—add his imprimatur to the ideas of McFarlan and other information management academics, the practitioner press took up the call (e.g. *Business Week*, 1985). Increasingly business executives began to demand the development of an IT strategy that was aligned to the strategy of the business. Globalization and business process re-engineering were further boardroom-level topics that clearly had significant IT content. Later, the ‘millennium bug’ issue served to highlight to executives the extent to which their businesses had become dependent on IT.

The mad rush to develop competitive advantage through IT led to burgeoning IT costs and tumbling systems reliability. The increasing importance to the business of a robust and coherent IT infrastructure often contrasted with the situation on the ground, where multiple technical

architectures had come into use. Recessionary pressures reinforced the urgent need, in executive minds, for IT activities to be rationalized and IT costs to be brought under control and significantly reduced.

At the same time executives were becoming aware of a seductively attractive new option—the outsourcing of IT activity. IT is not a core activity of this business, the argument ran; we should look to outsource it to a world class supplier whose core business is IT. Leading IT outsourcing companies were happy to reinforce the argument with claims of substantial potential cost savings, typically on the order of 20%. The promise of ERP systems struck a further chord with many executives. Surely it made obvious economic sense to standardize on packaged software, millennium compliant and maintained for the future by the vendor, rather than allow further in-house re-invention of the necessary wheels. By the late 1990s, IT outsourcing and ERP systems were industry sectors worth tens of billions of dollars each (Lacity et al, 1996; Kirkpatrick, 1998).

But as IT in various forms became a frequent topic for the boardroom, executives found that pursuing the new ideas was not straightforward. The idea that IT was a new competitive weapon—rather than a competitive necessity—was widely questioned (Warner, 1987; Kettinger et al, 1994; Mata et al, 1995). Hammer and Champy's (1993) own warning that the failure rate of business process re-engineering might be as high as 70% was echoed elsewhere (Moad, 1993). Various authors challenged whether wholesale and simplistic IT outsourcing contracts were viable (Lacity and Hirschheim, 1993; Lacity et al, 1996; Earl, 1996). The real business benefits of massive ERP projects began to come into question (Feeny and McMullen, 1999). By the mid-1990s it was suggested (Earl and Feeny, 1994) that executive attitudes towards IT had become polarized in the distributed era. While some senior management teams viewed IT as an asset that could transform the organization, others viewed IT as a liability with uncertain benefits and high costs. Consequently, some firms invested in the development of highly competent IT organizations (Clark et al, 1997; Earl and Sampler, 1998), while others slashed IT investment spending or outsourced the entire function to save money (Huber, 1993).

Distributed Era—Dominant Suppliers. As individuals in organizations gained computing power through distributed technologies, organizations lost IBM as the guardian of their computing environments. The dominance of IBM was dispersed across a wide variety of suppliers. Microsoft and Intel emerged as the first influential suppliers of the era, as they created a demand for desktop computing products by addressing the demands of individuals, who learned to expect powerful, flexible technologies on their desktops. Concurrently, individual users learned to live with the idiosyncrasies of new technologies. They substituted a demand for “bullet proof” systems upon implementation with a demand for responsive support organizations and continuous improvement in the post-implementation stage. As corporate IT architectures came to be developed, they almost invariably featured use of the products of the so-called ‘Wintel alliance’.

Another important group of suppliers built the IT outsourcing industry. Firms like EDS, Andersen Consulting, CSC, and IBM sold economies of scale and service expertise to firms who viewed their IT functions as commodities rather than unique business competencies. The major outsourcers were particularly aggressive in approaching the business executive team directly

with offers that were hard to refuse. As a result, a number of multi-billion dollar deals involved the outsourcing of the entire IT function. Over time, however, most firms elected to selectively outsource specific IT activities (Lacity et al, 1996).

The final rise to prominence featured the software development firms—like SAP, PeopleSoft, Oracle—that built enterprise resource planning packages. While these software package providers allowed firms to outsource primary responsibility for transaction processing systems development and maintenance, major consulting firms assumed a major role in systems implementation. Most noticeably the so-called ‘big 5’ firms, who had long had access to the boardroom through their accounting activities, became involved in first BPR initiatives, then ERP projects. External providers were substituting their services for more and more of the in-house unit’s traditional activities.

Distributed Era—CIO Role and Responsibilities. With all these changes in the elements of our model it is not surprising that CIOs experienced difficult and turbulent times in the distributed era. After the relative stability of the mainframe era, CIOs had to learn and master multiple *roles* in order to survive and prosper. Earl and Feeny (1994), Ross et al (1996), Rockart et al (1996) provide examples of the pressures and imperatives that CIOs faced. We can capture the essence of their findings by identifying and discussing in turn four CIO roles for the distributed era: Organizational Designer, Technology Adviser, Technology Architect, Informed Buyer.

In the *role* of Organizational Designer, the CIO had to devise and continuously adapt an IT organization that responded to the business-side realities of the distributed era. Generally this meant the creation of a ‘federal’ IT structure (Rockart et al, 1996; Sambamurthy and Zmud, 1999) in which a central IT unit shared responsibilities for IT with IT units that were located within business units and commonly had a dotted line relationship with the CIO. The *tasks* required to fulfill this role included clearly delineating responsibilities between central and distributed units. This involved the management of a broad and dynamic array of coordinating mechanisms (Brown and Sambamurthy, 1998). At the same time, the CIO was responsible for recruiting and developing a professional staff that was both technically proficient and business oriented. Even as the selective use of IT outsourcing grew, the CIO had to ensure that the firm retained the capability to exploit the changing technology (Ross et al, 1996; Feeny and Willcocks, 1998).

The objective of the CIO’s *role* as Technology Adviser was to achieve strategic alignment between business and technology (Rockart et al, 1996). Key *tasks* within this role were two-fold. On the one hand, CIOs engaged in persistent efforts to educate business management about the opportunities presented by information technologies. On the other hand, CIOs focused IT resources on solving business problems and identifying business opportunities (Earl and Feeny, 1994). These tasks demanded a continuous investment in relationship building with business executives. In fact, studies of the activities of CIOs (Stephens et al, 1992; Applegate and Elam, 1992) indicated that they spent much more of their time outside the IT function compared to their mainframe era predecessors (Ives and Olson, 1981).

Shorn of the mainframe era’s IBM security blanket, the CIO had to support corporate-wide computing requirements even as much development and operations activity became dispersed.

Accordingly, the CIO's operational responsibilities expanded beyond those of the previous era and evolved into a Technology Architect *role* (Ross et al, 1996; Rockart et al, 1996). *Tasks* included first scanning emerging technologies to identify existing and future capabilities. The Technical Architect was also responsible for designing a corporate IT architecture that satisfied firm-wide computing needs and then persuading IT and business management of the necessity of adopting consequent technical standards. Finally, in the role of Technology Architect, the CIO was responsible for achieving high service levels across what were invariably highly complex platforms involving multiple vendors. Whether or not they used external service providers to resource some or all of these *tasks*, the CIO's personal credibility was critically affected by the track record established in this role (Earl and Feeny, 1994).

Finally, a shrewd CIO mastered the *role* of Informed Buyer, to strategically deploy external resources in a manner that maximized the effectiveness of internal resources and lowered organizational costs. The *tasks* involved included a proactive scanning of the developing IT services market; the analysis of how IT activity could be successfully disaggregated and appropriately contracted; the building of relationships with chosen suppliers; and the monitoring of service provided against both the contractual requirements and the developing capability of the marketplace (Lacity et al, 1996; Feeny and Willcocks, 1998). CIOs such as BP's Cross deliberately made intensive use of the service marketplace in order to re-orient remaining in-house IT resources in support of the Technology Adviser role (Earl and Sampler, 1998).

CIOs who mastered all four of these roles came to enjoy the *status* of executive team member during the distributed era. Whether or not they reported directly, they enjoyed excellent relationships with their CEO and indeed often achieved a special relationship (Feeny et al, 1992; McKenney, 1995). In achieving such status (many did not) the single most important role seemed to be that of Technology Adviser, the person who could successfully provide the CEO and other executives with an understanding of the role of IT within a future business vision. CIOs who convincingly fulfilled this role were forgiven relative weaknesses in other roles (Feeny et al, 1992) provided they built a strong team of subordinates. Rockart et al (1996) suggested it would become increasingly common for CIOs to create the position of Chief Technology Officer (CTO) to focus on the roles we have labeled Technology Architect and Informed Buyer.

Consequently, the most important personal *skills* for CIOs in the distributed era can be seen as those required for relationship building and for strategic and organizational development. Earl and Feeny (1994) stressed the importance of consultative/facilitation/communication skills; together with an orientation towards goals, ideas, and systems thinking. In their experience the most successful practitioners had emerged from predominantly IT backgrounds, like the 'maestros' chronicled by McKenney (1995). But Applegate and Elam (1992) noted that new CIO appointees commonly had mainly business or hybrid (business and IT) experience. And one large scale empirical study (Armstrong and Sambamurthy, 1996) concluded that the extent of the firm's IT deployment was positively associated with CIOs who had both IT and business knowledge, as perceived by other members of the business executive team. Whatever their career record, it seemed clear that successful CIOs had to demonstrate a strong business orientation and understanding, as well as a mastery of fundamentals and directions of IT.

The Web-based Era

The web-based era began with the commercial introduction of the public Internet in the early 1990s. The evolution of the Internet introduced concepts like e-commerce and e-business and a flurry of activity within existing organizations to try to understand the implications of the Internet for their business. Because the Internet was fundamentally an information technology with enormous strategic implications, its importance firmly cemented the link between IT and business strategy. As CEOs proclaimed their businesses had embraced e-commerce, IT could be seen to be influencing corporate strategy (or at least the discussions of it) to an unprecedented degree.

Technologically, the distinction between the distributed era and the web-based era is that networks in the distributed era were centrally designed around a vendor's protocols to link internal machines. Networks in the web-based era use the public Internet protocol standard (TCP/IP) which allows rapid growth in internal and external links and at much lower costs. But the felt difference between the distributed and web-based eras is that senior management's earlier concern for aligning IT with business strategy shifted to a concern for aligning business strategy with the opportunities presented by new technologies better or faster than their competitors. As we write this, the web-based era is very young and it is not clear how it will evolve; but some early developments allow us to speculate on how the web-based era might affect the role of the CIO.

Web-based Era—Applications Portfolio. The development of Internet, extranet, and intranet applications has implications for the customer interface, for the supply chain, and for intra-organizational communications. While the longer term expectations are that the Internet will drive new organizational models (Venkatraman and Henderson, 1998), the early impacts are dramatic for just a handful of organizations. New Internet firms—the darlings of investors—have emerged that substitute electronic exchange for brick-and-mortar facilities. Meanwhile existing firms have more often extended existing business models to incorporate an electronic customer interface, but they are increasingly recognizing the opportunity to offer value-added services to customers at low cost across the web.

Initial intranet applications have focused on general organizational communications. These could have useful implications for strengthening individuals' sense of belonging and their general awareness of organizational policies and services, but they are hard to view as strategic developments. Over time, intranet applications are expected to allow significant changes in the infrastructures used to share data across business units and to standardize business processes. The communications they foster will facilitate new, more virtual organizational designs (Venkatraman and Henderson, 1998). In addition, intranets have the potential to support the knowledge management initiatives that are already at the core of corporate strategies in companies such as BP (Prokesch, 1997).

Extranet applications have, in many cases, represented marginally revised electronic data interchange (EDI) applications. These, too, however, offer the potential for new and more sophisticated linkages with larger numbers of suppliers, designers, customers, and alliance partners. At GE, a purchasing extranet has allowed the firm to relax its policy of working with a

limited number of suppliers in order to minimize procurement management costs. Now GE uses the extranet to display its needs to an expanded supplier base in perpetual competition with one another (Meyer, 1999). Web-based technology is also being used to support the alternate procurement philosophy of ever closer collaboration with supplier-partners to achieve reduced time to market for new products, or the build to customer order approach of companies such as Dell.

Web-based Era—Executive Attitudes. While many executives were cynical about the “competitive advantage” applications of the 1980s, the idea of new web-based opportunities has attracted universal attention in boardrooms. The hype around Internet start-up firms and the publicity given to web applications of existing firms suggests that executives who do not move quickly may be putting their firms “at risk” (Hamel and Sampler, 1998). At the very least, CIOs are the individuals to whom executives look to ensure they have the necessary IT infrastructure in place to support e-commerce initiatives. Most often they are also expected to help senior executives understand the opportunities and the business implications of competitors’ e-commerce initiatives.

A second important factor for CIOs is that executives seem to have changed, at least temporarily, their attitudes towards investment appraisal. Given the rhetoric of ‘Internet time’, more emphasis is being placed upon urgent pursuit of promising application ideas than on the traditional and lengthy development of detailed cost benefit cases. Furthermore the investment required to pilot new ideas, and the time required for the application development, are seen to be dramatically lower than in previous eras. In the minds of executives IT-based initiatives are at last demonstrating the favorable characteristics of low cost, short time-scales, and potentially high rewards.

Web-based Era—Dominant Suppliers. The fortunes of vendors in the web-based era seem likely to rise and fall as readily as Internet start-up firms. Network systems and equipment providers such as Sun, Cisco and 3Com seem to have secure commercial positions as providers of critical components, but there is little evidence that they are influencing the strategic thinking of their corporate customers. Companies that provide technologies like browsers, portals, and search engines offer important support to firms that are forging ahead in web-based applications, but it is unclear whether they are establishing positions of lasting influence and bargaining power. Most likely the important dominance will belong to whichever of the many large suppliers now ‘betting their future on e-business’ proves the most effective. The list includes what traditionally were hardware or software companies—IBM, Hewlett Packard, Microsoft, Oracle etc; the big service companies such as EDS, CSC; the major consulting companies, including PricewaterhouseCoopers, Andersen and so on. Uncertainty currently abounds.

Web-based Era—CIO Role and Responsibilities. We saw in the distributed era how three elements of our model each presented considerable difficulties for CIOs, and their fortunes varied as a result. Earl and Feeny (1994) argued that the CIO was personally instrumental in determining whether the host organization positioned IT as liability or strategic asset. In the early years of the web-based era we see these same three model elements in a much more favorable light: executives are in listening mode, looking for ideas; there is almost unlimited scope for new applications, and it is relatively straightforward to build them quickly and securely; suppliers are

desperately keen to help, and hence secure their own position in the new era. How then will the *role* of the CIO evolve? A number of scenarios seem possible.

One clear possibility is that the CIO will take increasing responsibility for defining an organization's strategic future—as the Networker who has an unrivalled understanding of the ideas that are being deployed throughout the organization and even outside its boundaries; as the Strategic Thinker who leads the executive team in developing a business vision that captures the opportunities presented by IT; maybe even as the Entrepreneur who line-manages the market introduction of new business initiatives. The CIO surely has a better opportunity than ever before to influence the organization at the highest level.

If the CIO is not able to step up to these roles, they presumably will be distributed among other executives. There will still be a need for someone to play those of Technology Architect and Informed Buyer. But this scenario implies that the CIO essentially becomes the CTO described earlier, a valued member of the organization but a senior operating manager rather than member of the top executive team. Alternatively the CIO might migrate to another specialist role such as Chief Knowledge Officer or CKO (Earl and Scott, 1998) as the various strands of the full CIO role unravel.

In a third scenario, greater interest in IT-related issues across the organization, greater availability of external expertise, and minimal enthusiasm for centrally managed IT leads to the rebirth of decentralized IT. In this scenario, communications, networking, data, information, and knowledge initiatives spring up throughout the organization and responsibility for managing both the initiative and the underlying technology rests with the interested business. This arrangement is likely to result in pockets of innovation and excellence. Experience from the distributed era, however, has taught that this governance arrangement typically results in a high-cost, unreliable infrastructure, as well as difficulty responding to strategic imperatives. Thus, we anticipate that a lack of strong corporate IT leadership during the web-based era will invariably lead to disillusionment with IT.

To avoid the third scenario, and maximize the chances of the first, we see CIOs having to pay particular attention to a number of *tasks*. First, the CIO needs to persuade all concerned that the web-based era is more about fundamental business change than about technology. Technology is now the easy bit, relatively speaking (especially if the CIO has built a competent IT management team). The challenge is to think through new business models which address concerns about cost structures, pricing, and channel conflict; to introduce new management processes that leverage the intranet. Vision and holistic thinking rather than technology rollout are the key requirements.

Secondly, the CIO will need to argue for a greater measure of central coordination. In the web-based era, the corporation will be more directly visible to stakeholders of all varieties. As they access web sites, these stakeholders should experience a consistent and coherent picture of a purposeful company, but they may instead view a smorgasbord resulting from a myriad of individual initiatives.

Thirdly, the CIO must work with executive colleagues to define and implement approval processes appropriate to the web-based era. There has always been a temptation to do the many

things that technology allows. Now it allows many more things than ever before. A financial analysis filter is unlikely to sort the wheat from the chaff. More likely, all proposals must be ruthlessly assessed for their relevance to a small number of corporate strategic directions.

Through particular attention to these tasks, we would expect the CIO to emerge with the *status* of leading member of the executive team—increasingly an obvious candidate for a future CEO position. The *skills* they will need most seem to be those we have already rehearsed in the discussion of the distributed era—the skills of relationship building across an even wider base of stakeholders, and of strategic and organizational development in now more innovative and far-reaching directions. Although the web-based era represents a revolution in technology, for the ambitious CIO it may feel more like an evolution—with the benefit of a trailing wind!

Synthesis of the Evolution of the CIO Role

Table 1: The CIO Role and Its Driving Forces

	Mainframe Era	Distributed Era	Web-based Era
Applications Portfolio	Transaction processing from order through delivery	Knowledge worker support; inter-organizational systems; process reengineering; ERP systems	Electronic commerce; knowledge management; virtual organization and supply chain reengineering
Executive Attitudes	IT for cost displacement automation; From enthusiasm to cost-consciousness	Increased involvement in IT issues and governance; Polarization of attitudes: IT as strategic asset or cost to be minimized	IT, particularly Internet, viewed as transformational, a driver of strategy; IT investments now more attractive in terms of costs and time scales
Dominant Suppliers	IBM	Desktop providers—Microsoft, Intel; ERP Software providers—SAP, Oracle; Outsourcing companies—EDS, Andersen, CSC, IBM	Network product firms—Sun, Cisco, 3Com; Browser/Portal/Search engine providers? E-business consulting and service companies
CIO Role and Responsibilities	<i>Role:</i> Operational manager of specialist function <i>Tasks:</i> On-time delivery; Reliable operations	<i>Role:</i> Executive team member; Organizational designer; Technology advisor; Technology architect; Informed buyer <i>Tasks:</i> Manage federal IT organization; Recruit and develop staff; Educate line management; Align IT with business; Design corporate architecture; Scan technologies; Stabilize and standardize infrastructure; scan services market; Develop alliances with key vendors	<i>Role:</i> Business Visionary? <i>Tasks:</i> Develop new business models for the Internet; Introduce management processes that leverage the intranet

Table 1 brings together the highlights of our discussion of each of the three eras, and positions us to overview the evolution of the CIO role. As the table shows, we see the CIO role changing from functional manager to (potentially) business visionary as the firm evolves from the mainframe to the web-based era. However, this should be seen as a growth process. Clearly the CIO who has become successfully established as an executive team member in the distributed era is far more likely to become a business visionary than one who has not. To illustrate this idea, we can adapt a model first proposed by Hirschheim *et al* (1988) and subsequently developed by Feeny (1997) as a result of a longitudinal study of ten leading CIOs. Figure 3 shows our adapted version. It depicts growth in CIO credibility and status through three stages as a function of organizational learning.

The Evolution of the CIO Role

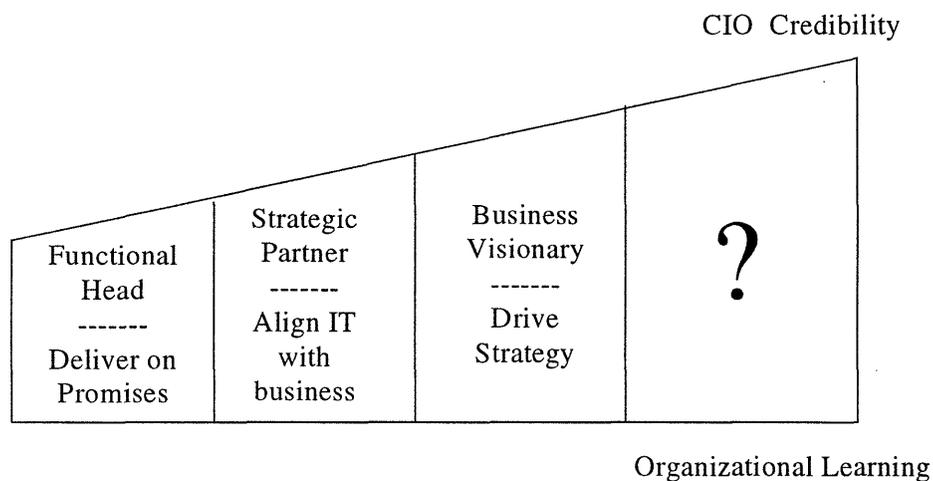


Figure 3

In the first of the three stages, the CIO is a functional head with responsibility to ‘deliver on promises.’ The promises involve developing new systems to time and budget; achieving the ROI expected when the investment was approved; and operating the portfolio of developed systems to the agreed service levels and satisfaction of the user community. The success (or otherwise) of the CIO’s track record for delivering on these promises determines the initial credibility of the CIO, and the CIO’s ability to convince executive management of the appropriateness of further investment in IT. At the same time successful organizational experience with each new system supports the organizational learning of both how to apply technology and how to recognize its value.

The credibility generated in the first stage is a prerequisite for progressing to the second stage. In this stage we have labeled the CIO's position as strategic partner, recognizing the suggestions of Henderson (1990) that CIOs should view their roles as akin to a strategic partnership with the business. The key task is to align, and be seen to align, investments in IT with strategic business priorities. This involves designing and developing a complex IT organization that can address immediate business needs while building an infrastructure that supports ongoing needs as well. Success in this stage further promotes CIO credibility and organizational learning about IT. In particular it brings the realization that IT can be integral to new ways of organizing and doing business. The approach to evaluating IT investment also begins to change as it becomes obvious that the contribution of IT cannot be meaningfully separated from the wider impacts of the strategic initiatives in which that investment is embedded.

This paves the way for the third stage, where the CIO potentially becomes a more proactive 'business visionary.' In this stage the CIO starts to be one of the main drivers of strategy by recognizing the emerging capabilities and applications of information technology, and arguing their significance to the business.

For some organizations the three stages of the model will align with the three technological eras. However, the model's potential power is to highlight two crucial points. Firstly, organizations and their CIOs do not automatically progress through the three stages as technology changes. In any of the technological eras it is possible to identify organizations and CIOs in each stage of the model. The eras determine the forces with which the CIO has to contend, not the organizational learning achieved in any specific company.

Secondly, the stages of the model define growth not substitution in the CIO's role. A CIO in stage three is still held responsible for delivering on promises and for aligning IT with business strategy as well as developing the business vision. The means of achieving the imperatives of stages one and two may have now changed, but imperatives they remain. It is therefore possible for CIOs to regress rather than progress through the stages of the model. Earl (1996) and Feeny (1997) provide instances of such regression, where CIOs were fired or pitched back from stage two to stage one due to high profile systems delivery failures or the arrival of new CEOs with different attitudes.

We suggest that the variability in CIO roles, CIO credibility, and organizational learning about IT is far greater than the variability in the positioning of firms within each of the technological eras. This is because firms are generally pushed into subsequent technological eras, whereas changes in the role and attitudes of management can evolve more slowly. Clearly, however, the model suggests that firms that are attempting to function in the web-based era with a CIO who is positioned as a stage one functional manager risk a troublesome mismatch.

Questions for Further Research

Research questions associated with the role and responsibilities of the CIO can first be reviewed by reference to debates arising in each of the technological eras. For example, in the mainframe era questions arose about the background, skills and characteristics of the effective IT manager; in particular, executives wrestled with the question of whether a business or IT background provided the best preparation for the new CIO role, and arguments continued over the

appropriate reporting line and level for the CIO. As a few firms started to unveil strategic applications of IT, organizations became interested in understanding the role of line management in systems implementation. In addition, business executives and IT management alike searched for insights into whether the IT unit should be centralized or decentralized as the applications portfolio grew to the point where multiple mainframes were a corporate commonplace. These questions have, for the most part, been researched and understood to the point where we believe they no longer prove interesting. For example, it is clear that CIOs should have both IT and business understanding, but there are plenty of examples where successful CIOs acquired missing experience in one or other area after accepting the CIO position (Applegate and Elam, 1992; Earl, 1996; Feeny, 1997). Similarly, it is clear that the optimal reporting level of the CIO depends on the firm's sophistication and expectations for the strategic use of IT—and the extent senior management expects the CIO to fulfill the role of strategic partner or business visionary. The centralization-decentralization debate is another one that depends on organizational demands for IT, although the federal model has become a dominant model that allows firms the benefits of both alternative structures (Rockart et al, 1996; Von Simson, 1990). Finally, line management's role in systems implementation includes both clarifying needs for the system and ensuring the organizational change that must accompany systems implementation (Davenport, 1993; Rockart, 1988).

A second set of research questions addresses issues that arose during the distributed era. This includes questions about how firms should govern IT and assess its value; how firms can move IT from a 'cost to be minimized' to a 'strategic asset;' and how do firms make successful IT outsourcing decisions. All of these questions have been researched, and some general parameters have been provided. However, these issues still trouble IT management. The success rate in handling these distributed era concerns is still remarkably low. Researchers can provide useful insights by identifying how to elevate current practice, perhaps by doing large-scale, multi-disciplinary research or by applying important learnings from other disciplines.

Finally, a whole set of questions is just starting to emerge that will help us better understand IT management in the web-based era. The questions will address issues such as management responsibilities for IT, business models for firms in the web-based era, the role definition of the CTOs and CKOs versus CIOs, and the development of core IT skills in organizations. Because firms are just entering into the web-based era, these questions are not, we suggest, well-suited for large-scale studies. Instead, a few leading-edge organizations can provide insights through case studies into how firms might address the opportunities and challenges that IT continues to present.

Focusing specifically on the future of the CIO we make two suggestions. Firstly, it seems the right time now to be studying the activities and time usage of CIOs in firms who are demonstrably living the web based era. Some of these firms may be long established corporations in sectors that are particularly impacted by web technology (e.g. publishing, financial services); others might be Internet start-up companies—what is the role of a CIO in Amazon.com? In E-bay? Such studies can contrast with their equivalents in earlier eras (Ives and Olson, 1981; Stephens et al, 1992; Applegate and Elam, 1992). Secondly, it may be a good time to research IT leadership by considering the future of the IT function through comparison with the evolution of other functions. Will the evolution of the IT function parallel that of finance and

accounting, with retention of a strong professional community? Will it become more like HRM where typically the HR executive takes a primarily policy role with business line managers directly responsible for execution? Does Marketing provide a better analog? Or R&D? Or will IT evolve a distinctive model of its own? More than twenty years have passed since Dearden (1987) predicted 'The withering away of the IS organization.' Whither now the CIO?

Bibliography

Ackoff, R.L., "Management Misinformation Systems," *Management Science* (14:4), 1967, pp. B147-156.

Applegate, L.J. and J.J. Elam, "New Information Systems Leaders: A Changing Role in a Changing World," *MIS Quarterly* (16:4), December 1992, pp. 469-490.

Armstrong, C.P., and Sambamurthy, V., "Creating Business Value through Information Technology: the Effects of Chief Information Officer and Top Management Team Characteristics," *Proceedings of the 17th International Conference on Information Systems*, Cleveland, Ohio December 1996, pp. 195-208.

Bock, G., Carpenter, K., and Ellen, J., "Management's Newest Star: Meet the Chief Information Officer," *Business Week*, 13 October, 1986, pp. 84-92.

Brown, C.V. and V. Sambamurthy, "Linking Intra-Organizational Stakeholders: CIO Perspectives on the Use of Coordination Mechanisms," MIT Sloan School of Management CISR Working Paper No. 304, November 1998.

Business Week, "Information Power," McGraw-Hill, New York, 14 October 1985.

Clark, C.E., Cavanaugh, N.C., Brown, C.V., and Sambamurthy, V., Building Change-readiness Capabilities in the IS Organization: Insights from the Bell Atlantic Experience," *MIS Quarterly* (21:4), December 1997, pp. 425-455.

Davenport, T.H., *Process Innovation: Reengineering Work through Information Technology*, Boston, Harvard Business School Press, 1993.

Davenport, T.H. and J.E. Short, "The New Industrial Engineering: Information Technology and Business Process Redesign," *Sloan Management Review* (31:4), pp. 11-27.

Dearden, J., "The Withering Away of the IS Organization," *Sloan Management Review* (28:4), Summer 1987, pp. 87-91.

Earl, M.J., "The Chief Information Officer: Past, Present and Future," in Earl, M. (ed.), *Information Management: The Organizational Dimension*, Oxford University Press, Oxford, 1996.

Earl, M.J., "The Risks of Outsourcing IT," *Sloan Management Review* (37:3), Spring 1996, pp. 26-32.

Earl, M.J. and D. F. Feeny, "Is Your CIO Adding Value?" *Sloan Management Review* (35:3), Spring 1994, pp. 11-20.

Earl, M.J. and J.L. Sampler, "Market Management to Transform the IT Organization," *Sloan Management Review* (39:4), Summer 1998, pp. 9-18.

Earl, M.J. and I.A. Scott, "What Is a Chief Knowledge Officer?" *Sloan Management Review* (40:2), Winter 1999, pp. 29-38.

Feeny, D.F., "The Five-year Learning of Ten IT Directors," in L. Willcocks, D. Feeny, and G. Islei (eds.) *Managing IT as a Strategic Resource*, McGraw-Hill, London, 1997.

Feeny, D.F., Edwards, B.R., and Simpson, K.M., "Understanding the CEO/CIO Relationship," *MIS Quarterly* (16:4), December 1992, pp. 435-446.

Feeny, D. F. and L.P. Willcocks, "Core IS Capabilities for Exploiting Information Technology," *Sloan Management Review* (39:3), Spring 1998, pp. 9-21.

Feeny, D.F. and McMullen, G., "Is Standardised Global IS Worth the Bother?" *Financial Times*, 1 March 1999.

Gibson, C.F. and Nolan, R.L., "Managing the Four Stages of EDP Growth," *Harvard Business Review*, January-February 1974, pp. 76-88.

Hamel, G. and J. Sampler, "The e-Corporation," *Fortune*, December 7, 1998, pp. 80-92.

Hammer, M. and J. Champy, *Re-engineering the Corporation*, New York, Harper Business, 1993.

Henderson, J.C., "Plugging into Strategic Partnerships: The Critical IS Connection," *Sloan Management Review* (31:3), Spring 1990, pp. 7-18.

Hirschheim, R., Earl, M., Feeny, D. and Lockett, M., "An Exploration into the Management of the Information Systems Function: Key Issues and an Evolutionary Model," Information Technology Management for Productivity and Competitive Advantage, IFIP TC-8 Open Conference, Singapore, March 1988.

Huber, R.L., "How Continental Bank Outsourced its 'Crown Jewels,'" *Harvard Business Review*, January-February 1993, pp. 121-129.

Ives, B. and Olson, M., "Manager or Technician? The Nature of the Information Systems Manager's Job," *MIS Quarterly* (5:4), December 1981, 49-63.

Keen, P.G.W., *Competing in Time*, Ballinger Press, Cambridge, Massachusetts, 1988.

Keen, P.G.W., *Shaping the Future: Business Design through Information Technology*, Harvard Business School Press, Boston, MA, 1991.

- Kettinger, W.J., Grover, V., Guhar, S., and Segars, A.H., "Strategic Information Systems Revisited: A Study in Sustainability and Performance," *MIS Quarterly* (18:1), March 1994.
- King, J.L., "Centralized versus Decentralized Computing: Organizational Considerations and Management Options," *Computing Surveys* (15:4), December 1983, pp. 319-349.
- Kirkpatrick, D., "The E-Ware War: Competition Comes to Enterprise Software," *Fortune*, 7 December 1998, pp. 62-68.
- Lacity, M.C. and Hirschheim, R. *Information Systems Outsourcing: Myths, Metaphors, and Realities*, Wiley, Chichester, England 1993.
- Lacity, M.C., Willcocks, L.P., and Feeny, D.F., "The Value of Selective IT Sourcing," *Sloan Management Review* (37:3), Spring 1996, pp. 13-25.
- McFarlan, F.W., "Information Technology Changes the Way You Compete," *Harvard Business Review*, May-June 1984, pp. 98-103.
- McFarlan, F.W., and Nolan, R.L., "How to Manage an IT Outsourcing Alliance," *Sloan Management Review*, volume 36, Winter 1995, pp. 9-23.
- McKenney, J.L., *Waves of Change: Business Evolution through Information Technology*, Harvard Business School Press, Boston, 1995.
- McKenney, J.L. and F.W. McFarlan, "The Information Archipelago—Maps and Bridges," *Harvard Business Review*, September-October 1982, pp. 109-119.
- Mata, F.J., Fuerst, W.L., and Barney, J.B., "Information Technology and Sustained Competitive Advantage: A Resource-Based Analysis," *MIS Quarterly* (19:4), December 1995.
- Meyer, A. "GE's Trading Process Network: Business Buying and Selling via the Web," 1999.
- Moad, J., "Does Reengineering Really Work?" *Datamation*, August 1, 1993, pp. 22-28.
- Nolan, R.L. "Business Needs a New Breed of EDP Manager," *Harvard Business Review*, March-April 1976, 123-133.
- Porter, M.E., and Millar, V.E., "How Information Gives you Competitive Advantage," *Harvard Business Review*, July-August 1985, pp. 149-160.
- Prokesch, S.E., "Unleashing the Power of Learning: An Interview with British Petroleum's John Browne," *Harvard Business Review*, September-October 1997, pp. 5-19.
- Raghunathan, B. and Raghunathan, T.S., "Relationship of the Rank of Information Systems Executive to the Organizational Role and Planning Dimensions of Information Systems," *Journal of Management Information Systems* (6:1), Summer 1989, pp. 111-126.

- Rockart, J.F., "Chief Executives Define Their Own Data Needs," *Harvard Business Review*, March-April, 1979, 81-92.
- Rockart, J.F., "The Line Takes the Leadership—IS Management in a Wired Society," (29:4), *Sloan Management Review*, Summer 1988, pp. 57-64.
- Rockart, J.F., Ball, L., and Bullen, C.V., "Future Role of the Information Systems Executive," *MIS Quarterly*, Special Issue, 1982, 1-14.
- Rockart, J.F., Earl, M.J., and Ross, J.W., "Eight Imperatives for the New IT Organization," *Sloan Management Review* (38:1), Fall 1996, pp. 43-55.
- Rockart, J.F. and J.E. Short, "IT in the 1990s: Managing Organizational Interdependence," *Sloan Management Review* (30:2), Winter 1989, pp. 7-17.
- Rothfeder, J. and Driscoll, L., "CIO is starting to stand for Career Is Over," *Business Week*, February 26, 1990, pp. 47-48.
- Ross, J.W., Beath, C.M, and Goodhue, D.L., "Develop Long-Term Competitiveness through IT Assets," *Sloan Management Review* (38:1), Fall 1996, pp. 31-42.
- Sambamurthy, V., and Zmud, R.W., "Arrangements for Information Technology Governance: A Theory of Multiple Contingencies," *MIS Quarterly* (23:2), June 1999, pp. 261-288.
- Stephens, C.S., Ledbetter, W.N., Mitra, A., and Ford, F.N., "Executive or Functional Manager? The Nature of the CIO's Job," *MIS Quarterly* (16:4), December 1992, pp. 449-468.
- Venkatraman, N. and J.C. Henderson, "Real Strategies for Virtual Organizing," *Sloan Management Review* (40:1), Fall 1998, pp. 33-48.
- Von Simson, E.M., The 'Centrally Decentralized' IS Organization, *Harvard Business Review*, July-August 1990, pp. 158-162.
- Warner, T., "Information Technology as Competitive Burden," *Sloan Management Review* (29:1), Fall 1987, pp. 55-61.
- Withington, F.G. "Coping with Computer Proliferation," *Harvard Business Review*, May-June 1980, pp. 151-164.
- Zani, W.M., "Blueprint for MIS," *Harvard Business Review*, November-December 1970, pp.95-100.