

HOW CIOs BALANCE FLEXIBILITY AND RELIABILITY IN UNCERTAIN BUSINESS ENVIRONMENTS

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ABSTRACT

The Information Technology (IT) organization has evolved from a backroom support function to a strategic business partner in organizations that use information technology to provide competitive advantages. Today, IT organizations operate within turbulent business environments dealing with change and uncertainty, supporting businesses struggling to survive while also demanding advanced IT to stay competitive. Rapidly changing IT is a major component of turbulent business environments. This results in an IT management paradox – rather than stabilize IT infrastructures and minimize technology changes, chief information officers (CIOs) should be encouraging and embracing the very IT improvements that are contributing to the turbulent business environments. They must be aware of the environmental impact of change and uncertainty and develop flexible IT organizations to minimize threats and leverage opportunities. The long term goal of this research is to develop an IT flexibility framework to create and manage an IT organization that is flexible and agile, yet is still reliable and cost-effective. This paper focuses on the early aspects of this research – understanding how conditions affecting change and uncertainty impact the IT organizations and its flexibility.

Keywords: Environmental change, environmental uncertainty, IT flexibility, IT organizational change, CIO leadership.

1. INTRODUCTION

The increasing reliance on information technology (IT) is changing the way companies do business. Global organizations require intense sharing of information to allow cooperation, coordination, and teamwork in partnerships and strategic alliances (Benamati and Lederer, 2000; Dhillon and Hackney, 2000). Information technology has removed the geographical constraints of where and when work is accomplished (Patten, 2000). As a result of this increased need for information technology, the IT organization has evolved from a backroom support function to a strategic business partner in organizations using information technology to provide a competitive advantage (Applegate, et al., 1999). As businesses struggle to grow their business and achieve a sustainable competitive advantage, they also have increased the use of information technology (IT) (Santos and Fjermestad, 2002; Malhorta, 1993; Tushman and Nadler, 1978).

But, information technology is also rapidly changing, making it difficult to make decisions concerning when and where to deploy new technology while balancing the investment of technology with maintaining the existing IT infrastructure. Rapidly changing IT also contributes to the turbulence of the business environment. Turbulent business environments are created by technological, economic, and social change according to Purser and Passmore (1992). These turbulent business environments result in high degree of unpredictability leading to business uncertainty (Scott, 1992; Burns and Stalker, 1961). Malhorta (1993) further described a form of IT paradox where IT solutions lead to increased complexity and uncertainty in the environment, thus increasing the demand for more advanced IT. Businesses then use the new emerging IT in increasingly more sophisticated ways to become more competitive. Malhorta developed a proposition that “increasingly turbulent environment would feed the need for further [and greater]

advancements in IT, which would further increase turbulence” (section 4), a form of a turbulent IT spiral.

Since IT organizations also operate in turbulent IT business environments, chief information officers (CIOs) and senior IT executives must be able to develop strategies to exploit opportunities and coping mechanisms to minimize threats. Unfortunately, research has shown that IT organizations may be more difficult to manage than other organizations, that IT executives are not well adapted to managing successfully in turbulent environments, and that the IT organization may be one of the least flexible organizations within the firm (Roepke, et al., 2000; Rackoff, et al., 1985; Starling, 1980).

Traditional IT organizations use long-term planning and control strategies that have proven efficient and successful in stable environments. Dietrich and Shipley (1999) pointed out that the IT environment is “anything but stable.” They postulated that IT organizations must develop a new model of business that is both more responsive and also proactive. Instead of reacting to change, CIOs must create and lead a new type of IT organization that acts as a change agent and sets an example for flexibility and adaptability (Drucker, 1974; Gottschalk and Taylor, 2000; Rockart, et al., 1996). In this new IT model, CIOs must balance innovation with efficiency while dealing with the change and uncertainties in today’s competitive world. They must make difficult IT technology choices based on user needs that are continuously changing and often conflicting, technology budgets that are shrinking, and technologies that are rapidly changing. Once the difficult choices are made, they must implement the new technology in shorter timeframes while focusing on their customers’ changing needs. Even in stable, predictable environments, IT projects typically have budget overruns and delays (Cash, et al., 1988; Jiang, et al., 1996). Changing technologies and economic conditions lead to unanticipated needs for new employee skills, user training, the re-allocation of personnel and resources, and the need to merge old technology, impacting carefully prepared plans and budgets. And, finally, change and uncertainty affect both the IT strategy and the corporate business strategy impacting their alignment (Reich and Benbasat, 1996) and the potential technology business benefits.

1.1. IT Management Dilemma

This leads to an IT management dilemma – rather than stabilizing IT infrastructures and minimizing technology changes, CIOs should be encouraging and embracing the very IT improvements that are contributing to the complexity and demand for new IT. CIOs must leverage IT investments to meet business needs to increase and sustain a competitive advantage, while balancing these business needs with stability and reliability (Kearns and Lederer, 1999; Yoon and McLean, 1995). To be successful in rapidly changing business environments, CIOs should be aware of the environmental impact of change and uncertainty and develop a flexible IT organization to deal with change and uncertainty to minimize threats and leverage opportunities. IT research in many different areas often recommends that IT organization should be more flexible and, as a result, the organization will be more successful dealing with changes and uncertainty. But, most research doesn’t define what is meant by flexible? What should be flexible: the IT organization, the people, the technology? How is flexibility developed, how is it managed? The long term goal of this research is to develop a framework to create an IT organization that is flexible and agile, yet is still reliable and cost-effective.

1.2. Research Proposal

The long term research proposal is that *a flexible IT organization will better be able to deal with change and uncertainty. The flexible IT organization must have three major characteristics: environmental awareness (of change and uncertainties); increasing speed of response (agility); and increasing innovation.*

This paper focuses on the early aspects of this research. Before developing an IT flexibility framework, this research-in-progress is intended to first understand:

1. What are the types of change and degrees of uncertainty that affect IT organizations.
2. What are the impacts of change and uncertainty on the roles and responsibilities of the people within IT organizations.
3. How do IT organizations deal with change and uncertainty based on current practices and previous experiences.

4. What are the flexibility theories and frameworks that relate to IT organizations.
5. What are the needs of CIOs or senior IT executives as they apply flexibility theories and frameworks to develop and manage IT organizations that support the competitive use of IT in the global firm.

Once, we understand the conditions affecting change, uncertainty, and IT organizations and flexibility, we plan to develop an IT flexibility framework that provides recommendations for a new type of IT organization, one that is well-organized and reliable, yet one that is agile and flexible. Future research will develop specific hypotheses for leading and managing this new type of IT organization and field experiments to test the performance of this new IT organization and its success dealing with changing and uncertain business environments.

The remainder of this paper includes a literature review about the impacts of turbulent business environments, business change theories, flexibility theories, IT organizational change, and CIO leadership roles and responsibilities. The subsequent section describes the proposed exploratory research and survey using a field survey and semi-structured interviews of CIOs and other business executives. The last section discusses the contributions of this preliminary research and plans for future research into developing and managing a flexible IT organization

2. LITERATURE REVIEW

The literature review covers research about the types and impacts of change and uncertainty resulting from turbulent business environments. It reviews theories and frameworks regarding organizational change and flexibility. It also discussed IT organizations, their structures, and needs for flexibility. Finally, it also includes information about the roles and responsibilities of the CIOs and senior executive officers acting as change agents.

2.1. Turbulent IT Business Environment

Starling (1980) defines the external environment as those forces that drive the behavior of an organization, but come from outside the organization's boundaries. This includes suppliers, customers, employees, shareholders, and competitors. A key aspect of highly competitive, rapidly changing, turbulent environments is environmental uncertainty. Changes in the business environment are both expected, requiring strategic and tactical plans to manage change, and unexpected, which increase the level of uncertainty within the firm. Uncertainty is defined as the difference between the amount of information required to perform a task and the amount of information actually possessed by the organization (Galbraith, 1973). IT research has identified methods to manage IT changes from a more traditional, reactive perspective. However, the reduction of uncertainty and managing change to increase opportunities requires a more proactive approach. The impact of business uncertainty occurring in turbulent IT environments differs by industry and by whether an organization is information-intensive or not. Information intensity refers to the amount of information necessary for the acquisition, transformation, and delivery of resources to the customer (Reich and Benbasat, 1996). Yoon and McLean (1995) defined information intensity as the combination of the reach of IT internally and externally and the richer range or modes of information generated. Cash, et al., (1988) demonstrated that information intensive industries have more opportunities for strategic benefits resulting from IT.

The environment significantly influences the structure of an organization. Burns and Stalker (1961) defined two types of organizational structures adapted to meet environment requirements. Mechanistic structures are for businesses operating in unchanging, stable environments, while organic or flexible structures should be adopted by businesses operating in turbulent environments. Benamati and Lederer (2000) further defined two ways that organizations interact with their environment. The first is *environmental determinism*, when the environment dominates organizations requiring the organizations to react to problems caused by environmental change. The second is *strategic choice*, when the organization interacts with its environment and takes proactive action to minimize negative impact and create opportunities from environmental change. IT organizations usually fall in one or the other based on its actions or lack of actions. Proactive IT executives seek change, while reactive managers avoid change.

Kearns and Lederer (1999) described how IT executives exhibit strategic choice in turbulent environments by seeking an appropriate *fit* of IT to business processes. This involves the participation of the firm's Chief Executive Officer (CEO) and other functional business managers. A number of studies have demonstrated that information-intensive companies are more successful planning IT strategies and using IT-based resources for a competitive advantage (Porter, 1980; Bergeron, et al., 1991; Reich and Benbasat, 1996), but little research has considered the role of strategic planning in turbulent environments. Business declines also contribute to turbulence. Leidner, et al., (2003) identified approaches used by CIOs to manage uncertainty when the budgets are reduced. However, do the same approaches to managing uncertainty work when the needs for competitive IT investments are increasing? CIOs also must consider the impact on IT plans from the involvement of external stakeholders, business partners, and customers when balancing IT demands and investments (Rockart, et al., 1996).

IT executives who follow "environmental determinism" theory often react to uncertainty problems by using coping mechanisms. Benamati and Lederer (2000, 2001) conducted several different research studies on coping mechanisms for changing IT. One critical finding from these studies was that IT managers use coping mechanisms that they perceive will alleviate the problems, however, they generally do not use mechanisms that they perceive are the most successful. For example, two of the most commonly used coping mechanisms are "pressuring vendors to provide support" and "teaching oneself," both of which are also considered to be less effective. Benamati and Lederer (2000, 2001) speculate that IT managers use coping mechanisms that are less expensive rather than using mechanisms that were more successful such as "maintain your own training staff" and "document differences between new and previous IT." Little research has been conducted in this area to determine why IT managers do not seem to know how to cope successfully with uncertainty, do not spend money to cope, and do not know if certain planning processes, used in the past, were successful or not. These studies showed that many IT organizations tend to either ignore problems or work around problems caused by changing IT. Changing IT requires IT professionals to have different skills and competencies. Yet, endurance or working around the problems is the second most common coping category. Benamati and Lederer (2000, 2001) concluded that it appears that IT organizations do not know what works and does not work.

Other IT uncertainty research concluded that increased uncertainty heightens the need for different organizational structures and integration of the IT strategy with the firm's business plan (Khandwalla, 1972). McFarlan (1971) found that environmental uncertainty expands the role for IT planning.

2.2. Change Theories

Van de Ven and Poole (1995, p. 512) defined change as the "empirical observation of difference in form, quality, or state over time in an organizational entity." They identified four theories that explain change. The first theory is the *life-cycle*, an organic growth from initiation to death or termination. For product life-cycles, the stages are introduction, growth, maturity, and decline. The second theory is *teleology*, when the purpose or goal guides change. Development proceeds towards a planned end state. The end state can be continuously modified based on evaluations. External influences also can force a new path. The third theory is *dialectics*, a win-lose form of change embracing opposing views of constant conflict. Finally, the fourth theory is *evolution*, going through cycles of variation, selection and retention.

IT organizations most often adopt either the life-cycle or the teleology theory of change when implementing new IT technologies, products, and services. Sometimes, IT organizations also follow evolution theories when technology capabilities evolve over time. On the other hand, users of IT within a firm may consider the implementation of new IT systems as dialectic. As a result, they resist the new technologies because they fear losing perceived power or capabilities. The ability to change continuously has become necessary in an era with growing convergence of telecommunications and consumer electronics, new multimedia applications, and the Internet explosion. The IT organization must help the firm maintain a balance between order and chaos and between the past and future (Brown and Eisenhardt, 1997). Therefore firms need to acquire a broad set of in-house multidisciplinary capabilities and core technological competencies.

Galy and LeMaster (2001) compared performance differences between organizations that exhibit *pioneering* changes versus *strategic* changes. The key difference is based on how organizations either create continuous incremental effort to adapt to change, or radically create revolutionary change. To determine which situation applies, the IT organization must know when and how to change and to identify all the potential impacts of known changes. This study on pioneering change demonstrated that change is accelerated by technological developments and, to be successful, organizations must follow suit. Conflicts occur based on the choices made concerning change. Cyclical change is predictable and comforting. Revolutionary change brings chaos to the order in the organization (Galy and LeMaster, 2001).

2.3. Information Technology (IT) Organization

The definition of information technology (IT) differs depending on context. As a result, we must define what is meant by *IT organization*. Some consider the IT organization as the organization that plans, installs, and maintains the *hardware* or the physical IT infrastructure. Others would add the *software* or the informational aspects of IT systems to the function of the IT organization. A third view is to consider the *cognitive* nature of the IT functions including the IT tasks and individuals within the organization. And, finally, the fourth perspective is to add the *social* aspect including the management procedures and group considerations of the organization as the whole system (El Sawy, 2001). For this research, we define the term *IT organization* to include all four aspects of information technology management. Table 1 summarizes these four views as they apply to IT organization.

Table 1. Four Views of Information Technology (IT) Organization

	Aspect	Description	IT roles
4th	Social	procedures, processes, policies, group behavior	organizational structure, governance, and management styles
3rd	cognitive	task, individual behavior	OAMP (operations, administration, maintenance, and planning)
2nd	Software	information systems	systems analyst
1st	Hardware	physical infrastructure	Architect

The traditional IT organization is a services-based internal organization that includes the management of an information technology infrastructure and its related products and services. Its customers are usually the employees of all other departments or organizations within the firm. All large corporations and most medium-sized businesses have internal IT organization. Even small businesses have internal IT usually managed by a few individuals who also have other responsibilities. Over the last twenty years, the structure of the IT organization has evolved from being a *utility* to a *business within a business* providing traditional operations and maintenance functions as well as customer services, marketing, and new IT product and services development (Keen, 1988; Patten, 2000).

Applegate, McFarlan, and McKenney (1999) compare traditional organizational models including bureaucratic, hierarchy, entrepreneurial, matrix, and adhocracy. Each is discussed in terms of its environmental and organizational context, its power structure, its people, and its management and operating processes. IT organizations currently exist that are governed using each of these models. Keen (1988) describes a hybrid model, referred to as the federated organization, which centralizes the direction, coordination of policy, and control of the IT infrastructure, while distributing location-independent functional business applications development. This model balances local flexibility with central control and coordination. Highlights of this model include the use of distributed computer supported teams, groupware, and decision support applications.

Another useful way of considering the IT organization is to look at its evolution over time and pinpoint the evolutionary stage of a specific IT organization. A number of researchers, including Applegate, et al., (1999) and Keen (1988), trace the evolution through three eras based

on the IT infrastructure including the *Mainframe Era* (1960s-1970s), the *Personal Computing and early Telecom Era* (1980s-1990s) and the *Network Computing Era* (1990s to present). Another way to consider IT evolution is to focus on the customers and the manner in which products and services are delivered. Keen (1988) traces the evolution of telecommunications management from the early *operations* focus of keeping the network running as efficiently as possible (early 1980s) to an *internal utility* focus with several common packages selected by customers at fixed prices (late 1980-early 1990s) until the present day *business within a business* focus managing the internal organization as a fully functional business organization with operations, planning, customer support, marketing and research and development departments (Patten, 2000.).

The Leavitt Diamond (Leavitt, 1965) is a conceptual framework that may be used to help transform IT organizations (El Sawy, 2001; Sarker, 2000). In this model, the organization includes four interacting components: task, structure, people, technology. El Sawy modified the Leavitt Diamond giving it an information technology perspective as shown in Figure 1. The value of this model is recognizing the interaction of the components. If one is changed in any way, the others must also be changed so that the system, in this case the IT organization, remains balanced or in equilibrium. Different types of organizational change perspectives usually look at only one component at a time, such as the IT-driven perspective or an human resource (HR) perspective. Ideally, any planned transformation of the IT organization should consider all components from the start.

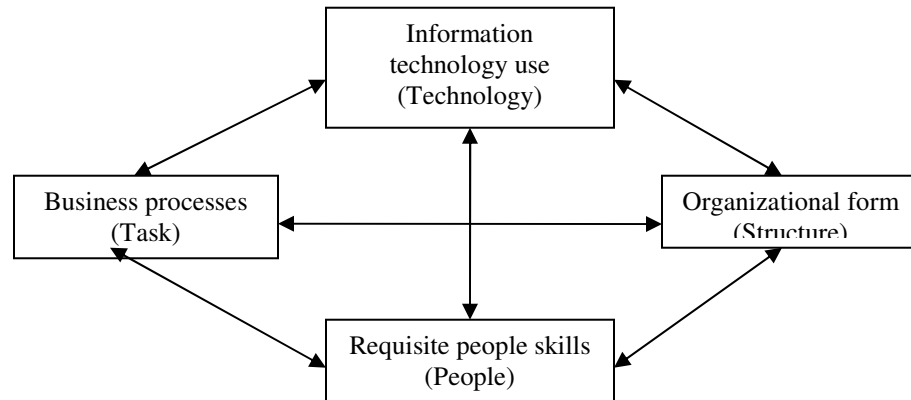


Figure 1: An Information Technology Representation of the Leavitt Diamond
(Source: El Sawy, 2001, Figure 1-2, p. 9)

2.4. IT Organizational Flexibility

Flexibility is currently used to describe a wide range of forms of work, organizations, individuals, plans, etc. Tiernari and Tainio (1999) define flexibility as the ability to respond to fast and unpredictable changes in increasingly turbulent business environments. Byrd and Turner (2001) referred to the degree to which an organization possesses a variety of actual and potential procedures to increase controls by management and controllability of the organization over its environment as flexibility. High flexibility implied that an organization has high control over its environment. Organizations are providing *just-in-time* manufacturing, inventories, sales, etc., as they strive to increase time-efficient delivery of services. Types of flexibility include numerical, temporal, functional, and locational (Burchell, 1998). Numerical flexibility is the balance of part time and full time employees to balance workload during periods of growth and decline. Temporal flexibility is changing when work must be performed from the traditional work day. Examples include formal telecommuting and teleworking programs introduced in the last ten to fifteen years. Functional flexibility provides employees and employee teams with the training and opportunities to perform different types of tasks thus encouraging job enrichment. Locational flexibility means that work can be performed wherever appropriate. Teams can be created regardless of geography and time zones to include the best skills and experiences as needed.

Organizational flexibility balances different extremes such as formal and informal, centralization and decentralization, and bureaucracy and adhocracy (Sushil, 2000). Flexibility is also referred to as responsiveness, agility, versatility, and adaptiveness (Tienari and Tainio, 1999; Evans, 1991). Terreberry (1968) hypothesized that *organizational adaptability* is a function of the ability to learn and to perform according to changing environmental contingencies. Research has shown the ability to respond to customer's needs as quickly as possible is the hallmark of successful service firms. As a result, highly-structured organizations are becoming more flexible (Townsend, 1998.)

IT executives struggle with the conflicting mission of providing a robust and scalable IT infrastructure at the same time, lowering costs and being efficient. New IT implementations often result in three different impacts on the firm: shifts in real and perceived power and influence; job enrichment and job deskilling; and increases in long-term market share at the cost of short term profits. The same IT solution may benefit some functional organizations while being detrimental for others. Silver, et al., (1995) identifies ways where IT technology investments may actually hinder the flexibility of business processes and the effectiveness of the organization because the IT infrastructure is inflexible. The infrastructure needs to be both robust and scalable IT, yet maintained at lower costs and be efficient. The underlying question is how should IT executives provide an IT infrastructure that is flexible, yet efficient and effective?

Earlier research on the alignment of IT with business strategy assumed a static environment (Roepke, et al., 1999). The alignment of IT to the business in dynamic environments requires flexibility to deal with business changes and uncertainty. Knoll and Javenpaa (1994) defined "flexibility" as the ability of software to change or *fit* the changing turbulent environment. Nadler and Tushman (1980) defined *fit* as the degree to which the needs, demands, goals, objectives, and/or structure of one component are consistent with those of another component. Applying the same definition to the IT organization, requires us to answer the question of how should the IT organization change to *fit* the changing environment? Do we change the structure, the leadership, the employee skill base, etc.?

Knoll and Javenpaa (1994) defined three different types of flexibility as it applies to the IT infrastructure flexibility: its *functionality*, where the system or component remains stable while inputs and conditions change; its *use*, which deals with strategic outcomes and proactive opportunities; and its *modification*, which refers to the ease and variability of changes to the processes and the technology. Evans (1991) also identified three flexibility dimension categories including yielding to pressure, capacity for new situations, and susceptibility to modification. Knoll and Javenpaa (1994) identified twenty IT flexibility dimensions mapped to Evan's three types of flexibility. They referred to this as the "IT Dimensions of Flexibility." Some of these include robustness, scalability, trialability, connectivity, modularity, reusability, etc. They defined sample measures for each of these dimensions. Could the "IT Dimensions of Flexibility" performance measures be used to measure and evaluate the performance of the entire IT organization?

Flexible IT organizations should be able to (1) precipitate intentional changes, (2) continuously respond to unanticipated changes, and (3) adjust to unexpected consequences of predictable changes (Knoll and Javenpaa 1994; Bahrami 1992). To do this, the IT organization should become more flexible – the ability to rearrange the organizational structure and processes resulting in improvements and stability within the environment (Davis and Olson 1985; Knoll and Javenpaa 1994). Other terms that refer to flexible management characteristics include adaptability, agility, corrigibility, elasticity, hedging, liquidity, malleability, plasticity, pliability, resilience, robustness, and versatility (Evans 1991).

Stalk and Hout (1990) define flexibility as the ability to provide rapid response, expand the variety of products and services, and increase innovations. They described how organizations attempt to transform themselves and create competitive advantages from change and uncertainty with two approaches: restructuring or through time compression. Restructuring is considered a reductive process where activities are compressed using fewer people. On the other hand, time compression considers the entire picture and looks for ways to do more work and add more value from the time savings. Time compression focuses on the customer. The goal is to determine the needs of the customer and serve them better than the competitors by maximizing speed and variety.

When applied to the IT organization, this requires responsiveness and coordination of all parts of the business. Stalk and Hout (1990, p. 56) recommend that an organization should use “closed-loop cells, “self-contained, multifunctional, self-scheduling, sub-organizations empowered to perform the key activities required to meet explicit objectives.” Time compression and closed-loop cells transforms the traditional organization into a flexible one with low overhead by using short operating and change cycles and employees who are continuously learning and gaining more experience.

2.5. CIO and IT Executive Roles and Responsibilities

Research on IT organizations in turbulent business environments identified a number of responsibilities relating to IT impacts and change management. The IT organization should act as a change agent for the firm. It does this by suggesting new business strategies, new information-based products, and coordinating developmental user needs (Gottschalk and Taylor, 2000). “The manager’s job has been enormously changed as a result of turbulent change and increased complexity in the external business environment” (Starling, 1980, p.1). The CIO position is also continuously evolving. One key is that the CIO must develop both a business and an IT perspective. Earlier research about the CIO focused either on the *micro* level, the executive’s activities and contacts, or the *macro* level, dealing with issues, strategies, and objectives (Applegate and Elam, 1992; Stephens, et al., 1992). CIOs are also becoming more strategic while functional IT managers are assuming more of the planning, implementing, and operating responsibilities (Gottschald and Taylor, 2000.) The strategic role of the CIO is also becoming more complex, requiring leadership attributes that are visionary and collaborative.

To be flexible, all the IT materials, skills, knowledge, and practices used to operate, develop, and manage computer and telecommunications systems within an organization must be considered when designing the organizational structure and business processes. (Davis and Olson, 1985). This should enhance the IT organization’s ability to assist the firm in achieving competitive advantages and seeking new business opportunities. A CIO responsibility should be to reduce uncertainty by perceiving, reviewing, and analyzing the external environment to anticipate and plan for sudden changes (Benamati and Lederer, 2000; Starling, 1980).

The evolution of the IT organization is affected by the growing user influence on IT investment decisions, the growing array of technological choices, more literate and demanding user groups, and pressure from executives to expeditiously deploy and support critical organizational needs (Grover, et al., 1998). Peter Drucker (1974) identified two major managerial functions dealing with change and its impact on the business environment. The first is to identify business challenges including technological change, economic uncertainty, and new regulations and competitors. The second is to understand shifts in people’s values and perceptions and to insure economic performance. This hasn’t changed over the last thirty years. The success of CIOs in the future will depend on their ability to anticipate and deal with change and uncertainty.

Keen (1988) identified key characteristics for successful IT executives. Executives must be aware of the importance of the IT assets and be able to turn that awareness into action. They must have extensive knowledge of their customer needs so that they can successfully exploit opportunities and understand the actual customer motivations, not the perceived. They gain this understanding by doing customer research, not market research. The IT executive must know the difference between IT architecture and architects. The architecture is the blueprint and the rules for the IT infrastructure. It is critical that a senior IT executive be considered as the architect responsible for the design of the IT infrastructure. All the information technology functions must be integrated to insure that the IT infrastructure is composed of integrated technology and for critical for integrated thinking and skill-building. An important element is that the IT executives must also be able to change the culture of the organization along with the strategy.

Even though change is constant, the IT executive still needs to *foresee* the future needs because it is critical that the IT infrastructure be in place when the demand occurs. This still requires a strategic long-term planning window. Keen (1988) emphasizes that the executives should *think ahead and compete in time!* He reminds IT managers that this long-term focus requires managerial courage because *if innovation were easy, everyone would do it.* IT executives should recognize that if innovation were easily cost-justifiable and guaranteed, there would be no risk. Also, if information technology were only about technical operations, then strategic and

tactical business managers would not be needed. By educating all the IT employees, the IT organization will build senior manager awareness and actions and be ahead of the change curve when its managers think ahead and move in current time. This will require IT executives with boldness, real commitment, and business leadership.

Flexibility also leads to rapid response, expanding variety, increasing innovation (Stalk and Hout, 1990). Keen (1988, p. 247) advises that “time, not technology, is the strategic management issue” and “planning should start with the opportunity, not the technology” (p. 21). To be successful, IT managers must emphasize *speed* in the action phase. Reactive managers suffer late recognition, disparate views, plus extra cost of studies and the constant formal upward reviews. IT executives should be alert to potential barriers (Stalk and Hout, 1990) to adding *speed* and *responsiveness* to the IT organization. These include long-design and ramp-up cycles, which increase the potential for changes, and when events spin out of control of management. Changes in specifications will usually delay or disrupt the development process. Other potential barriers include the impact of non-located program resources and the ways that support functions can delay development programs. And, finally, one potential barrier that is often overlooked is the disruptive influence of reward measurement systems and conflicting goals. Managers can cause more problems than technical problems in product development programs. Managers often make unnecessary personnel changes in the name of grooming that result in the turnover of program management and design team members.

Keen (1988) recommends that the IT executives should take charge of change, and not react to change. This requires challenging the existing processes for design and delivery of IT products and services. For example, the payoffs for technology investments are based on the changes to work from the new applications. All IT departments (telecommunications, information systems, etc.) should be integrated into one organization to encourage integrated thinking. Standards and procedures will balance the need for central coordination. The business vision and technical architecture benefits should be conveyed and understood by all managers. IT executives should create a new organization that is staffed with groups of *specialists*. This will result in creativity, speed, and flexibility advantages as opposed to organizations staffed with *generalists* that are based on building size and reputation.

3. DISCUSSION

To become more flexible, CIOs should understand the impact of change and uncertainty and anticipate the potential benefits wherever possible. The management challenge is to “take charge of change, not react to it” (Keen, 1988, p. 38). In this paper, we define agility as the *speed of response* to potential changes.

We also define innovation as taking advantage of potential opportunities by developing new IT products and services by reusing existing technologies, implementing new emerging technologies, reengineering processes and procedures, and educating IT employees. The bottom line measure of success is that the IT organization is able to focus on its internal customers and add IT value.

Table 2 expands on the earlier analysis of the four aspects of an IT organization by adding a flexibility element to the IT organization. If we want a flexible IT organizations, then every aspect of the organization should also be flexible. Every IT organization could analyze its *flexibility* quotient by exploring how flexible it is from each of the four aspects. The problem is how to quantify the degree of flexibility in each aspect. A particular IT organization may have a very flexible infrastructure, but inflexible software systems. The structure of the IT organization may be decentralized and it may have flexible procedures and policies, but an inflexible infrastructure will limit the organization’s success. In other words, most IT organizations will have some level of flexibility, but this level of flexibility may or may not lead to IT success. This in turn may not help the IT organization support its corporate competitive strategies through the use of information technology.

Table 2: Four Aspects of Flexible Information Technology (IT) Management

	Aspect	Description	IT roles	Flexible IT
4th	social	procedures, processes, policies, group behavior	organizational structure, governance, and management	flexible IT organization
3rd	cognitive	tasks, individual behavior	OAMP (operations, administration, maintenance, and planning)	flexible IT individuals, skills
2nd	software	information systems	systems analyst	flexible software
1st	hardware	physical infrastructure	architect	flexible hardware

4. EXPLORATORY RESEARCH METHODOLOGY

This research study builds on the work of earlier researchers. Leidner, et al., (2003) asked “How CIOs manage IT in economic decline.” This research explores the larger question, “How CIOs should manage change and uncertainty.” More specifically, can CIOs develop and lead an IT organization and infrastructure that is flexible? This research proposes to identify and prepare recommendations concerning how CIOs currently manage uncertainty and change. We plan to conduct exploratory research using semi-structured interviews with ten CIOs and IT executives to identify the issues and problems occurring from change and uncertainty and to test the concepts necessary to develop an IT flexibility framework. Based on the information learned through the semi-structured interviews, we plan to conduct a formal survey of CIOs, IT executives, functional managers, and external suppliers and stakeholders in over sixty firms in the New Jersey USA. The formal surveys will be collecting information concerning:

1. The types of change and degrees of uncertainty affecting IT organizations.
2. The impacts of change and uncertainty on the roles and responsibilities of the people within IT organizations.
3. Practices and processes used by IT organizations to deal with change and uncertainty based on current practices and previous experiences.

The formal survey will also be used to test the proposed flexibility framework based on flexibility theories and time-based management best practices. Once, we understand the conditions affecting change, uncertainty, and IT organizations and flexibility, we plan to develop an IT flexibility framework that provides recommendations for a new type of IT organization, one that is well-organized and reliable, yet one that is agile and flexible. Future research will develop specific hypotheses for leading and managing this new type of IT organization and field experiments to test this new IT organization and its impact in turbulent business environments.

5. PROPOSED CONTRIBUTION AND FUTURE RESEARCH

The early stages of this research should help to develop standardized definitions and characteristics of the impact of change and uncertainty on IT management and the need for flexibility within the IT organization. This should help IT professionals to compare and evaluate the flexibility of their own IT organizations. Secondly, this research should identify the IT organizational characteristics and management practices that must be in place to be considered a flexible IT organization. This information will be used to develop a flexibility framework for IT organizations.

This research study specifically builds on several implications for future research listed by Benamati and Lederer (2000): (1) Evaluate different organization characteristics and behaviors from different environmental conditions; and (2) identify the nature of IT change and resulting problems. As mentioned earlier, this research will lead to future experiments to validate two

hypotheses: 1. Improved IT organizational flexibility leads to improved IT success; and 2. successful IT organizations are also flexible.

In conclusion, CIOs need to reduce the impact of change and uncertainty on the IT organization and on user interactions with the IT infrastructure. To do this, the IT organization should become more flexible – the ability to rearrange the organizational structure and processes resulting in improvements and stability within the environment (Davis and Olson 1985; Knoll and Javenpaa 1994). This research is the first step to developing a better understanding of how CIOs currently manage in changing and uncertain environments and how we can begin to develop and manage a more flexible IT organization.

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