Leading IT Flexibility: Anticipation, Agility and Adaptability

Karen Patten
New Jersey Institute of Technology

Brian Whitworth
New Jersey Institute of Technology

Jerry Fjermestad
New Jersey Institute of Technology

Edward Mahinda
New Jersey Institute of Technology

ABSTRACT

Chief information managers (CIOs) lead IT organizations in a changing and uncertain competitive environment. IT managers deal with external environmental changes, changing internal customer needs, and rapid technology changes. Studies suggest that to manage change and prepare for uncertainty, IT leaders should create an organization that is more flexible. The authors propose in this conceptual paper that flexibility can be analyzed and introduced systematically within the IT organization.

The authors suggest that three distinct organizational characteristics, *anticipation, agility, and adaptability,* be combined into a unique 'IT Flexibility Framework (IFF).' CIOs could use this IFF to assess the IT organization's readiness for change and improve its capability to support the agile enterprise. On-going research is planned to validate the IFF and its potential usefulness to manage IT change and uncertainty, while still providing cost-effective and reliable services.

Key Words
Flexibility, anticipation, agility, adaptability, IT flexibility framework, CIOs, work system principles, conceptual accuracy, planned flexibility, structured flexibility

INTRODUCTION

Turbulent business environments result in environmental change and uncertainty as a normal course of business. Corporate executives who positively deal with environmental change and uncertainty develop strategies to exploit opportunities and coping mechanisms to minimize threats as opposed to strategies that avoid or only react to change. Dietrich and Shipley (1999) postulated that IT organizations must be more responsive and also more proactive. Instead of reacting to change, Chief Information Officers (CIOs) can manage IT changes and uncertainty better by becoming a change agent exploiting opportunities and minimizing threats (Benamati and Lederer 1999, 2001, 2000; Gottschalk and Taylor 2000; Patten 2004; Rockart, Earl, and Ross 1996). Besides managing change, they also need to balance day-to-day IT operations with developing new IT services.

Because of the global nature of business, information technology is necessary to share information, market products and services, and build critical business relationships and alliances (Benamati and Lederer 2000; Dhillon and Hackney 2000). A number of research studies on managing IT in a changing world conclude that IT should be 'more flexible,' but what is meant by 'being more flexible?' This term is used many different ways. Consequently, it is equally unclear how IT can become more flexible. The purpose of this paper is to present a unique *IT Flexibility Framework* (IFF) that defines aspects of flexibility to help CIOs assess the IT organization's readiness for change and improve its capability to support the agile enterprise.

This paper briefly discusses why flexibility is important to the IT organization. It provides a series of definitions from the IT literature as well as industrial engineering and manufacturing, organizational behavior, and general management literature. The authors then propose an *IT Flexibility Framework* (IFF) combining three flexibility aspects: anticipation, agility, and

adaptability. The last section describes on-going research to test the IFF validity and how flexibility might be operationalized in an IT organization.

THE NEED FOR IT ORGANIZATIONAL FLEXIBILITY

IT organizations are difficult to manage because IT complexity and uncertainty is accelerated by technological change, increased outsourcing and IT alliances, and compressed product life cycles (Mahinda and Whitworth 2004). Information technology has removed the geographical constraints of enterprises, dispersed control and authority within the enterprise, increased the speed of transactions, and changed the way companies do business (Patten 2000; Santhanam and Hartono 2003). The structure of the IT organization affects how IT services and solutions help an enterprise sustain a competitive edge, increase its business, and compete in an Internet-enabled economy (Malhorta 1993; Santos and Fjermestad 2002). In the digital enterprise, internal IT customers have changing needs that often conflict requiring new IT solutions that must interoperate with embedded IT services (Sambamurthy, Bharadwaj, and Grover 2003; Sambamurthy and Zmud 2000). IT executives struggle with the conflicting mission of providing a robust and scalable IT infrastructure at the same time lowering costs and being efficient. Certain IT solutions may be beneficial for some functional organizations and detrimental for others. Silver, Markus, and Beath (1995) argue that increased IT investments actually hinder the flexibility of business processes and the effectiveness of the organization. The simple question is how should CIOs create and then lead an IT organization where the IT infrastructure is flexible, but yet efficient, effective, and reliable?

The goal of introducing IT flexibility within the organization should be to leverage opportunities that come from external change and uncertainty while at the same time minimizing the threats. Leveraging opportunities requires the capability to recognize opportunities and to creatively or innovatively initiate change. Minimizing threats requires the capability to assess risks and develop alternatives. Both require immediate action. IT flexibility impacts all components of an IT organization – its management including leadership and its necessary processes, policies, and practices, its personnel including customers, suppliers, and partners, and its infrastructure including hardware, software, products, and services. Earlier studies recommend that to be more flexible, IT organizations should precipitate intentional changes, continuously responding to unanticipated changes, and adjusting to unexpected consequences of predictable changes (Bahrami 1991; Knoll and Javenpaa 1994).

FLEXIBILITY DEFINITIONS

Frost (1999) maintains that people generally understand the need for flexibility, but understanding the need does not lead to implementation. Terms are often used interchangeably causing a lack of precision, which necessitates terms to be carefully defined resulting in *conceptual accuracy* (Shee 2001). Flexibility is considered a multi-dimensional concept with different connotations, paradigms, foundations, dimensions (Sushil 2001). Flexibility and its synonyms – hedging, malleability, pliability, resilience, robustness, and versatility – are often used interchangeably as are flexibility and its closely related attributes – anticipation, agility, and adaptability (Evans 1991).

Dictionary definitions of flexibility vary by application as shown in Table 1. A classic manufacturing industry definition is the ability to change or react with little penalty in time, effort, cost, or performance (Upton 1994). An U. S. Army definition is "to be responsive to change and adaptable to the volatility, pressures, and complexities of military operations, while constantly focusing on the objective" (Frost 1999). Different fields also have different definitions of flexibility. Sethi and Sethi (1990) developed eleven different types or flexibility and measurements in operations management.

Flexibility also relates to specific business functions including strategic, manufacturing, human resources, financial, technology, marketing, organizational, and IT/IS. Because the management of technology is key to competitiveness and wealth creation, a technology perspective is an important criteria when evaluating flexibility and competitiveness (Khalil 2001). Certainly, many IT managers would agree with Frost's military definition that IT operations include a number of volatilities and complexities, although not viewed as a life or death decision.

Flexibility is also the ability to predict and sense environmental change and to respond appropriately. A flexible system should have ability to effectively adapt or respond to environmental change to take advantage of opportunity and to minimize threats (Whitworth and Zaic 2003). Duncan (1995) found that no common, operational definition of *IT infrastructure flexibility* existed. He also concluded that the characteristics of infrastructure will vary by firm resources and industry

characteristics such as information intensity. Therefore flexibility might be encouraged or discouraged based on different perceptions.

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.

hyperdictionary, Merriam-Webster Online	
Flexibility\flex'i'bil'ty	n 1. The property of being flexible; capable of being flexed : pliant. *Synonyms: flexibleness, malleability, inflexibility, bendability.* n 2. The quality of being adaptable or variable; characterized by a ready capability to adapt to new, different, or changing requirements. *Synonyms: adaptability, flexibility, wiggle room.* n 3. The trait of being easily persuaded; yielding to influence : tractable. *Synonyms: manipulable, manageability, docility, domestication, obedience.*

Anticipation\an'tic'i'pa'tion	n 1a. A prior action that takes into account or forestalls a later action.
	  1b. The act of looking forward; especially : pleasurable expectation. *Synonyms: expectancy, hope, suspense, fever.*
	
	n 2a. Visualization of a future event or state; the act of predicting (as by reasoning about the future.)
	  2b. An object or form that anticipates a later type. *Synonyms: prediction, prognostication, foreshadowing, projection, forecast.*

Agility\agil'i'ty	n 1. The property of being flexible. *Synonyms: flexibleness, malleability, inflexibility, bendability, whip.* n 2. The quality or state of being agile : nimbleness, dexterity, quickness; quickness of motion. *Synonym: legerity, lightness, lightsomeness, nimbleness.*
Adaptability\a'dapt'a'bil'i'ty	n 1. The ability to change or be changed to fit changed circumstances. *Synonym: ability, flexibility, pliability.*

Table 1. Flexibility Definitions

ASPECTS OF FLEXIBILITY

The authors concluded that the definition of flexibility is not as simple as one size fits all, but that three related aspects, *anticipation, agility, and adaptability*, should be considered. Combining these aspects into a framework for managing IT in a changing and uncertain environment should improve understanding and use. Anticipation balances planning for expected change with preparing for unexpected change. Agility is the capability to respond quickly to environmental change. And, adaptability is the capability of the organization to self-learn and self-organize based on previous experience. The dictionary definitions are also shown in Table 1.

Anticipation and Flexibility

It is recommended that that the first step of becoming more flexible is to anticipate what might happen by planning for the known and preparing for the unknown. Aligning the IT strategy with the business strategy is an example of anticipation (Luftman 2004; Luftman, Papp, and Brier 1999). Sledgianowski, Luftman, and Reilly (2004) identified factors, which determine an organization's ability to align its business/IT strategies. Aligning the business / IT strategy and preparing tactical/operational plans demonstrates that the IT organization understands the known business needs and is the first step to becoming more flexible. These plans should be considered guidelines since unanticipated changes will change the plans.

The ability to anticipate provides the opportunity to plan and then prepare. Forecasting, scanning the Internet, and analyzing trends are management tools used to predict. This helps managers to make decisions about what products to make, where to ship, when to hire, etc. Plus, anticipating competitive actions allows managers to take steps to minimize the potential competitive threats.

Environmental change and uncertainty especially impacts IT product development processes (PDP). Verganti (1999) defines *planned flexibility* as the capability to clearly identify all the critical areas early in a project and to plan for the key reaction measures that may be necessary later. This allows the project team to link both anticipation and reaction in order to minimize the problems of anticipating constraints and opportunities too early in the product development process when uncertainty is greater versus delaying PDP decisions to later when uncertainty decreases, but cost and time to take corrective action increase. Product development teams must be able to both anticipate and react, a function, Verganti describes as *structural flexibility*. Structured flexibility is impossible unless planned flexibility is built during the early stages of the project.

Agility and Flexibility

Agility is the ability to both create and respond to change in order to profit in a turbulent business environment (Goldman, Nagel, and Preiss 1995). Business agility is rapidly becoming the focus of managers trying to be more competitive in a global economy. Agile manufacturing has developed methods over the last fifteen years that can be applied to the IT organization. Agile software development is used by some organizations, but not by all.

Critics argue that agility is really the lack of planning or just reacting in an ad hoc manner. Supporters argue, agile managers plan for both the known and the unknown (Schrage 2004). It is recommended that the next step of becoming more flexible is to train employees to be able to sense changes when they occur and use processes and practices that are designed to be flexible based on changes occurring. Agile managers act versus react to respond quickly and effectively to both anticipated and unanticipated business changes.

Adaptability and Flexibility

Adaptability has different IT-related definitions. Some include the change in the system to accommodate change in its environment, the ease of system/component modification, the modification of behavior in response to environmental changes; and the adjustment to changing requirements. Adaptability is also a non-functional (software) requirement (NFR).

Applying Alter's (2004) work system principles to the IT organization implies that the IT organization, as a system, should have the capability to adapt, change, and grow. Alter's research found that sometimes IT supports adaptability, but other times, IT constrains adaptability as stated in his Principle #21:

- Principle #21. Maintain the ability to adapt, change, and grow – recognizes that environments will change over time.

Alter also found that his Principle #21 had the highest acceptability of all 21 principles, but also has the highest difference between applicability and reality. In other words, respondents agreed that this is very important, but rarely applied it.

Terreberry (1968) hypothesized that *organizational adaptability* is a function of the ability to learn and to perform according to changing environmental contingencies. Jaruzelski and Kumar (2004) define adaptability as the capacity to anticipate, trigger, and absorb change whether cyclical or structural where flexibility is the capability to adapt the quantity and the quality of each factor as it either re-acts or pro-acts to environmental changes. Adapting emphasizes the ability to maintain the status quo despite an internal or external change, also referred to as robustness – the ability to maintain status quo. Change emphasizes the ability to instigate change not react to change, also referred to as agility – the ability to instigate change.

IT FLEXIBILITY FRAMEWORK

The above definitions suggest aspects of flexibility that focus on dealing with change (Whitworth and Zaic 2003). Since external changes always occur, uncertainty will always be present. The CIO has created and is leading a flexible IT organization when the organization is prepared:
1. To anticipate the change, giving time to prepare through forecasting and planning (anticipation).

2.   To wait for the change to occur, then to react quickly and fix the problems that occur as effectively as possible (agility).

This is not an either/or choice, as he or she can do both. However, each is distinct from the other, as an entity can be agile without anticipation, and anticipate without being agile. In both cases, flexibility increases.

There is yet a third option, where an entity has neither agility nor anticipation, yet still develops flexibility. This option, adaptability, is the ability to develop or learn both anticipation and agility from experiences. An example is a small baby, who is neither agile nor able to anticipate, yet is highly adaptive and able to learn.

This paper suggests that flexibility can be systematically analyzed and introduced within the IT organization. However, all three distinct aspects: *anticipation, agility, and adaptability,* should be used by an IT organization wishing to become more flexible. We propose that these aspects be combined into an *IT Flexibility Framework* in a continuous cycle as shown in Figure 1. First, anticipation balances planning for expected change with preparing for unexpected changes within the organization. Then, over time, situations change requiring agility, the capability to respond quickly to the environmental changes. And, finally, after responding to the changes, adaptability is the capability of the organization to self-learn and self-organize based on previous experience. Then the organization starts the cycle over by beginning the anticipation stage again.
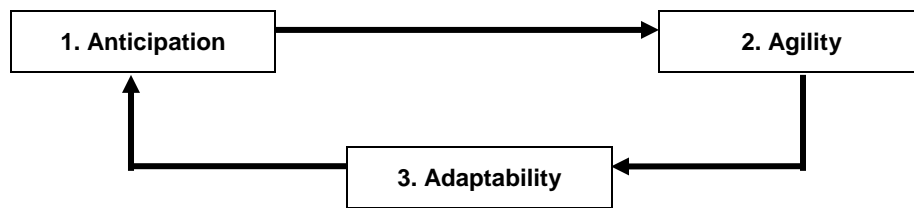

Figure 1. IT Flexibility Framework

CONCLUSIONS AND FUTURE RESEARCH

This paper describes the need for IT flexibility and proposes an *IT Flexibility Framework* (IFF) with three critical aspects that any IT organizations should consider. This IFF is part of a long term study expected to develop a roadmap for CIOs to use to assess the potential for flexibility within the IT organization, to determine where improvements should be made, and to provide guidelines on how to become more flexible. Research is underway to assess the validity of the IFF, test its potential use and effectiveness, and develop methods to increase flexibility within the IT organization. On-going research will demonstrate how CIOs can manage change and uncertainty within the IT organization, while still providing cost-effective and reliable services.

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