Agile Information Technology Infrastructures

Nancy Alexopoulou
University of Athens, Greece

Panagiotis Kanellis
National and Kapodistrian University of Athens, Greece

Drakoulis Martakos
National and Kapodistrian University of Athens, Greece

INTRODUCTION

Operating in highly turbulent environments, organizations today are faced with the need to continually adjust their infrastructure and strategies in order to remain competitive. Globalization and continual technological evolution are the main drivers of this turbulence (Dove, 1999b). To adapt at the same pace as their changing environment, organizations have to be agile. Loosely defined, an agile enterprise is one that is characterized by change proficiency. Change proficiency is the defining characteristic of agility and denotes the competency in which an adaptive transformation occurs (Dove, Benson, & Hartman, 1996). In a more detailed definition, an agile enterprise is one that is characterized as a fast moving, adaptable, and robust business, which is capable of rapid adaptation in response to unexpected and unpredicted changes and events, market opportunities, and customer requirements (Henbury, 1996).

According to Dove (1999b), agility is very much related to the ability to manage and apply knowledge effectively. Dove (1999b) felicitously associates agility with cats. A cat is both physically adept at movement and also mentally adept at choosing useful movement appropriate for the situation. If a cat has merely the ability to move quickly but moves inappropriately and to no gain (e.g., a cat on a hot tin roof), it might be called spastic or confused but never agile. On the other hand, a cat that knows what should be done but finds itself unable to move (e.g., a cat that's got itself up a tree), might be called catatonic, confused, or paralyzed but never agile.

This example implies that agility cannot be easily attained. It requires knowledge, experience, and skill. Enterprise agility depends on many factors such as personnel capabilities, information technology (IT) infrastructure, business strategy, and so forth. When an enterprise is agile, all its constituents are agile and vice versa. This article focuses particularly on IT infrastructure. It defines agility in IT infrastructure and explains how it contributes to enterprise sensing and response agility. *Sensing agility* is defined as a firm's ability to rapidly discover and interpret the market opportunities through its information systems, and it concerns not only an ability to distinguish information from noise quickly, but also to transform apparent noise into meaning faster (Haeckel, 1999). *Response agility* relates to the organizational capability to quickly transform knowledge into action in response to the environmental signals (Haeckel, 1999).

BACKGROUND

The term *agility* has over a decade of use in manufacturing practices, where it has been defined as a principle competitive issue (Kidd, 1994; Dove, 1994a; Goldman, Roger, & Kenneth, 1995). Dove (1999a, 2005) has introduced the principles for agile systems at an abstract level so that they can be interpreted either from a business or a technical perspective. The term *system* is used to characterize a group of interacting modules sharing a common framework and serving a common purpose. At the business level, modules represent groups of people while at the technical level correspond to software components or machines. These principles are summarized in Table 1.

Dove (1995) has also defined four agility metrics, namely *time, cost, robustness,* and *scope*. The first concerns the time required to complete a transformation. The second defines the cost regarding the transformation implementation. Robustness measures the strength and quality of the change process. Scope indicates how much latitude for change can be accommodated. Kidd (1994) has additionally defined a fifth agility metric which is the *frequency of change*.

The concept of agility has also been employed in the research area of information systems (IS) development where the term is much more recent (Aydin, Harmsen, Slooten, & Stegwee, 2004; Levine, 2005). Agile IS development concerns a new methodology paradigm proposed as an alternative to traditional disciplined methodologies for software development because these methodologies are no longer successful for rapidly changing environments due to their bureaucratic nature (Conboy & Fitzgerald, 2004; Nerur, Mahapatra, & Mangalaraj, 2005). Agile development

Table 1. Agile design principles (Source: Dove, 1999a)

Encapsulated Unit Modularity	System of interacting unit not intimately integrated. Internal workings unknown externally.
Plug Compatibility	System units share common interaction and interface standards, and are easily inserted or removed.
Facilitated Unit Reusability	Standardized unit replication information, unit modification tools, unit capability catalogs.
Non-Hierarchical Interaction	Empowered self-directed units that communicate negotiate and interact directly among themselves.
Dynamic Late Binding Relationships	Relationships are transient when possible; fixed binding is postponed until immediately necessary.
Distributed Control & Information	Units respond to objectives; decisions made at point of knowledge; data retained locally but accessible globally.
Self-Organizing Relationships	Dynamic unit alliances and scheduling; open bidding; and other self-adapting behaviors.
Scalable Size	Unrestricted unit populations that permit large increases and decreases in total unit population.
Unit Redundancy	Duplicate unit types or capabilities to provide capacity fluctuation options and fault tolerance.
Extensible Framework	Evolving open system framework capable of accommodating legacy, common, or completely new units.

methodologies (Abrahamsson, Salo, Ronkainen, & Warsta, 2002), such as Extreme Programming (Beck, 1999) and SCRUM (Schwaber & Beedle, 2002), promise faster development times and higher customer satisfaction. Extreme Programming and SCRUM constitute instantiations of the Agile Manifesto (Fowler & Highsmith, 2001), which was published by the Agile Alliance in 2001 (www.agilealliance.com). The basic principles of the Agile Manifesto are: first, individuals and interactions over processes and tools; second, working software over comprehensive documentation; third, customer collaboration over contract negotiation; and fourth, responding to change over following a plan (Williams & Cockburn, 2003).

In IT and IS literature, the term agility has not been broadly used. A relevant concept for IT infrastructure that has been defined instead is that of *flexibility*. *IT Infrastructure flexibility* is defined as the ability of the IS department to respond quickly and cost-effectively to system demands, which evolve with changes in business practices or strategies (Duncan & Bogucki, 1995). In this definition, however, the