

Business Agility: A Systematic Review of Literature and Design Oriented Research Synthesis

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Abstract – Turbulence in the US economy has been increasing since 1930 as reflected in measurement of matrices such as revenue volatility, profitability and employment of publicly traded firms in United States (Sull, 2009) Industry level turbulence has accelerated rapidly since 1990 as reflected in industry level measures such as concentration, performance gaps and shift in leadership positions. Data on IT spending during the same period indicates that this increase has coincided with massive increase in IT investment, therefore suggesting that IT has created a new economics of competitiveness (McAfee and Brynjolfsson, 2008)

Agility as a concept was first introduced in 1990s to deal with the emergent new competitive environment (Stanculescu, Niculae & Grigore). Defined as an organization's "ability to sense and respond to changes in an organization's internal and external environment by quickly assembling resources, relationships and capabilities" (Gallagher and Worrel, 2007), organizational agility is today viewed as a strategic imperative

In this paper we explore the evolution of the concepts of organization agility which combines customer agility, strategic agility, operational agility and partnership agility, the role of Information technology in enabling agility and the mechanisms underlying the influence through a systematic literature review.

For the purpose of this research we use Design Oriented Research Synthesis. Structured Literature Review (SLR) of relevant literature on Organizational Agility and IT Enabled Organizational Agility is conducted to extract the conceptual ontology of the current research and design prepositions identifying the Organizational Agility are formulated. These prepositions can form the basis of further empirical research.

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INTRODUCTION

Business Agility has been identified as critical to the survival of organizations in turbulent environments characterized by rapid shifts in technologies, customer preferences and competitive landscape.

PricewaterhouseCoopers described the ten-year period ending in 2006 as "10 years of high-speed change" characterized by "unsettling twists and turns," as managers were forced to contend with a series of events such as the dot-com bust, September 11 attacks, the two Gulf wars and the emerging market growth (Sull, 2009). The trend has since accelerated with the capital market crisis and the global recession in the latter years of the decade followed by debt crisis and imminent trade disputes.

Sull (2009) cites several studies to demonstrate an increase in firm level turbulence. Measures such as

volatility of revenues, profitability and employment of publicly traded firms in United States point to a doubling of the firm-level turbulence between 1960 and 2000. (Comin, 2009). The spread between corporate bonds and ten-year treasury notes indicates a fourfold increase in volatility in the same period. The extreme turbulence also indicates higher risks and the average lifespan of a firm listed on the S&P Index decreased from ninety years during the 1930's to under twenty-five years by late 1990s (Sull 2009). The competitive environment is increasingly seen as being characterized by "creative destruction" with greater gap between leaders and laggards and more churn among rivals in sector

McAfee and Brynjolfsson (2008) posit "fundamental change in the underlying economics of competition" in the decade of 90's in the US correlated closely with the increased IT innovation "when the internet and enterprise software application – like enterprise

resource management(CRM) and enterprise content management (ECM) –became practical tools for business”.

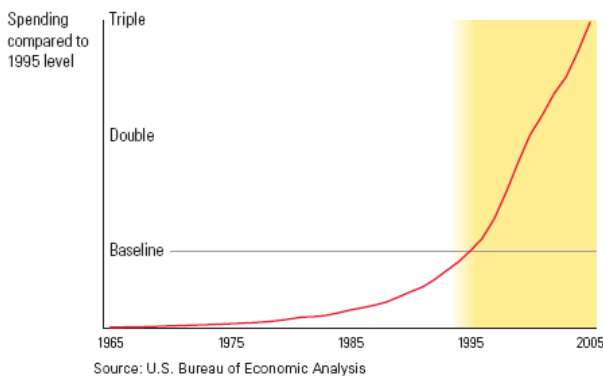


Figure 1: Dollar value of total U.S. corporate IT Stock

Chart from McAfee & Brynjolfsson (2008)

Using data based on three matrices namely a) concentration, b) performance spread in an industry and c) average change in number of places in ranking McAfee and Brynjolfsson(2008) concluded that “average turbulence within U.S. industries rose sharply starting in the mid-1990s. Furthermore, after declining in previous decades, industry concentration reversed course and began increasing around the same time. Finally, the spread between the highest and lowest performers also increased.” They also found turbulence was significantly higher in IT intensive industries therefore suggesting that IT has contributed to increased turbulence.

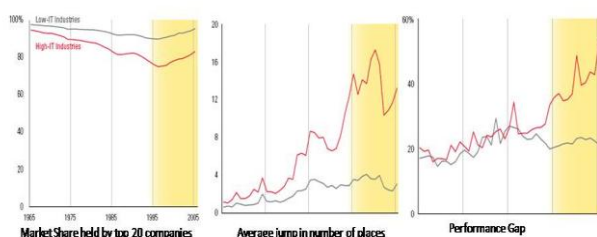


Figure 2: Market Concentration, turbulence and performance spread among US firms

Chart from McAfee & Brynjolfsson (2008)

The concept of an agile organization was introduced in the context of environmental turbulence and a firm was considered agile if it was “capable of operating profitably in a competitive environment of continually, and unpredictably, changing customer opportunities” (Goldman, Nagel, & Preiss 1995) or as an organization where “the competitive foundations are continuous change, rapid response, quality improvement, social responsibility and total customer focus” (Kidd, 1994)

Organizational Agility is considered to reflect a company’s “ability to consistently identify and capture business opportunities more quickly than its rivals do” and is considered to be critical to the firm’s survival in turbulent environments. Yusuf, Sarhadi & Gunassakheran(1999) take a capability centric view of agility and define agility as “successful exploration of competitive bases (speed, flexibility, innovation pro-activity, quality and profitability) through the integration of reconfigurable resources and best practices in a knowledge-rich environment to provide customer-driven products and services in a fast-changing market environment”.. The concept of agility has attracted widespread interest both from the practitioner as well as academic scholars.

Information Systems researchers have conceptualized agility as “a firm level competency to sense and respond to shifts in the business environments” (Sambamurthy, Bharadwaj & Grover, 2003) and have argued that in a “Schumpeterian environment the value of process innovation greatly multiplies” (McAfee & Brynjolfsson, 2008) and that business process “digitization enables firms to coordinate its activities and interact with its stakeholders through electronic networks. Moreover, firms that have successfully digitized their business processes have digital options that could be exercised in creating new channels for accessing customers, building real-time integration with supply chain partners, gaining efficiencies in internal operations, and offering new digital products or services” (Ravichandran, 2007)

A number of researchers have identified the firm’s IT capabilities as key enabler or inhibitor of the firm’s business agility. Several studies have posited that information system capabilities are translated into business capabilities (e.g. Piccoli and Ives, 2005) and several empirical studies have established that agile information systems contribute to business agility (e.g. Weill, Subramani and Broadbent, 2002; Oosterhoun, Waarts and Hilleberg, 2006).

Several recent advances in application architectures (such as Service Oriented Architecture (SOA) and infrastructure architectures (such as Cloud Computing) and technologies such as Web Services have addressed the agility of the underlying platform(Tallon,2007) but have highlighted the need for exploring the relation of agility to broader governance issues. (Tallon,2007)

IT impacts business agility at multiple levels namely a) inter-firm b) firm c) process and d) initiative level. While the fundamental assumption of enterprise agility being an automatic consequence of IT adoption underlies a number of scholarly studies as well as practitioner writings other researchers have suggested that the impact of IT Capabilities is mediated through a) impact of IT on business processes (Tallon, 2007), or through complementarily

with other organizational capabilities. (e.g. Sambamurthy, Wei, Lim & Lee, 2007; Ravichandran, 2007)

Tallon goes in to add that "Recent interest in IT governance has identified the risks of ineffective IT management whether in the form of weak cost control or project oversight, ineffective strategic planning, mistrusting end-user relationships or a lack of standards—factors that can result in IT rigidity. As such, it could be argued that agility is as much a managerial issue as a technical issue" (p21)

To this end, this research concerns itself with exploration of existing knowledge base identifying the relation between business agility and IT as well as to develop sharper and more insightful questions about the topic (Yin, 1989).

RESEARCH METHOD

Literature Review

This research involved a structured literature review to identify research themes and to construct concept ontology as related to the domain of Organizational Agility.

The literature survey used the methodological framework of Structured Literature Review (SLR) as proposed by Tranfield et. al. (2003) and modified by Armitage and Keeble-Allen (2008) through Rapid Structured Literature Review (RSLR) a "light version" of SLR, suitable for smaller-scale research projects and adopts a scientific and transparent process that is replicable. The selection of SLR approach was also guided by its emphasis on providing evidence based "approach to practice guidance" therefore enhancing the efficacy and relevance of the literature review exercise

Objectives

The overall nature of the survey was exploratory with primary objective to identify the current research focus, directions, concepts and themes applied to the study of Organizational Agility

Study Selection

In this literature survey we included both theoretical-conceptual and empirical research, using qualitative or quantitative approaches originating from both academic and practitioner sources. The practitioner sources included consulting companies, research agencies, service and product vendors as well as experience reports from user organization. An interdisciplinary broad-based approach is adopted to

capture the existing knowledge of relevance to the research questions.

The external quality was judged based on "revealed preference" approach defined by Herzing & Wall (2008). They propose an approach based on Hirsch's h-index – and data source – Google Scholar – to assess journal impact". The h-factor is defined by Hirsch (2005) as "A scientist has index h if h of his/her N_p papers have at least h citations each, and the other ($N_p - h$) papers have no more than h citations each". The h-index can therefore reflect combination of both quantity (number of papers) and quality (impact, or citations to these papers) (Glänzel, 2006). The h-factor in case of journal can be used to identify if journal consistently publish papers with lasting and above-average impact.

Individual contribution impact was measured as the citation count reported by Google Scholar. The studies were evaluated for inclusion based on evaluation of validity and relevance of research. The overall validity was assessed as the assessment of construct validity, internal validity and external validity (Yin, 2003), operationalized through a set of questionnaires were evaluated for all studies considered for inclusion.

Organizational Agility

What is Organizational Agility?

Sull (2010) positing the persistence of environmental change, proclaims that "Market turbulence did not begin with the fall of Lehman Brothers, and it will not end when the global economy recovers. Indeed, a variety of academic studies — using measures such as stock price volatility, the mortality of firms, the persistence of superior performance, the frequency of economic shocks, and the speed of technology dissemination — have concluded that volatility at the firm level increased somewhere between two-and fourfold from the 1970s to the 1990".

The concept of environmental turbulence encompasses conditions of uncertainty and unpredictability due to rapid and large scale technological development and changes to market preferences (Wolf, Vykoukal & Beck, 2010) caused by unpredictable market demand, changing consumer preferences, competitive activities and rapid technical innovation and diffusion with unanticipated consequences for an industry. The difficulty to assess a turbulent environment ex ante, require organizations to respond swiftly to remain competitive (Stigter, 2002)

The modern competitive landscape is characterized by hyper-competition a term used by D'Aveni (1994) to describe escalating competition leading to

continuous generation of “new forms of competitive advantage through neutralizing, destroying, or rendering competitors' advantage obsolete” (D'Aveni, 1994, 1997, 1999; Gimeno & Woo, 1996) characterized by time-to-market pressure, changing customer needs and regulations (McAfee and Brynjolfsson 2008; Overby et al. 2006).

The underlying logic of the “hypercompetitive strategy is that enduring competitive advantage may not come from a single strategy, but rather the ability to modify or adjust strategies more quickly than competitors recognizing that the only enduring advantage results from the ability to generate a continuous flow of new advantages”. (Harvey, Novicevic, Milorad & Kiessling, 2001)

These changes indicate a shift to the “logic of opportunity” as the basis of economic rent generation (Sambamurthy, Bhardwaj and Grover. 2003). Grounded in Evolutionary economics (Nelson and Winter, 1982) and Austrian school of economics (Jacobson, 1992; Schumpeter, 1939) logic of opportunity posits that competitive advantage is temporary and short lived. The evidence of lowering of periods of competitive advantage and existence of hypercompetition has been found across industries has been supported empirically (Wiggins, Ruefli, 2005). Other authors Eishenhart and Sull (2001) have also emphasized the role of newer models of strategic thinking such as use of strategic principles instead of detailed strategic plans. In high velocity environment firms ability to effect continuous change is therefore crucial to survival. (Brown and Eisenhardt, 1997)

Consequently, organizational agility, defined as “the ability to consistently detect and seize market opportunities with speed and surprise” (Sambamurthy et al. 2003), is viewed as an important precursor to business success (Sull, 2009) and has witnessed a lot of interest from both academic and practitioner communities. A number of related concepts such as strategic flexibility, adaptability, resilience, versatility and absorption capability (Bahrami and Evan, 2005) have also been used to highlight the need of organizations to respond to fast paced changes in the environment.

Technology innovation is adding to the turbulence e.g. the advent of Internet as a “communication and transaction infrastructure has led (and will lead) to turbulence and uncertainty in the business and consumer markets” where “On one hand there is the trend to blur industry boundaries (finance, media, telecom and information technology are converging) (Bradley and Nolan, 1998). On the other hand re-intermediation creates new actors with new capabilities, providing new services to the final customers” (Oosterhout, 2010)

With the step-shift advances Information Technology (IT) is a significant business platform Sambamurthy et

al. 2003, Weil and Subramani, 2002), and is critical to enterprise agility (Mathiassen and Pries-Heje 2006; Sambamurthy et al. 2003). Information Management researchers have focused on IT capabilities of the firm as an important antecedent to enabling the recombinative and integrative capabilities of the firm. Consequently, the concept of IT-enabled enterprise agility has attracted considerable research attention since its introduction an extension of adaptability and flexibility to include speed and scalability (Holmqvist and Pessi, 2006). Researchers in this stream posit that firms that have successfully digitized their processes have digital options that could be “exercised in creating new channels for accessing customers, building real time integration with supply chain partners, gaining efficiency in internal operations and offering new products or services” (Ravichandran, 2007) therefore enabling organizational agility

Agility Definition and Concepts

The concept of organizational agility evolved as a management concept in recognition of the need of organizations to respond to changing organizational forms and dynamism of the organization's competitive environment and as an evolution of earlier concepts such as flexibility, market orientation, dynamic capabilities (Teece et al., 1997) and absorptive capacity (Overby, 2006). The concept was initially introduced in the 90s through studies conducted at the behest of Governments in the US and the UK, The US study commissioned in 1990 envisaged agility as the border of competitiveness in the context of virtual enterprise as the organizational form. Four agility dimensions of enriching the customer, Cooperating to enhance competitiveness, organizing to master change and leveraging impact of people and information were identified as part of the study

A similar study by Department of Trade and Industry in the UK introduced the concept of turbulence in organizational environment and concluded that an appropriate strategy in a turbulent environment would be the reconfiguration of operations in order to allow for product customization within the mass production system thereby introducing the concept of “mass customization”.

Agility Definition

Several definition of agility have since been proposed in the literature and there seems to be no single universally accepted definition (Gallegher and Worrel, 2007). Most definitions however propose a similar set of concepts

Table 9: Definition of terms agility in literature

No	Term	Definition	Reference
1	Business Agility	“Business Agility is the	Westerman, Weil and

		set of possible business initiatives a firm can readily implement leveraging pre-determined competencies with managed cost and risk."	McDonald 2006
2	Agility	"Agility is the successful exploration of competitive bases (speed, flexibility, innovation pro-activity, quality and profitability) through the integration of reconfigurable resources and best practices in a knowledge-rich environment to provide customer-driven products and services in a fast-changing market environment"	Yusuf, Mansoor & Gunasekhar , 1999
3	Agility	"Agility is the ability of a firm to face and adapt proficiently in a continuously changing and unpredictable business environment. Agility is not about how a firm responds to changes, but it is about having the	Kassm and Zain(2004)

		capabilities and processes to respond to its environment that will always change in unexpected ways "	
4	Agility	"Agility as the firm's nimbleness to quickly assemble its technology, employees, and management via a sophisticated communication infrastructure in a deliberate, effective, and coordinated response to changing customer demands in a market environment of continuous and unanticipated change"	Kodish et. al (1995)
5	Enterprise Agility	"Enterprise agility is defined as the ability of firms to sense environmental change and respond readily. As such, enterprise agility consists of two components: sensing and responding."	Overby et. al. (2006)
6	Agility	"Agility can be characterized as the ability	Gallegher and Worrel (2007)

		to sense and respond to changes in an organization's internal and external environment by quickly assembling resources, relationships and capabilities. The underlying components of agility focus on the organization's capabilities to sense anticipated and unanticipated changes in the internal and external environment, and to respond to those changes."	
7	Agility	"Agility is primarily concerned with the ability of enterprises to cope with unexpected changes, to survive unprecedented threats from the business environment, and to take advantage of changes as opportunities"	Sharifi Zhang, (2000) &
8	Agility	"Agility is the ability of an organization to thrive in a continuously changing, unpredictable business environment"	Dove (2001)

9	Agility	"The ability of an enterprise to develop and exploit its inter- and intra-organizational capabilities"	Hooper et al., (2001)
10	Agility	"Agility is the continual readiness of an entity to rapidly or inherently, proactively or reactively, embrace change, through high quality, simplistic, economical components and relationships with its environment"	Conboy & Fitzgerald (2004)
11	Agility	"Agility is the ability to detect opportunities for innovation and seize those competitive market opportunities by assembling requisite assets, knowledge, and relationships with speed and surprise"	Sambamurthy et. al. (2003)
12	Organizational Agility	"Organizational agility is a company's ability to consistently identify and capture business opportunities more quickly than its rivals do"	Sull(2009)
13	Enterprise Agility	"Enterprise agility is commonly conceived as"	Tan,Lu,Pan and Huang(2009)

		an organizational capability consisting of two components: the ability to sense or anticipate changes in the internal and external organizational environment, and the ability to respond effectively and efficiently in a timely and cost-effective manner"	
14	Strategic Agility	"Strategic agility is thoughtful and purposive interplay' on the part of top management between three 'meta-capabilities': 1)Strategic Sensitivity 2) Leadership Unity and 3) Resource Fluidity leading to successful business model renewal"	Doz and Kossenen(2009)
15	Business Agility	"Business agility is the ability of an organization to swiftly change businesses and business processes beyond the normal level of flexibility to effectively	Oosterhout(2010)

		manage highly uncertain and unexpected but potentially consequential internal or external events based on the capabilities to sense, respond and learn."	
16	Organizational Agility	"organizational agility as a set of processes that allows an organization to sense changes in the internal and external environment, respond efficiently and effectively in a timely and cost-effective manner, and learn from the experience to improve the competencies of the organization."	Seo and La Paz(2008)
17	Agility	"the continual readiness of an entity to rapidly or inherently, proactively or reactively, embrace change, through high quality, simplistic, economical components and relationships with its environment"	Corboy and Fitzgerald (2004)

Mansoor and Gunashekhar(1999); Kassim and Zain(2004); Gallenger and Worrel(2007))and most definitions emphasize the efficiency and effectiveness dimensions of recombination activity(e.g. Seo and Lopez(2010);Oosterhost(2009)

Outcome

Most definitions don't specifically mention the outcome except successful adaptation. However Yusuf, Mansoor and Gunashekhar(1999) refer to customer driven products as the outcome, Doz and Kossenen(2009) mention transformed business model and Seo and La Paz (2008) mention learning.

For the purpose of this study we adopt the concepts of turbulent environment; capabilities to sense respond and learn through recombinative capabilities and business model transformation as the outcome. The adaptation is further required to be timely and cost efficient.

Agility Typologies

Sengupta and Masini(2008) borrow from the flexibility framework defined by Slack to classify agility as Range Agility and Time Agility.

The former represents an organization's ability to "broaden (or shrink) specific aspects of its capabilities. They include increasing or decreasing the repertoire of products and/or services offered to the market, or expanding or shrinking internal capabilities in manufacturing, services or processes". The further describe the possible mechanisms for accomplishing reconfigurations to arise "by exercising options available internally (for example, better integration in processes or strategic business units), and externally (for example, via alliances and partnerships)."(Sengupta and Masini,2008). Time agility on the other hand refers to the speed of response or the time it takes for organizations to reconfigure their capabilities to respond.

Sengupta nad Masini further point out that the two types are distinct types of agility: they bring different business values to the processes they underlie and require different execution capabilities. Thus an organization needs to focus on the type of agility consistent with its objectives and environmental context.

Range agile companies can add value through a greater number and variety of new competitive actions and inimitable range of repertoires by leveraging its ability to "add variety to its products, routines and practices by as well as to create and sustain webs of collaborative relationships and extend reach." (Sengupta. And Massini, 2008)

Time agile companies create competitive advantage through their ability to reconfigure processes and resources faster than competition.

The market dynamism that an organization is operating in is an important determinant of the type of agility that is desired. In a moderately dynamic environment managers can commit to building maneuvering capability into their organizational infrastructure according to envisaged scenarios and incremental responses such as altering volumes or adding feature are sufficient to cope with change. Highly dynamic environments are characterized by uncertainty and "firms need simple and highly adaptable routines. Thus, privileging the time component for gaining the ability to achieve rapid adaptation can be highly valuable" thus making time agility much more valuable in highly dynamic environments.

Sulll (2009) distinguishes between agility (the ability to spot and exploit opportunities) and absorption (the strength to withstand sudden shifts)" and identifies three kinds of agility based on the means that are deployed to achieve agility and labels them as Operational Agility, Portfolio Agility and Strategic Agility. The first kind of agility or Operation Agility is defined as "a company's capacity, within a focused business model, to find and seize opportunities to improve operations and processes". Operational Agility is enabled by shared real-time market and process data that is detailed and reliable

Portfolio agility is the ability to quickly and effectively shift resources, including cash, talent, and managerial attention, out of less-promising units and into more-attractive ones and is enabled by a diversified portfolio of businesses and central control of resources such as cash and talent.

Strategic Agility refers to the ability to spot and decisively seize the last kind of opportunity, the game changers, is the essence of strategic agility. Such opportunities usually entail rapidly scaling up a new business, aggressively entering a new market, betting heavily on a new technology, or making significant investments in capacity.

Building on the study by Sambamurthy et al. (2003), Lee et al. (2009) classifies organizational agility based on the way companies respond to environmental turbulence, and distinguishes between entrepreneurial agility and adaptive agility.

One way of responding to market dynamics is to anticipate environmental changes and conduct strategic experiments with new business approaches and models. The purpose of this is to take first-mover advantage by launching radical changes. The capability for such type of market response is named

as entrepreneurial agility by adopting the concept of organizational entrepreneurship. This concept represents a firm's stance of seeking to create new resources, ideas, and their applications beyond the boundaries of the firm.

Adaptive agility relates to the mode of responding to market dynamics that "is to be resilient and adaptive to environmental change in order to maintain competitive parity and competitive leadership. It is also referred to as the capability to cope with uncertainty and recover rapidly from disruption, without fundamentally changing products or processes"(Lee et al., 2007).The capability for such a type of market response is named as adaptive agility by adopting the concepts of organizational adaptability and resilience.(Lee, 2007)

Sambamurthy (2007) classifies agility along a two dimensional grid consisting of the strategic orientation and the response mode. While Entrepreneurial Agility relates to a leadership profile and anticipation Adaptive Agility relates to a strategic orientation based on a quick response.

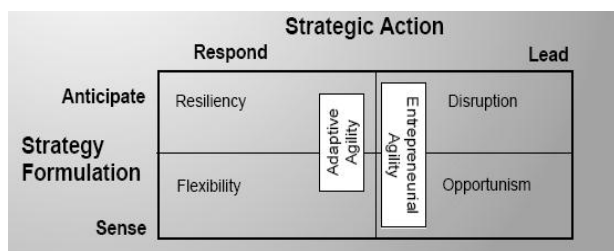


Figure 15: Agility Typologies

From Sambamurthy (2007)

Adaptive Agility can be achieved by keeping with the industry's best practices in facing the emerging business. It is also referred to as the capability to cope with uncertainty and recover rapidly from disruption, without fundamentally changing products or processes (McKee et al. 1989; Sheffi and Rice Jr. 2005). With this conceptualization of the two types of agility, this study aims to reveal the mechanisms by which organizational IT usage can lead to these two types of agility.

A widely accepted perspective which is based on the source of business agility and has been adopted by several researchers is that of Sambamurthy et al. who define business agility as "... a firm's capabilities related to interactions with customers, orchestration of internal operations, and utilization of its ecosystem of external partners." They argue that agility is comprised of customer agility, partnering agility, and operational agility. They define customer agility as the ability of the firm to leverage the voice of the customer to gain market information and detect competitive opportunities. Partnership agility is defined as the ability to leverage the assets, knowledge, and

competencies of suppliers and distributors to form a network to explore opportunities for innovation and competitive action. Operational Agility is similarly defined as the ability of the firm to redesign their existing processes rapidly and create new processes in a timely fashion in order to be able to take advantage of dynamic market conditions.

Ashafi et al. (2006) similarly define operational agility as "the ability to excel simultaneously on operations capabilities of quality, delivery, flexibility, and cost in a coordinated fashion."

IT-Enabled Agility

Definition

With the concept of agility closely related to the capability of organization to sense and respond to environmental changes through reconfiguration of resources IT literature has considered IT as a potent enabler of enterprise agility (Mathiassen and Pries-Heje 2006; Sambamurthy et al. 2003) and the concept of IT-enabled enterprise agility has garnered considerable research attention (Holmqvist and Pessi 2006).

The definitions of IT Agility reflect the differences in the definitions of the two constructs IT and Agility found in literature. Fink and Neuman(2009) identify three different approaches to IT found in literature as a) The technical-oriented approach employs a narrow definition that regards IT as an architecture (arrangement) of technical components, shared across the organization with components belonging to four categories identified as platforms, networks and telecommunications, data, and core applications b) The component oriented approach which adopted a broader perspective that viewed IT as having two distinct elements –technical and human with human components defined in terms of knowledge and skills possessed by IT personnel. iii) Process Oriented approaches extend the definition to incorporate processes and activities that utilize the components. "The process element frequently corresponds to shared IT services provided by IT. Such services are considered part of ITI when they are available."

Another difference found in studies relate to the scope of agility considered as part of the definition of IT enabled agility. While some researchers limit the definition to enterprise IT others extend to include the impact of IT agility at a broader level such as process or organization.

Sengupt and Masini(2008) define IT Agility as being "about reconfiguring or replacing your information technology systems when new marketplace realities change the way you have to do business".

Ahsan and Ngo (2005) define IT infrastructure agility as the ability "to build a system that can easily be

reconfigured, scaled, deconstructed and reconstructed as needed, to adapt to unanticipated changes.” They limit the definition of IT Infrastructure to “shared IT resources consisting of a technical physical base of hardware, software, communications technologies, data, and core applications”. This definition therefore brings out a development perspective to the agility construct and is restricted in scope to the information systems

Fink and Neuman (2004) consider IT – Dependent Agility to be a polymorphous concept and define IT dependent agility to include

1. IT dependent strategic agility which is defined as the “ability to respond efficiently and effectively to emerging market opportunities by taking advantage of existing IT capabilities”.
2. IT-dependent system agility which refers to the ability to accommodate change in information systems through activities of system development, implementation, modification, and maintenance. An organization's information systems are considered agile when organization's IT capabilities allow the development or modification of systems without incurring significant penalties in time or cost.
3. IT-dependent information agility relates to the ability to accommodate change in the way organizational users' access and use information resources. It relies on existing IT capabilities to increase the efficiency of using internal and external information.

Oosterhout (2010) defines IT Agility as the “...ability of Information Technology to support an organization to swiftly change businesses and business processes beyond the normal level of flexibility to effectively manage highly uncertain and unexpected, but potentially consequential internal and external events. In order for Information Technology to be agile, it needs to support and align the three dimensions of business agility -- sensing, responding and learning.

Martensson (2007) defines IS Agility as a “capability that companies can possess to a varying extent—the capability of acting agilely”. They classify agile action using a two dimension matrix: time perspective and the type of goal- expressed as pursuing opportunities or meeting obligations- to define four different kinds of “efforts, or projects”, labeled agile action, firefighting, business transformation and platform construction

Agile action is defined as the reconfiguration designed to pursue short term opportunities based on existing flexibility. Firefighting refers to short-term projects to meet some obligation, is typically under- taken to solve

technical problems reactively or fend off business threats. Platform development and business transformation refers to the longer term perspective of meeting obligation or pursuing opportunities through technology driven business transformation.

	Short-term Perspective	Long-term Perspective
Pursuing Opportunities	Draw on existing flexibility Agile action	Technology-driven business development Business transformation
Meeting Obligations	React to everyday problems Firefighting	Well-planned orderly upgrade projects Platform construction

Figure 16: Agility Typologies

From Martensson (2007)

Thus different definitions of IT agility derive mostly from the definition of agility but treat the notion of IT differently with some definitions considering only the underlying technical components to be part of IT, while others include the impact and drivers of organizational and process agility as part of the definition of IT Agility.

IT Agility and Business Agility

IT as an Enabler of Business Agility

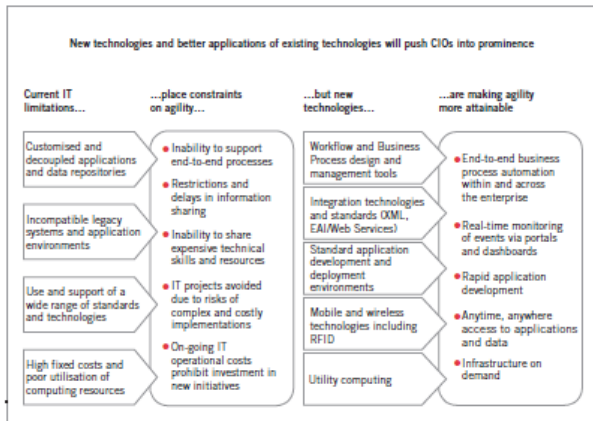
Mathiassen and Heje (2006) consider the “ability to quickly change the type and flow of information within an organization” as fundamental to a rapid and graceful reorganization and argue that the diffusion of IT based innovation plays a crucial role in shaping business agility.

Several studies have posited that information system capabilities are translated into business capabilities.(e.g. Piccoli and Ives, 2005) and several empirical studies have established that agile information systems contribute to business agility (e.g. Weill, Subramani, and Broadbent, 2002; Oosterhout, Waarts and Hilleberg, 2006).

This fundamental assumption of enterprise agility being an automatic consequence of IT adoption underlies a number of scholarly studies as well as practitioner writings.

Malarkode, From-Poulsen and Warnakulsuriya(2004) posit five levers of agility to be quality, efficiency, visibility, velocity and flexibility and argue that evolving technologies “such as Business Process

Management (BPM) and utility computing, as well as improved application of existing technology, are enabling end-to-end process management, rapid application development, the seamless sharing of business resources and the ability to expend budgets primarily based on demand” allowing the organizations to be agile.



From Malarkode, From-Poulsen and Warnakulsuriya (2004)

Sambamurthy Bharadwaj, and Grover (2003) state that IT “can be an enabler of agility by virtue of the differences between digital economics and the (traditional) economics of physical components” (p. 243)

Weil, Subramani and Broadbent (2002) define strategic agility to be “family of electronically-enabled business initiatives that are readily implemented” and identify high capability infrastructure clusters that can enable strategic agility. Based on statistical analysis of data from 180 business initiatives in 118 businesses in 89 enterprises from 1990 to 2001.- which included detailed interviews, extensive questionnaire data - and applying both statistical and qualitative techniques to analyze the data they found support for the preposition that capabilities such as IT architecture and data management enable strategic agility of the firm.

Martesson (2007) state that “Business agility has many sources, one of them being the agility of the Information Technology (IT) portfolio of the company” and cite literature support for information capabilities being translated to business capabilities to posit that agile information systems contribute to business agility.

They examine the role of IT in supporting agility on the dimensions of the i) kind of agile action that can be supported ii) way of acting agile and iii) the level at which agility can be applied .

They characterize the potential ways that IT can support agility to be through i) versatility or configuring existing variety, ii) reconfigurability that refers to the ability to support agile actions through flexibility built

into the information system or application portfolio and iii) redevelopment. The organization’s agility is therefore determined by the way an action is supported

The level to which agile action can be applied refers to the application, application portfolio or network.

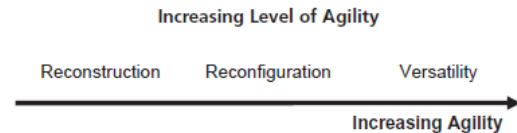


Figure 17: Levels of Agility

From Martesson (2007)

Overby, Bhardwaj and Sambamurthy (2006) provide a framework for different combination of sensing and responding and differentiate firms according to agility needs and capability required in each quadrant. They extend the previous studies by postulating that IT can enable agility i) directly through support for sensing and responding capabilities and ii) indirectly through the creation of digital options and complementarities with business processes.

Direct support for sensing and responding requires firms to have sufficiently advanced IT capabilities to sense opportunities in their business that arise due to advances in IT and in IT intensive industry to respond to changes in the dynamics of customer and supplier relationships.

The indirect relationship is posited on the logic of complementarities. Under this theory IT contributes to performance in business processes such as product development, manufacturing, and supply chain, which in turn contribute to firm performance. In effect, “IT provides the infrastructure upon which other functions and processes depend (Lewis & Byrd, 2003). Thus, other firm processes mediate the effect of IT on performance”.

Sambamurthy et al.,(2003) states that IT Supports agility by providing firms with digital options, which are defined as a set of IT-enabled capabilities in the form of digitized work processes and knowledge systems. A basic premise of this theory is that IT enhances the reach and richness of a firm’s knowledge and its processes. Enhancements in the breadth of resources (reach) and quality of information (richness) available to a firm improve its ability to sense and respond to environment change, thereby making it more agile. The concept of ‘digital options’ encapsulates this ability of IT to make firms more agile.

They further divide the technologies into knowledge oriented and process oriented technologies and

argue that knowledge-oriented IT is more directly supportive of a firm's sensing capability and that process-oriented IT is more directly supportive of a firm's responding ability

Oosterhoun, Waarts and Hilleberg (2006) based on a survey of 181 respondents across industries reported appropriate architecture to be a major enabler of IT driven agility. They found that companies which had relatively simple and flexible IT architectures based on styles such as component and service driven architectures were able to reduce the agility gap "which arise when the firm has difficulty in meeting the required level of agility (for a specific change factor) for changing from one state to another in a timely and cost-effective manner". They posit that agile IT and process architectures are key enablers where business agility is required

Gallagher and Worrel (2007) point to the need for standards and effective management of standards in the context of a multi-unit business organization. "Given the complexity of simultaneously addressing uncertainty at the organizational and business unit level, combined with changing technologies, organizations often implement standards as a basis from which to increase response capabilities". They point out that managing standards can represent a mechanism for controlling changes to a system and avoiding complexity and response disability.

They find through a longitudinal study of an organization that has digitized products that governance has an important role in the development of organizational agility and find that "achieving agility requires organizations to innovate, organize and integrate information technology and business objectives in oftentimes complex settings"

IT as a Barrier to Agility

A stream of literature has also highlighted the potential of IT to be a barrier to organizational agility.

Oosterhout and Waartz(2006) as part of their study found organizations "entangled in large, complex information systems with hard coded embedded business processes and complex nests of links between applications, which often are organized into separate silos of technology from different vendors. Changing requirements takes very long to implement and insufficient (IT) budget remains to be spent on innovation". They attribute a large number of agility gaps to inflexible legacy IT systems or to the multitude of immature technologies used to build recent systems. They also report the lack of architectural ability to support rapid reorganization of system in response to regulatory and business practice changes such as CRM as IT linked barriers to support of organizational agility.

Overby et. al. (2006) point out that "depending on how it is deployed and managed, IT may actually hinder enterprise agility". While some of these rigidity traps may arise from the underlying IT infrastructure elements, such as monolithic architecture and incompatible data storage that limit the range of responses available to the firm or create high costs when firms seek to adjust their strategies. They argue that most of these may be the result of inappropriate IT investments and governance.

Mathiassen and Heje (2006) point to the gap between the IT function and the rest of the organization which they term as IT paradox as a disabler to the realization of IT potential as an enabler of organizational agility. "The IT Paradox reflects how top management sees the value of an effective IT operation and infrastructure, but lack an understanding of how IT essentially contributes to business value" Mathiassen and Heje (2006). They posit that an alignment of IT strategy with business goals and practices is essential to organizations being able to bridge this gap.

Se and La Paz (2008) postulate the role of IT in enabling organizational agility to be based on IT support for the organizational capabilities that underlie an agile organization. Based on the definition of agility they identify these to include i) Perception, which refers to the ability to sense changes in the environment ii) Processing which refers to is the ability to filter, evaluate and process incoming signals iii) Response which refers to an organizational pro- or re-action to the signals it collects or environmental changes iv) Align which refers to the arrangement or re- arrangement of IS in keeping with business environmental changes and v) Learning which refers to the ability to build on experience to continuously improve and be better prepared to deal with changing conditions.

They describe several factors related to IS that can potentially hinder organizational agility terming them as the dark side characterized as "set of forces that may act against agility by means of inefficient or ineffective design, use or understanding of the role of IS in the process of acquiring signals, responding and learning from experience." where IS is used to refer to "both systems and technologies that support business functions such as collecting, creating, editing, processing, storing, retrieving, filtering, and delivering data, information, and knowledge. " They identify a total of twelve such barriers to organizational agility and include factor such as i) Collection of overwhelming amount of data ii) Lack of integration between perception systems and sources iii) Un-standardized perceived data iv) Information overload for decision makers v) Time lag between installation of IS and organizational response vi)

Inflexibility of IS vii) Technology dependence: which can inhibit learning

Agility Design Propositions

Studies identified as part of the SLR process were analyzed for extracting CIMO rules and subsequently unique CIMO extracted from these by combining semantically similar items. The operationalization differences between authors were ignored as the intent of the present review was to develop a conceptual framework of relations.

Context

A structured analysis of literature based on the Context, Intervention, Mechanism and Outcome (CIMO) logic was undertaken to identify commonly found themes. The exercise included a total of 15 items.

Competitive Environment

The most common context elements for agility is a dynamic competitive environment described as either turbulent environment (Holmqvist, 2006 & Ashrafi, Xu and Sathasivian, 2005) hypercompetitive environment (Ravichandran, 2007) or dynamic competitive environment (McAfee & Brynjolfsson, 2007) Environmental context is further classified as moderately dynamic and highly dynamic environments. (Sengupta & Maisini, 2008)

Value Net

Another context theme that emerges relates to the classification of the context in which the agility needs arise (Sambamurthy, Wei, Lim & Lee, 2007) i) position on value net which refers to the position of initiative as demand side, supply side or internally focused ii) type of exchange which refers to the exchange involved in business initiative to refer to either B2B or B2C and iii) type of innovation as refereeing to new markets or new customers in existing markets

Organizational Characteristic

Among the context elements studied are also themes related to organizational characteristic such as Multi-unit organizations (Gallegher, 2008) or agility orientation (Sambamurthy, Wei, Lim & Lee, 2007) of the organization which refers to a proactive or reactive approach of organizations in dealing with agility

Technology or Process Context

Other context items studied include organizational context due to the deployment of Enterprise Systems (Seethamraju, 2009) or deployment of Service Oriented Architectures (Yoon & Carter, 2007).

Intervention Themes

The intervention item refers to the management actions that can be used to promote organizational agility. Taking a viewpoint that capabilities can be acquired through investment or management action we treat capabilities as part of the intervention element when the model reported in a study assumes the capability as an independent variable

The following themes emerge from an analysis of intervention elements

IT Capabilities

IT capabilities are described in a number of studies as the key intervention that enables business agility. IT Infrastructure is used by authors to describe either i) the technical components ii) or a set of technical and human capabilities and iii) as a set of services shared by the organization. The capabilities included as part of the key interventions include i) Digitized Platforms ii) Capabilities of human resources iii) IT Agility and iv) Explorative and Exploitative IT Capability.

Some interventions refer to IT Capabilities applied to specific processes such as knowledge management processes

Technology Platform

Technology platforms that allow i) standardization and integration or support ii) flexibility through properties such as connectedness, compatibility and modularity or iii) have specific characteristics such as iii) reconfigurability, reconstitutable and versatility or use an iv) architectural style that supports flexibility are described as interventions that can contribute to organizational agility

Complementary Capabilities

Along with IT Capability, a number of complementary capability that are necessary for the development of business agility. Among the complementary capabilities that were reported include i) Operational capabilities classified as operational excellence and operational innovation ii) Entrepreneurial alertness iii) Firm Innovativeness and iv) Intensity of organization learning.

Process Interventions

Process intervention refers to those interventions that are improvements in organizational processes and may sometime refer to IT specific processes. Some process interventions that are reported in the study include i) Scenario Planning and ii) E Biz Coupling

Governance

A number of studies report governance practices as significant interventions. Some interventions in this category include i) IT Investment Orientation ii) Strategic Business Initiatives iii) governance mechanisms such as relational and integration architecture and iv) Capability building processes

Mechanism Themes

The mechanism elements refer to the effect of action in a certain context that answers the question “why a certain intervention produces an outcome?” (Boucharas, 2010). The themes that could be seen in research studies analyzed for the purpose of identifying the agility drivers can be classified as

Alignment Mechanisms

Better alignment of business and IT (Yoon and Carter, 2009), complimentary abilities of IT and Operational ability (Sambamurthy, Wei, Lim & Lee, 2007) and alignment of IT Infrastructure cluster with the context of the business initiatives (Weill, Subramani & Broadbent, 2002)

Capability Development

Several mechanisms found as part of the study refer to capability development and include i) easier to integrate systems (Yoon and Carter, 2007) ii) improved strategic awareness (Holmqvist, 2006).

Efficiency Improvement

Efficiency gains in certain processes facilitate intermediate outcomes and in some cases improve agility by allowing ease of re-configurability. Among the efficiency elements considered significant are i) lowering of operating costs, ii) reuse of existing functions and iii) Quality improvements Yoon and Carter (2007).

Process Improvements

Process improvements are identified in a significant number of studies as contributing to the improvement of agility or the intermediate outcome. Mechanisms in this category include:

- i) Improvement to business services such as customer service or improvement in response to market (Yoon and Carter, 2007)
- ii) Improved technological process through improvement in data flows or flexibility

- iii) Improvement to learning processes through Learning by Action (Ashrafi, Xu and Sathhasivian, 2005) or improvement in knowledge characteristics (Holmqvist, 2006) and
- iv) Range improvements, including improvements in velocity and visibility (Melarkode & From-Poulsen, 2004) or expansion in the range of managerial and physical capabilities (Fink, 2009) or IT enabled the propagation of changes (McAfee & Brynjolfsson, 2008)

Outcomes

The outcome elements in the synthesis can be divided into two classes namely i) intermediate outcomes that are reported as outcomes of interventions or generative mechanisms that arise because of these interventions and the ii) final outcomes or the outcomes that are used as the final dependent variable by the study being reported or analyzed

Final Outcomes

Due to the context of this literature review the final outcome reported in most studies was Business Agility, Organizational Agility or Strategic Agility. Some studies treat Agility as an intermediate outcome and an immediate precursor to Competitive Advantage. (Fink, 2009; Bhatt & Grover, 2005; Sambamurthy, Wei, Lim & Lee, 2007; McAfee & Brynjolfsson, 2008) or Firm Performance (Sengupta & Maisini, 2008; Ravichandran, 2007; Sambamurthy, Wei, Lim & Lee, 2007)

Other outcome elements found in the literature review include Strategic Alignment (Fink, 2009) indicating the common precursors shared with Agility

Intermediate Outcomes

The following themes emerge based on an analysis of the intermediate outcomes reported as part of the papers included in this literature review

Organizational Capabilities

Absorptive Capabilities, Dynamic Capabilities (Ashrafi, Xu & Sathhasivian, 2005) and Innovation Capabilities (Ravichandran, 2007) are intermediate capabilities that are reported as antecedents to Business Agility usually as complementary to IT Capabilities of the firm Operational Agility (Ashrafi, Xu & Sathhasivian, 2005) is another organizational capability that is considered critical to business agility.

IT Dependent Capabilities

A number of studies report IT Dependent Capabilities as important intermediary outcomes that lead to business agility. Digital Options described as the digitized knowledge and processes of the firm (Ravichandran, 2007). IT Dependent Systems Agility, IT Dependent Information Agility (Fink, 2007) and Enterprise Systems Enabled Capabilities (Seethamraju, 2009) are some capabilities that mediate the link between IT Capabilities and Organizational Agility

IT Capabilities

IT capabilities reported as significant to the development of Organizational Agility include i) IT Infrastructure (Gallagher, 2008) ii) Range of Physical Capabilities and Range of Managerial Capabilities (Fink, 2009) iii) IT Infrastructure Quality (Bhatt & Grover, 2005) iv) Technical IT Capabilities (Tallon, 2007) v) IT Capabilities (Gallagher, 2008) vi) IT Business Expertise (Bhatt & Grover, 2005) and vi) Relational Infrastructure (Bhatt & Grover, 2005)

DISCUSSION

The above analysis clearly indicates that IT can contribute to Organizational Agility in multiple ways. Thus IT can enhance enterprise agility through i) provisioning flexible IT infrastructure ii) improved efficiency of IT processes, ii) improved IT Capabilities iii) Enhancing organizational capabilities and iv) Digitization of organizational processes.

Further organizational agility is improved through i) alignment of business and IT organization and ii) improvements to IT Governance

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