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The Value to the Organization of an Adaptive Approach to a Technologically Disruptive Environment

Hillary Wittich
University of Pennsylvania, hwittich@gmail.com

Submitted to the Program of Organizational Dynamics in the Graduate Division of the School of Arts and Sciences in Partial Fulfillment of the Requirements for the Degree of Master of Science at the University of Pennsylvania
Advisor: John Pourdehnad

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Comments
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THE VALUE TO THE ORGANIZATION OF AN ADAPTIVE APPROACH TO A TECHNOLOGICALLY DISRUPTIVE ENVIRONMENT

by

Hillary G. Wittich

Submitted to the Program of Organizational Dynamics
in the Graduate Division of the School of Arts and Sciences in Partial
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THE VALUE TO THE ORGANIZATION OF AN ADAPTIVE APPROACH

TO A TECHNOLOGICALLY DISRUPTIVE ENVIRONMENT

Approved by:

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John Pourdehnad, Ph.D., Advisor

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Ana Reyes, Ph.D., Reader

_____

Steven Freeman, Ph.D., Reader

ABSTRACT

The purpose of this Capstone is to explore the possible roles Information Technology (IT) could play in the success of the organization as it transforms into a workplace capable of adapting to the disruptive nature of digital technology. This is accomplished by identifying the positive value to the organization provided by digital technology and social business tools; describing the disruptive nature of this new technology and the tools associated with it and its impact on the organization-as-a-whole; presenting some of the tensions and possibly evolving paradigm shifts within the organization as a result of the disruptive nature of digital technology and social business tools; evaluating predominant near-term operational models being considered by IT leadership and their responsiveness to this disruptive technology environment; and recommending a course of action that will provide an organization with the necessary tools required for continuously adapting to the uncontrollable and disruptive nature presented by the heavily digital technological environment that will most likely persist throughout the first quarter of this 21st century.

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CHAPTER 1

INTRODUCTION

With the growing popularity of digital technologies and the pervasiveness of such popular devices as smart phones and media tablets, behaviors previously perceived as threats to an organization's most cherished commodity - its experience and tacit knowledge - are finding their way into the everyday work environment and practice. Such behaviors as sharing sensitive data and strategic information through unsecured document sharing services, such as Dropbox, Google Docs, Google Sites, are becoming prevalent as more functions are outsourced to partner organizations and more people are turning to technologies they are familiar with to solve every day work-related problems.

The disruptive nature of digital technology is forcing the various parts within the organization to face the potential for change. Changing conditions within the workplace are as far reaching as redefining who we work with and how we interact with each other, and are even effecting our own sense of security in a still uncertain economy. As William Bridges reminds us: "Changes of any sort – even though they may be justified in economic or technological terms – finally succeed or fail on the basis of whether the people affected do things differently" (Bridges, 2003, p. 6).

The challenge for the organization-as-a-whole today is to recognize the need to change and then choose a method by which to enact this change.

One of the core components of the IT function is to protect the purpose and objectives of the organization by thoroughly testing all new technological solutions, whether purchased or built in-house. In today's highly competitive, first-to-market environment, pressures coming from the business units to speed up this vetting process are common, especially when it involves digital technology and cloud computing solutions. This pressure may manifest itself in the form of an unresolved paradigm shift around the role of IT within the organization and could lead to increased tension and even internal conflict between the business unit(s) and IT. This tension and the ensuing conflict could ultimately spread throughout the organizational structure and threaten its ability to survive within the disruptive technology environment.

If not handled properly, the organization could fail because it acted too quickly and made decisions that led to the loss of control over what are quickly becoming its most valuable assets: its information, data, and knowledge. Finding the best means of resolving this conflict before it even occurs should be of paramount importance to the organization.

The Generation of New Knowledge

For the purposes of this discussion, digital technology and 'social business tools' are used to refer to any computer-mediated communication devices and formats used within the workplace to enable two or more people to engage in the

activity of exchanging information or messages and to discuss it in either a synchronous or asynchronous fashion (Spitzberg, 2006). Common forms of social business tools used in the workplace today are: voicemail, instant messaging, electronic bulletin boards, audio conferences, video conferencing tools, wikis, mind maps, and in-house social networking sites.

An example of how information is gathered by one business unit within the organization, stored by IT, and then transformed into new knowledge may look like this: the Marketing Department of All Clad, a large retail cookery manufacturer, sends an email to a known customer who'd recently purchased a set of new pots, using the contact information provided when they sent in their warranty form. The person decides to make a purchase based upon the promotional information provided in the email. They go online; input their personal information; enter the promotion code and their payment information; and hits the <Submit> button. The transaction, along with the promotion code and any new information, is added to the individual's record within the Customer Relationship's database residing on a server housed and maintained by the IT department. Future operational activities performed by the organization, such as attempts to cross-sell other products and product lines, are also recorded to this same database and used by individual business units to track:

- How many cross-sell emails they've sent out to this particular customer;
- Which ones were actually opened versus those they ignored;
- What, if any, action they took in response to this email; and
- Even which phrase or concept elicited an action tied to a purchase.

At this point, the information initially collected about the customer has been transformed into new knowledge - knowledge about how that particular customer behaves and what concepts might possibly resonate with them to the degree that they take an action. Kernels of information, such as this, can grow into new knowledge that reaches far beyond Marketing and Customer Relations. Aggregating data into trend predictions and other data mining algorithms can lead to strategic decisions for R&D initiatives, expansions into new market areas and other growth opportunities that reach far beyond the actual individual customer. This knowledge is at the core of any organization's attempts to grow their business as higher emphasis and focus is placed upon sharpening and deepening customer and client relationships.

Central to this process is the role Information Technology (IT) plays as the owner of all technology tied to the generation and maintenance of information. This ownership traditionally spans all business decisions made relative to the creation, acquisition, and maintenance of those applications and internal and external distribution channels required to manage an organization's data repositories. The introduction of digital technology is giving a new, 'sexier' sheen to the role technology plays in the distribution of information and content tied to this data.

The recent economic downturn has placed greater emphasis upon the importance of using the tools and applications tied to digital technology as a new money-saving / revenue-generating distribution channel that extends far beyond

the traditional confines of the organization. Websites and emails are easier and cheaper to create than producing printed copy; there's an instantaneous feedback loop tied to texting and tweeting; and the ability to reach a whole network of people through Facebook is not only immediate, but cost efficient.

The Challenge for IT

Actions tied to decisions to move technical functionality into the business unit have many upper-level IT managers and officers questioning requests by the business unit managers to invest in new emerging digital technology. Potential risks abound as personal devices with access to sensitive data may be lost or stolen and inappropriate or confidential information lost or even stolen through the theft of devices or the transference of data across uncontrollable and unsecured environments (Bernoff, Shar VanBoskirk, & Polanco, 2010).

Gartner, Inc., one of the premier information technology research and advisory companies in the United States, predicts that by 2014, at least one-third of organizations in the United States without formalized controls in place to protect them will experience:

- The substantial loss of data;
- Disintegration of process integrity, and
- The exposure of security vulnerabilities (Knipp, Norton, & Gall, 2010).

The recent release of highly sensitive and damaging governmental documents to Wiki Leaks highlights the importance of the implementation and enforcement of a strong security policy as a barrier to the early and uncontrolled disclosure of highly sensitive and confidential strategic and financial information.

The desire to embrace the power enabled through this new technology persists as Gartner, Inc. advises CEOs and CIOs on the risks associated with not embracing the free-flow of social business tools and devices finding their way into the every-day functionality of the business unit.

> Consumerization of IT is an irreversible megatrend. IT organizations that look at consumerization to enrich the flow of information [in order to] discover new ideas and reach new markets will excel. Those that attempt to fight consumerization will sink into irrelevance. Fit the future; don't fight it….. IT consumerization is about more than devices, software and access.

The net result of all this activity is strain and tension between the business unit and the IT department as a new paradigm shift may evolve within the organization's internal structure and it re-evaluates:

- The value of its unique information and data;
- The knowledge it can generate; and
- Who, ultimately, should own and control the technology needed to generate it.

Structure of Capstone

This capstone begins by expanding upon the split within the organization between the IT department and the business unit over the usage of digital technology and social media tools. This is achieved in Chapter 2 by examining the effects these tools have upon the organization and its workers and the possible need for a systemic change in the relationship between IT and the business units. This chapter includes a discussion of four near-term operational restructuring models that many IT leaders are considering as a solution to what is recognized by many to be a real need for change. Chapter 3 looks deeper into the role IT is currently playing within the organization-as-a-whole and the evolving and shifting nature of this role due to the potentially disruptive nature of digital technology and social business tools. In Chapter 4, this thesis proposes approaching the development of a solution from a Systems Thinking perspective as an alternative plan to the four near-term operational models considered in Chapter 2. It concludes in Chapter 5 by recommending the organization take an adaptive approach to solving the tension by following Russell Ackoff's Ideal Design and Interactive Planning methodology which looks to the larger containing technological environment for guidance on how best to deal with disruptive forces.

CHAPTER 2

DISRUPTIVE NATURE OF DIGITAL TECHNOLOGY.

The Disruptive Nature of Emerging Digital Technology

At the March 24, 2011, GameTech 2011 panel session entitled "The Future of Virtual Worlds," Richard Boyd, Director of Emerging/Disruptive Technologies at Lockheed Martin, used the following story as an example of how disruptive this emerging digital technology will be.

> This era of us learning how to adapt to the devices I think is rapidly coming to a close and it's going to be all about, and I think the companies are going to win - like the Intels and whoever - are going to learn how to make this stuff adapt to us and make it more natural. We're using natural language processing and gesturing. Another one of my colleagues, Frank Bowsman, coined the term – you guys have heard of the term 'digital immigrants' and 'digital natives' by Marc Prensky – he coined the term 'gestural natives' and that's like my 5 year old today.
>
> I often tell the story of when she was three. From the time she was three, she'd already had a year or more experience working with an iPod Touch and that interface. And I caught her one day out swiping her hand in front of my television. And I asked her what she's doing … and she said 'Daddy, it's broken'. 'Oh, you're trying to change the channel.' So I explained to her: 'here are the three or four things I have in my den. I use this for that device…' and she just looked at me puzzled and I said, 'of course, you're right! Why don't these things just do what we ask them to do? Why do I have to figure out the interface?' And I think that age is ending soon (Metanomics, 2011).

With the growing popularity of digital technologies and the pervasiveness of such popular devices as the smart phone and the media tablet, behaviors previously perceived as threats to an organization's most cherished commodity - its experience and tacit knowledge - are finding their way into the everyday work

environment and practice. Behaviors such as sharing sensitive data and strategic information through unsecured document sharing services through Dropbox, Google Docs, Google Sites, are becoming prevalent as cost-cutting efforts have outsourced previously internal function to partner organizations, and users turn to technologies they are familiar with to solve work-related problems.

Central to this new behavior is the growing importance of cloud computing as a solution platform. The cloud is the computing platform upon which most web-based collaborative tools and applications are built and is recognized as a reliable, cheap and easy solution to many of today's private sector woes. Gartner Inc., defines cloud computing "as a style of computing where scalable and elastic IT-enabled capabilities are delivered as a service using Internet technologies" (Smith, 2010). Gartner rates this technology as transformational and goes on to describe the impact it will have on the business sector as "changing the way the IT industry looks at user and vendor relationships." The flexibility provided by the 'scalable and elastic' nature of cloud computing means that costs are primarily subscription based and a la carte by nature. Thereby placing those technical companies providing cloud services perfectly to address the needs of those organizations wishing to cut technology costs by reducing head count and infrastructure investments.

The Advantages and Disadvantages of Cloud Computing

Since the early days of the Internet, one of the Information Technology department's principal responsibilities has been to protect the organization from

loss or theft of its sensitive data, intellectual or other knowledge-based property. In 1996, as a result of recent improvements in Internet connectivity rates instituted by the telecommunications industry and efforts by the financial services sector to develop secure online transactions, the National Institute of Standards and Technology, (NIST) released a report entitled "Electronic Commerce and Intellectual Property on the Internet: An Overview of the Concepts."

This report is the initial response by the Federal Government to requests from the private sector for role definitions and guidelines tied to protecting and securing the electronic transference of protected personal and private information over the Internet. Their response was predictably restrictive and reflects the prevailing mindset, views and attitudes upon which most IT departments built their internet security policies.

> Business use of the Internet has increased dramatically. New technologies and procedures involving Intellectual Property and Electronic Commerce will revolutionize the marketing of products and other business transactions. Intellectual Property Assets are expensive to develop and with electronic mediums can be disseminated widely, with or without the owner's approval, in minimal time and minimal cost. Electronic Commerce transactions *must be secure and must be integrated into an organization's marketing and information dissemination procedures. Without controls in place, the assets and information can be pilfered or misused without the owner's knowledge* (Kaetzel & Padilla, 1996, p. 184, emphasis added).

Since 1996, much has changed – including the NIST. This agency is now promoting the power and capabilities of cloud computer.

> The Cloud Computing model offers the promise of massive cost savings combined with increased IT agility. It is considered critical that government and industry begin adoption of this technology in response to difficult economic constraints. However, cloud computing technology challenges many traditional approaches to datacenter and enterprise application design and management…. [S]ecurity, interoperability, and portability are cited as major barriers to broader adoption (Mell & Grance, 2011).

Cloud computing is just one of the "*technological forces*" or trends that Gartner considers disruptive to the degree that if these services reach their full anticipated potential, they could permanently change the way we interact and operate. Gartner also includes the following within this list:

- Increases in the level of technological savviness throughout the workplace as younger generations enters the workforce;
- The influx of more affordable digital devices, along with improved telecommunication access to the Internet from virtually any place in the world;
- The evolution of a ubiquitous, global network that enables a universal sense of community and a 'communications everywhere' sense of entitlement;
- The pervasiveness of cheaper, more accessible collaborative solutions that enable distributed and global connectivity; and
- The increased prevalence of decentralized, online web services (i.e. via the 'cloud') that reside outside an organization's firewall and are replacing traditional licensed software (Basso, 2008).

<u>Effects of Technological Forces on the Workplace</u>

The growing influence of these technological forces is influencing the way work is being performed within most organizations. The introduction of digital

technology is highlighting the importance to the organization of a tech-savvy workforce equipped with the tools and devices necessary for accessing a cheap, decentralized, ubiquitous global network – and, most importantly, the ability to work anywhere and collaborate with anyone at any time on an as-needed basis.

Central to this shift is recognizing the importance of:

- Knowledge generation to the organization's bottom line.
- Supporting a distributed, global workforce;
- Restructuring the organization down to its core competencies and outsourcing essential operational functions; and
- Finding a technology savvy, business professional workforce capable of meeting the organization's growing dependence upon technology applications and programs.

<u>The Growing Value of a Knowledge Generation</u>

In 1969 Peter Druker introduced the concept of the *Knowledge Economy* in his book The Age of Discontinuity; Guidelines to Our Changing Society. This information-driven economic model views an organization's knowledge as its most important asset - the one pivotal to the organization's ability to maintain and grow its competitive advantage.

> The knowledge-based view of the firm views a firm as a knowledge-creating entity, and argues that knowledge and the capability to create and utilize such knowledge are the most important source of a firm's sustainable competitive advantage. Knowledge and skills give a firm a competitive advantage because it is through this set of knowledge and skills that a firm is able to innovate new products/processes/ services, or improve existing ones more efficiently and/or effectively. The raison d'etre of a firm is to continuously create knowledge (Nonaka, Toyama, & Nagata, 2000, p. 1).

Central to this economic model is the generation of knowledge, - the byproduct, not product, of an organizational decision to openly share information and data throughout the organizational structure as a means to allowing new knowledge to naturally evolve and be created (Peters, 1997). Critical to the generation of knowledge are '*knowledge resources*' - the individual pieces of tacit and explicit knowledge that the organization and the individual working within the organization have to contribute to this natural synthesis process. Unlike the typical resource constraints of time, money, and materials, knowledge is abundant and self-regenerating by its very nature. In fact, a concern that many have about an economy based solely upon the generation of knowledge is how to manage it so we don't drown in it.

The value of knowledge to both the organization and its individual workers are far reaching. The recent explosion of new collaborative formats and applications now available through digital technology and social business tools provides the organization with many options for generating new knowledge. To find and keep its competitive edge, organizations are turning within - to the people, technology and knowledge it has already pulled together - to find the means for remaining creative, innovative and successful.

Innovation, creativity and knowledge evolve out of unique combinations of people, circumstances and technology. In today's knowledge marketplace, it is the individual, the *knowledge worker*, and his or her unique set of personal needs, wants, and desires, that provides the spark igniting the creation of new knowledge. And it is the role of the company to provide the right combination of people, environment, and technology that will generate the knowledge and innovations it wishes to create (Nonaka, et al., 2000).

With the introduction of digital technology and social business tools, the ability to generate new knowledge through interaction has moved outside the original boundaries of the organizational structure in a way that could have disruptive consequences to the organization-as-a-whole. Examples of how people are taking advantage of these new opportunities are evident in what some call *The Gift Economy* and *Collective Intelligence.* Each has proven both exhilarating and yet challenging to the internal structure of most organizations; especially at those pressure points where it is the responsibility of the IT

department to protect the organization from the theft of its hard earned knowledge.

The Gift Economy. In the Gift Economy we see signs of both intrinsic and extrinsic gains motivating people who do not know each other to extend a helping hand. Through online exchanges, such as social networking communities, blogs, and personal websites, it is easy to find others who have knowledge or experience in areas that an individual employee may not. People turn to Pod casts, blogs and social networking sites such as YouTube, MySpace and Facebook, to find answers to questions they cannot solve. You go to an online forum and search for an answer that can help you. If you can't find one, then you post your question in hope that someone who has had a similar problem sees it and shares what they have learned with you. While up there you see a question someone else has that you can answer. So you do.

This desire to share - to find peers who have gone through similar experiences and to reach out and give in order to help others - may have grown out of our innate need to be esteemed, respected and valued as unique individuals with something to contribute and share with our fellow human beings (Maslow, 1946). This motivation alone may explain why so many are willing to give away these 'gifts of knowledge.' In many cases, receiving positive feedback around the value of their contribution is all that is needed to fuel this knowledge economy - although intrinsic rewards, such as making a connection that could lead to a better job down the road, are also good motivators. However, the cost

to the organization of the loss of the competitive edge gained through valuable explicit information and individual tacit knowledge could be great.

Collective Intelligence. An alternative to the Gift Economy, Collective Intelligence, or 'Crowd Sourcing,' assumes that people wish to be financially rewarded for their contributions and is a conscious decision made by many companies to benefit from the desire of others to give of their knowledge and experience in order to provide value to another.

In Collective Intelligence, a company posits a question to a community of self-proclaimed experts and these experts work together to find a solution. There is no centralized authority, so it is the crowd that decides how to approach the problem and what the best solution is. "Quality is determined by peer acceptance of contributions as the basis for further work and development, and contributors tend to be motivated by reputation rather than financial rewards" (Gartner Inc., 2006).

Practices tied to initiatives such as the Gift Economy and Collective Intelligence are examples of why social business tools are considered disruptive within the business sector. It is to the advantage of the business unit to find the best solutions and to be as efficient as possible in doing so. Reaching outside the confines of the organizational structure to make connections and to learn from others is one means towards getting the competitive edge. Yet, it has traditionally been the responsibility of the IT department to protect valuable information, including strategy, data and plans. And the ready access to digital

devices and other collaborative tools makes it virtually impossible for the IT department to control the leaking of valuable information, even if the intent is honorable.

By using digital tools such as social networking, wikis, blogs, podcasts, videos and mind maps, a user can take information and data from behind the organizations' protective firewall (those same protections put in place by IT) and disseminate them to an unknown audience within an unprotected environment via an unsecured connection. In a Knowledge Economy, this behavior is encouraged because the ultimate value to the organization and the individual is found in the solution, the knowledge gained – not in the parts, such as the individual units of information and data. However, it is possible to see how this type of behavior could contribute greatly to the tension and internal conflict between IT and the business unit over who controls the technology and the valuable knowledge it can cultivate.

Supporting a Decentralized, Global Workforce

> "I work on seven different teams that average 9.2 members each from twelve different company offices on three different continents. I have four different bosses, two of whom I've never met personally and one that just set my salary for next year. I see a lot of technology to stay in touch." From a Fortune 500, middle-management, information worker (Reeves & Read, 2009)

Where we work is being just as affected by digital technology as how we work. The concept of 'globalization' really took off in the 1980s and '90s with the fall of communism, the growth of a strong Asian workforce and market, the rise of

the united European Union, and the introduction of digital technologies providing immediate communications regardless of location and time. Recently, spurred on by an economy that is forcing management to rethink where their vanishing budget dollars are spent, today's workers and organizations are being forced to rethink how they interact across geographic and time zone distances. This has led to a recent spike in interest for technologies that support a more distributed organizational model; and has forced organizations to fast-track development of the technological solutions needed to handle a large, distributed, global work force.

In 2008, Nemertes Research, a research firm specializing in IT trends, released a report entitled "Managing the Virtual Workplace". This article reported an 800% increase in the number of distributed workers (those working in locations outside the structure of the traditional office space) for the period spanning 2001 and 2006. In 2009, Accenture found that over 10% of the worldwide work force telecommunicated to work - a triple increase since 2000. Thomas Cheese, et al., in their report entitled "The Talent Powered Organization: Strategies for Globalization, Talent Management and High Performance" attributes this growth as much to the overall globalization of work as to recent technological advancements in new digital technology and tools which enabled rich collaborative interactions from a distance. Outside of any uncontrollable or unpredictable cataclysmic event, all indicators (such as a weak economy, the high cost of gas, expanding global markets, and an aging workforce to name a

few) point to this trend continuing through this and into the next decade (Cheese, Thomas, & Craig, 2010).

Independent of development tied to enhancing digital communications and collaboration, recessionary cutbacks are impacting organizational structures and cultures to a degree that many organizations are finding it necessary to significantly trim headcount in such key operational areas as IT, accounting, marketing, and public relations. This necessity is forcing some to rely heavily upon external freelance and contract workers to perform those duties previously performed by dedicated full-time employees. Although organizations may experience immediate increases in productivity and savings, new tensions stemming from survivor's guilt, distrust, and fear (to name a few) are seen creating fissures between those who remain, those temporarily brought in to fill the gaps, and anyone considered ‘management.’

These tensions are compounded by the call for rapid integration of global team members into previously local organizational cultures and structures. As the number of global interactions increase, management’s lack of knowledge and experience with cross-cultural issues becomes more and more apparent. According to a survey of senior executives from 68 countries, close to 90% of the

executives queried see "Cross-cultural leadership" as the biggest management challenge of this new century (Livermore, 2009).[1]

For the individual global manager, whether at home or abroad, the frustration level can be high as they contemplate what effects a failed cross-cultural assignment might have upon their career. For the global teams they manage, the low satisfaction and high turnover rates among managers has a residual effect especially as questions such as 'when will this person leave us for another assignment?' or 'why can't these Americans understand us?' persist.

With the advent of digital technology and social business tools, many in the United States are feeling connected and empowered by their ability to access information, opportunities, and people regardless of the constraints of location, time, and culture. Integration of these tools into global organizational interactions is benefiting both the organization and the worker. But they are also increasing tensions among team members, since the level of access to the infrastructure required to operate these devices is not universally guaranteed. According to a study performed by Brown and Czerniewicz, physical access to the means (i.e. the physical devices and software) required to interact with the digital technology

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[1] Up to 40% of managers sent abroad on long-term foreign assignments end them early due to cross-cultural problems. The impact of this trend is estimated to cost corporations between $250,000 and $1.25 million. Livermore, D. A. (2009). *Leading with cultural intelligence : the new secret to success*. New York: American Management Association.

creates the biggest divide between those who qualify as tech-savvy and those who don't (Brown & Czerniewicz, 2010).

A Tech-savvy Business Workforce.

Don Tapscott and Marc Prensky, two popular gurus on the topic of today's digital youths, believe that those born after 1994 (the *Digital Natives*) are better adapted to a digital world than the rest of us (the *Digital Immigrants*) simply because they never experienced a world without digital technology.

> Today's kids are so bathed in bits that they think it's all part of the natural landscape. To them the digital technology is no more intimidating than a VCR or toaster. For the first time in history, children are more comfortable, knowledgeable, and literate than their parents within innovation central to society. And it is through the use of digital media that the N-Generation will develop and superimpose its culture on the rest of society. Boomers, stand back. Already these kids are learning, playing, communicating, working, and creating communities very different than their parents. They are a force for social transformation (Tapscott, 1998, pp. 1-2).

This discourse has found its way into our popular culture and even our educational system. In 2001, Marc Prensky arguing that it is virtually impossible for today's 'Digital Immigrant' teachers to reach their younger, more technically savvy students, stated that "[T]he single biggest problem facing education today is that our Digital Immigrant instructors, who speak an outdated language (that of the pre-digital age), are struggling to teach a population that speaks an entirely new language." (Prensky, 2001, p. 2, emphasis in original). Despite much controversy around this concept that people born after 1990 were 'born digital,' popular culture is rich in references to the generational split implied by the Immigrant/Native dichotomy. A search query on Google for *Digital Natives* and

Digital Immigrants returned about 231,000 results, among them a YouTube wrestling comic book/video pitting Digital Immigrant tools (such as webpages, PCs and email) against those of the Digital Native (Facebook, MACs, and Instant Messaging).[2]

If the state of being a Digital Native is defined as "*certain attributes and experiences*… and the impact of this upon how they interact with information technologies, information itself, one another and other people and institutions" (Palfrey & Gasser, 2009, webpage. Emphasis added) can this state of 'nativehood' transcend the constraints of age as those born both before and after 1990 learn and adapt, both within the workplace and at home, to the changing rules introduced by this new technological and cultural phenomenon? As stated in the above quote, Palfrey and Gasser, co-founders of the Digital Natives program at the Berkman Center for Internet and Society at Harvard University and its affiliated www.digitalnative.org, appear to believe it does. And they're not alone.

The Bureau of Labor and Statistics (BLS) is expecting the US adult civilian, non-institutional (i.e. those not working in such public institutions as schools or hospitals, or in the military, municipal, or federal government sectors)

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[2] Access this video, "WWWF WIMBARAW Presents: The Digital Immigrants v. The Digital Natives", by going to http://www.youtube.com/watch?v=zlKH96CSz-w. The overarching theme of this video is that old teaching techniques and technology are no longer relevant for today's students. The narrator appears to be of school age and the video has the feel of a comic book.

workforce population to increase by 10.7%, or 25.1 million workers through the ten years spanning between 2008 and 2018. This rate is a significant drop from the 1998 to 2008 period when that growth rate reached a high of 13.9% (Bureau of Labor Statistics, 2010).

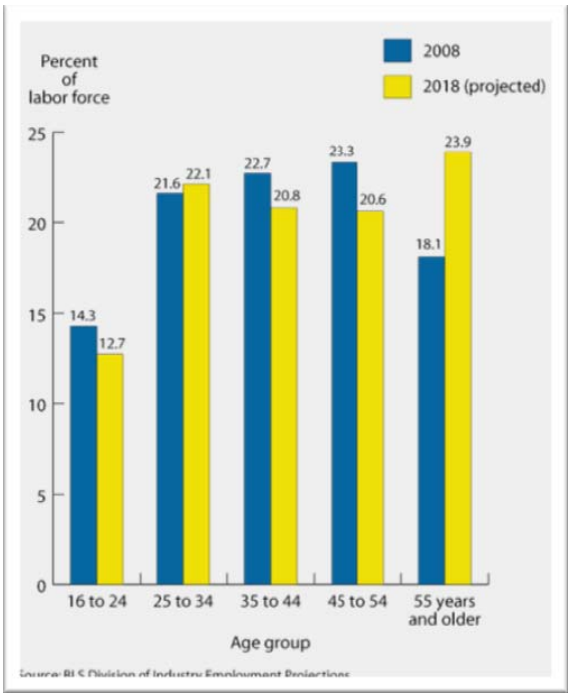
Continuing a trend begun in the 1960's, the BLS predicts that the population growth will vary by age, race, and ethnicity with the most significant percentage of workers being the Baby Boomer segment (those born following World War II and before 1964). The BLS anticipates this trend to continue. By 2050, the Population Division of the United Nations is predicting: "The number of older persons has tripled over the last 50 years; it will more than triple again over the next 50 years" (McNicoll, 2002, Chapter II, p. 11).

Between 2008 and 2018, the Boomers are expected to increase their share of the overall workforce by 29.7% - an increase drastically more than any other age group at this time. While the presence of Baby Boomers continues to be high, the level of active participation in the workforce by younger generations is anticipated to drop (Bureau of Labor Statistics). For instance, 70% of the 2020 total workforce is already out of college today (Wattenberg, 2004). In contrast to the 5.8% growth anticipated for the older Baby Boomer segment, the BLS predicts no or little change in participant numbers for those between 35-44 years old (i.e. those born from 1974-1983). The number of those falling within the 45-54 age group is predicted to actually decrease by at least 4.4% throughout this same 2008-2018 period. That being said, there was a spike of births around the

time of the millennium. The impact of this increase in birthrate will slowly begin to be felt, but no earlier than 2012, as those born between 1994-2002 turn 18 and start entering the workforce (Bureau of Labor Statistics, 2010).

The implication of these numbers for the U.S. work force is that by the year 2018, the largest two age groups in the U.S. labor market will be those 55 years and older (48 and older in 2011) and those between 25 to 34 years old (18 to 27 in 2011). Although not necessarily significant, the importance of this information lies in the possibility that come 2018, the U.S. workforce will be influenced by two experientially opposite age groups: those who are at the end of their careers, and those who are just beginning. See Figure 1 below for a summary.

Figure 1. Percentage of Labor Force by Age Group



Effects of Technology-based Forces on the Workplace

As discussed above, multiple external forces created by the introduction of digital technology and social business tools are affecting the way work is being performed within most organizations. The introduction of digital technology is highlighting the importance to the organization of a tech-savvy workforce, equipped with the tools and devices necessary for accessing a cheap, decentralized, ubiquitous global network, able to work anywhere and collaborate with anyone at any time on an as needed basis.

In their 2008 report entitled “2018: Digital Natives Grow Up and Rule the World,” Gartner argues that by 2018 technological and social trends and advancements will impact the way we work to such a degree that the organizational and operational models of yore will no longer apply (Basso, 2008).

The extent, speed, and intensity with which digital technology and social business tools are permeating our society and the process of performing the work of the organization is making it virtually impossible for us to ever return to our old ways of behaving and operating. This is the disruptive effect of the forces tied to digital technology

The disruptive nature of digital technology is forcing the various parts within the organization to face the potential of change. Changing conditions within the workplace are as far reaching as redefining who we work with and how we interact with each other, and are even effecting our own sense of security in a still uncertain economy. As William Bridges reminds us: “Changes of any sort – even though they may be justified in economic or technological terms – finally succeed or fail on the basis of whether the people affected do things differently” (Bridges, 2003, p. 6).

CHAPTER 3

RESPONDING TO TODAY'S CHANGING ORGANIZATIONAL ENVIRONMENT

The Value-Add of Social Business Tools to the Organization

The impact of digital technology and social business tools upon the organization is not restricted to just marketing or customer retention. It also has direct implications upon how successfully the organization operates and functions. Jive Software, Inc., a software development company specializing in bringing "the innovation of the consumer web to the enterprise" (Jive Software, 2011b), and second only to Microsoft as a leader in Gartner's Magic Quadrant for Social Software in the Workplace (Drakos, Mann, & Rozwell), commissioned an independent survey firm in December, 2010 to conduct a study of over 500 respondents and their usage of social media and digital technology in the workplace.

The range of respondents was diverse and spanned 35 different industry sectors. It included the full spectrum of workers from subcontractors through CEOs, and covered more than 300 companies whose sizes ran from greater than 1,000 employees to over 100,000. The survey asked questions about their current and anticipated use of social media within the organization. The intent was to measure the impact of social media tools (which they refer to in this context as social business tools) within the corporate environment.

For the purposes of this discussion, I use '*social business tools'* to refer to any computer-mediated communications format used within the workplace to enable two or more people to engage in the activity of exchanging information or messages and to discuss it in either a synchronous or asynchronous fashion (Spitzberg, 2006). Common forms of social business tools used in the workplace today are: voicemail, instant messaging, electronic bulletin boards, audio conferences, video conferencing tools, wikis, mind maps, in-house social networking sites, and virtual environments. Examples of the efficiencies these tools are contributing to the organization are: increased connectivity and collaboration among distributed teams; improved overall productivity; tangible and intangible cost savings tied to less travel and less time spent in meetings; to name a few.

According to the results of the Jive Software survey, the benefits of using these tools in the work place are:

> For your employees, social business tools are a no-brainer. Easier ways to collaborate with each other, customers, and partners; simpler ways to share information; faster resolution of service issues; and robust customer conversation monitoring across all forms of social media (from Twitter to Facebook to blogs) all make the lives of line employees in sales, strategy, support and marketing easier. (Jive Software, 2011a)

In their conclusion, they found that "[t]he survey results provide strong evidence that social business tools produce more than sufficient ROI, on average, to make any senior executive happy" (Jive Software, 2011a, p. 2). Granted, Jive Software is in the business of promoting their product line,

however, they do provide a window into how organizations are using this digital technology today. Key findings included those listed below in Table 1.

Table 1. Key Results of Social Business Tool Success Rates

- 39% increase in employee connectedness;
- 30% increase in employee satisfaction;
- 25% decrease in onboarding time;
- 33% increase in customer satisfaction
- 34% increase in feedback and ideas from customers
- 27% decrease in duplicated tasks
- 34% decrease in the time to find information and experts
- 27% reduction in email sent
- 37% increase in project collaboration and productivity;
- 32% decrease in the time required to find appropriate answers to questions or information requested
- 29% increase in executive communication;
- 31% increase in customer retention
- 26% decrease in time needed for meetings
- 24% decrease in need for travel
- 42% increase in communication with customers
- 26% increase in web-based sales

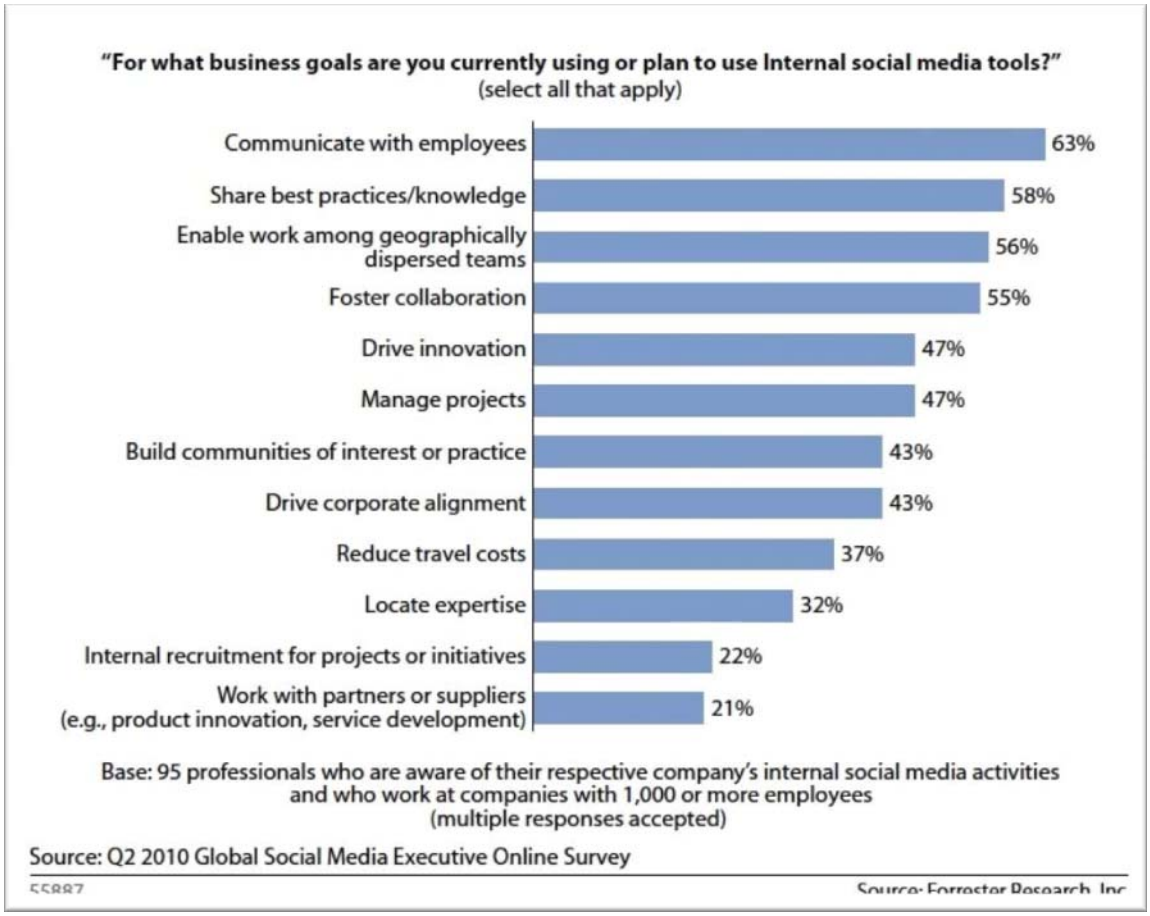
(Source: Jive Software, 2011a)

In their rush to take advantage of the new opportunities evolving out of the confusing nature of our rapidly changing and highly competitive economic and technological environment, business unit leaders are supporting attempts by their employees to circumvent the more cautious, risk adverse, and process-laden IT department - the traditional owners of all technology-based functions and processes. Evidence of this trend is apparent in recent shifts in operational decisions. For instance, many business unit leaders are requiring new hires to

have experience in web development, animation, data mining analytics and CRM software programs. Referred to as the *Citizen Developer,* by Gartner, Inc., this user-type resides within the business unit and brings with them a strong knowledge of both the business side of the operation (such as knowledge of customer preference, the competitive environment and enterprise strategy) and the technological experience and knowledge to either create new business applications or retrofit IT-managed ones to better respond to the immediate needs of the business unit (Knipp, et al., 2010).

In their report entitled "Social Breaks the Logjam on Business Process Improvement Initiatives," Forrester, Inc.'s Clay Richardson, et al, surveyed vendors and user companies such as Accenture, IBM, and the Business Transformation Agency (United States Department of Defense) to get a better understanding of this movement by the business unit to incorporate social media and digital technology tools into the everyday function of their units. They found that 63% use social media tools to communicate with employees; 58%, to share best practices/knowledge; 56% to enable work among geographically dispersed teams; and 55% use social business and digital tools to foster collaboration (Richardson, Moore, & Anderson, 2011). These results (see Figure 2 below) correspond with those reported earlier by Jive Software.

Figure 2. Social Business Tool Usage Trends - Forrester Research, Inc.



A Disconnect Within the Organization.

When reviewing the above listing of benefits to the organization stemming from the usage of digital technology and social business tools within the workplace, it is easy to see the expanse of their influence and reach throughout the organization. Missing from this list, however, are any apparent benefits to the one department with the traditional responsibility for fulfilling the technological and informational needs of the organization: the IT department. This may be a result of the budget cuts to personnel and infrastructure made to the IT department during the recent economic downturn (Gilbert & Austin, 2010), but it

may also be indicative of the absence of an open dialogue between the IT department and its business units.

Forrester's Craig Symons, et al. performed a recent survey of IT CIOs, CTOs, CFOs, VPs, and IT directors and managers throughout the US, and found that only 38% of the organizations indicated that the business was either extremely engaged (13%) or very engaged (25%) in discussions when decisions were being made around what technologies the organization should invest in and where to allocate technical resources (Symons, Leaver, & Cahill, 2011).

> Despite the fact that IT governance is really the business governance of IT and that the majority of IT governance decisions (e.g., how much to invest, where to invest, etc.) are really business decisions, the CIO and IT organization are driving IT governance in many organizations without the active participation of the business leadership (Symons, et al., 2011, p. 7).

The effect of this apparent limited interaction between IT and individual business units during critical technological decisions could have long term implications and consequences for the future of the IT department, the business units, and the organization. Although from an IT perspective, the risks to the organization tied to security breaches and congested networks may trump the needs of the individual business units, promoting a governance policy that does not include the voice of the business unit, may be short sighted and possible disruptive nature to even the overall organizational structure in the long run.

How is IT Responding?

During the first quarter of 2011, Forrester Research, Inc. released a series of reports calling attention to the recent spike in interest on the part of the

business unit to take ownership of their technological solution decisions. This development is creating an internal divide that Forrester believes is a result of the ease of access to information and knowledge now made possible through such emerging digital technologies as infrastructure-as-service (IaaS) cloud computing services, smart phones and digital tablets, such as the iPad.

> Over the past several years, we've seen two key cloud trends in the infrastructure-as-a-service (IaaS) space: 1) Public cloud adoption rates are highest among "informal buyers" (non-IT employees), and 2) infrastructure and operations professionals, the "formal buyers" of these types of technologies, prefer to build private internal solutions. Informal buyers are drawn to the fast and easy access to low-priced computer power that public clouds offer, slipping these purchases under the I&O [Information and Operations] radar. But I&O teams fear the public cloud for its immaturity and insecurity and seek to provide an in-house alternative delivering similar values but with proper controls (Staten, 2011, p. 1).

According to Forrester's Forrsights Hardware Survey, Q3 2010 of 2,321 IT executives and technology decision-makers throughout the US, Canada, France, Germany and the UK, the split is manifesting itself in a tug-of-war over the ownership of the relationship with cloud technology. In a recent survey by Jive Software, the business units indicated their interest in pre-packaged vendor cloud products because of the flexibility and agility they provide and the fact that most are paid for on an as-used basis rather than subscription or per license basis.

Many of the vendor strategists that Forrester talks to are betting on enterprise adoption of IaaS cloud services by core IT infrastructure buyers to fuel future growth in this category. Forrester believes that this expectation is

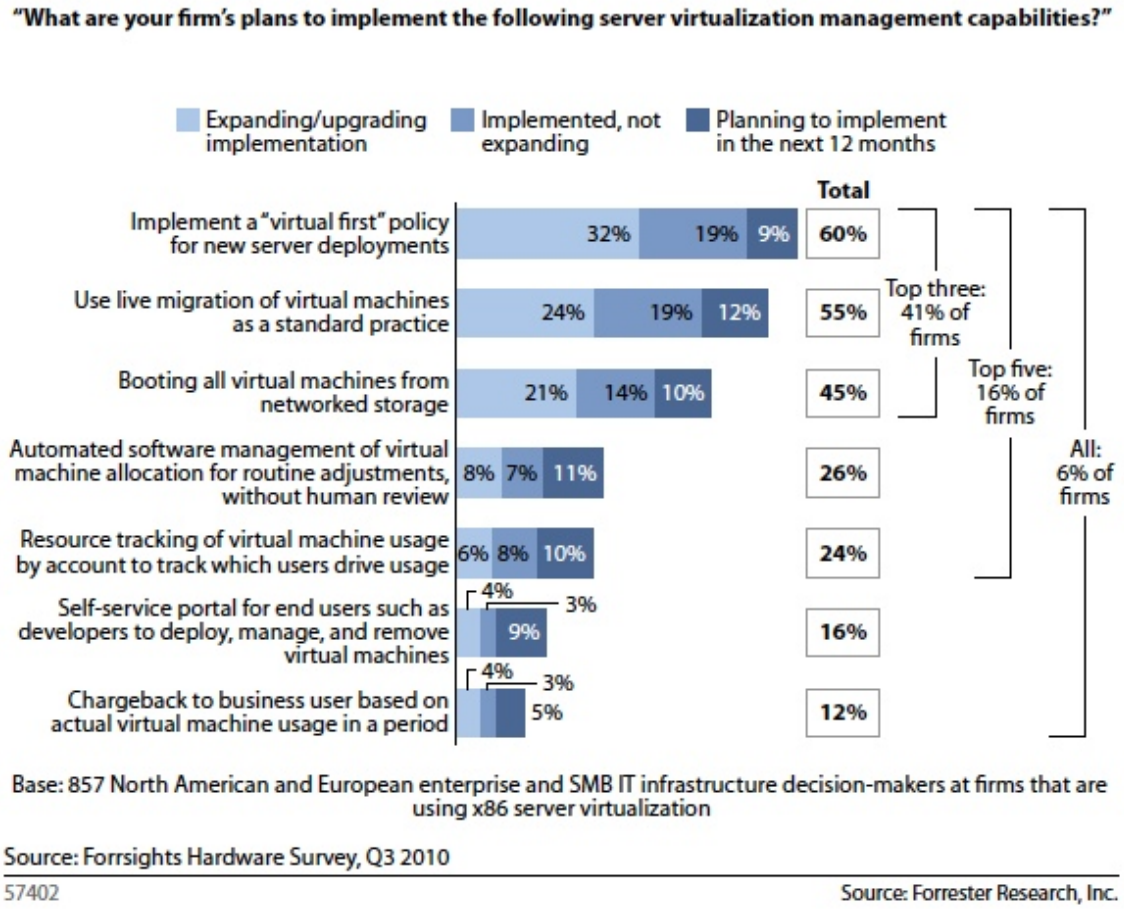
misplaced. Total enterprise IT infrastructure decision-maker interest in IaaS solutions is growing, yet actual adoption by IT infrastructure decision-makers is essentially flat, according to various Forrester surveys performed between 2008 to 2010 (Gillett, Mines, & Iqbal, 2011).

Growing awareness of the business units' interest in cloud computing products is apparent as 58% of the IT professionals responding to Forrester's Forrsights Hardware Survey, Q3 2010 stated that they knew the interest in these IaaS solutions was coming from those outside of the IT department (Gillett, et al., 2011). Although equally interested in the capabilities and possibilities promised by this technology, most IT departments are cautious in their approach towards embracing it fully. Many expressed their desire to bring a form of cloud computing technology in-house in order to automate the process and corral it into a more formal format that they can secure and better control. In this way, they fulfill their dual objectives of meeting the needs of their clients, the business units, and of guaranteeing a system that meets all security requirements and policies and is compliant with other approved systems.

The problem does not lie with intent. Instead it lies with execution. Contrary to the desires of the business unit leaders for quick access to cloud technology, many IT departments do not have the server hardware or infrastructure, also referred to as *'virtualization infrastructure'*, in place to support a move to either a public or internal cloud solutions today. Nor do they foresee

access to the funds and resources needed to do so in the near future (Gillett, et al., 2011) as is presented in Figure 3.

Figure 3. Only 6% of firms will reach server virtualization maturity by 2011.



Gillett, Mines and Iqbal, in their Forrester report entitled "Navigating the Shifts in Computing Infrastructure Markets," use the car leasing industry as a metaphor to describe the difference between these two stances. For the business unit, they're approach is akin to that of renting a car for an hour through one of the recent Zip Car or Car Share rental programs; while the IT department's approach

favors a more traditional corporate car lease program: dependable, predictable and with no surprises (Gillett, et al., 2011).

Due to this increased interest in IaaS services by the business units, Forrester has gone so far as to advise IT infrastructures vendors to refocus their current targeting strategies away from their traditional customers, the IT infrastructure buyers, and instead to focus more upon individuals within the business unit, such as:

- The individual developer who bypasses IT infrastructure managers to find variable and flexible capacity for testing and development purposes;
- Engineers and scientists who are establishing their own simulation environments for training and demonstration purposes; and
- Individual business unit decision-makers who are turning to the web to aggregate information and organization project data, augment internet and eBusiness investments, and improve team collaboration and management.

The problem for IT management now becomes one of remaining relevant. IT can either take a more active role as a player in the IaaS movement underway by providing the technological know-how and experience needed to successfully implement this sexy new computing-based solution throughout the organization - and thereby bring it under the tutelage of the IT department. Or, it can take a less active role in the decision-making process and concentrate on maintaining the infrastructure and networks required to keep the organization chugging along.

In its attempt to resolve this tension, many IT leaders are evaluating restructuring their organizations.

The Revisioning of IT

Over the past couple years, many IT departments and management consulting firms have been experimenting with new operational models geared towards breaking down the barriers between IT and the other units within the business. As discussed earlier, many business units are bypassing the IT department and going directly to public, cloud solutions to improve how they perform their work. Fifty eight per cent of the IT professionals responding to Forrester's Forrsights Hardware Survey, Q3 2010 stated that they knew the interest in these infrastructure-as-service (IaaS) solutions was coming from outside the IT department, and that over 70% of the IaaS cloud applications known to be used throughout the organization were tied to non-IT sponsored programs (Gillett, et al., 2011).

In October, 2010, Marc Cecere of Forrester Research released the results of another Forrester survey, this one conducted to measure 178 IT leaders' current and anticipated interest in restructuring their departments, and if so, according to what type of model. A critical piece of this study was the identification of the key levers and drivers motivating these IT leaders to change or modify their current operating model.

> Several new IT models are emerging from the experiments by IT shops and the innovative thinking of management consulting firms. These models attempt to overcome the silos both within IT and between IT and the business….In terms of common elements, they are process-oriented, make greater use of outsourcing in different forms, and require more specialized roles. Their primary advantages are that they have the potential to break down existing barriers, increase the focus on areas of weakness such as strategy, and consolidate systems and processes. Their primary disadvantages are that they have limited track records, require difficult transitions, have the potential to break effective relationships between groups, and, to date, are primarily of interest to large IT shops (Cecere, Fenwick, & Worthington, 2010, p. 1).

The findings: 52% of respondents stated that they expect to restructure their IT organization within the next three years. The key motivations for this restructuring are improving service to the rest of the business; improving overall cost reductions; and providing great consistency among processes.

Near-Term IT Operational Model Options

The Cecere report went on to identify four of the top operational models being considered for rollout over the next three to four years. These four near-term models are: IT Process-based, Business Process-based, Demand-Supply, and Plan-Build-Run. All four are heavily focused on providing more structure around getting the work of IT done. This is to be accomplished by improving standards, redefining and realigning IT roles and responsibilities, improving key performance indicator measurements and overall process governance.

What they don’t appear to provide, according to Forrester, is a fundamental change to the services IT provides or to address the possibility of these services being performed outside the realm of ITs’ control. “Changing IT as we know it may occur someday, but it is likely to be a long-term, gradual

change that moves IT to a model based on some combination of clouds, end user development, and reusable objects (Cecere, et al., 2010, p. 14).

1. *IT Process-based model*[3]. A common element across all four of the near-term models is the decision to reorganize the IT organizational structure along process rather than infrastructure roles. To date, the focus of most IT organizational structuring has been upon supporting the technological infrastructure of the networks and applications owned and managed by the IT department. Most IT departments are broken out into separate groups responsible for one of the following features: network administration, database management, security and access management, incident management, software distribution, application development and end user support.

This IT Process-based model shifts the emphasis away from the infrastructure and focuses instead upon the actual processes and application services provided by the IT department to their business unit customers. For instance, within a heavy applications driven IT department, employees would be reorganized according to which phase of the application development process they were responsible for: requirements development, coding, testing, maintenance, infrastructure, etc. The primary advantage of this process model is

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[3] See Marc Cecere, Nigel Fenwick and Brandy Worthington's October 29, 2010 report for Forrester Research, Inc. entitled "Pros and Cons of Future IT Models" Cecere, M., Fenwick, N., & Worthington, B. (2010). Pros and cons of future IT models. Retrieved from http://www.forrester.com.

that it addresses the concerns many outside of IT have that IT is isolated from the rest of the organization and not interested in working with the business units to address their specific needs. This model refocuses the attention of those within IT upon providing particular application development services to the individual units - not just meeting the technological needs of the overall organization.

One of the key disadvantages of this model is that it requires IT professionals to give up their rarified role as jack-of-all-trades and specialize in one specific piece of the whole process. Over the past two decades, IT departments have evolved from the small Dot.com shops dependent upon a creative-developer mentality, into a new mind-set based upon repeatability, process, and procedure. The image of the creative-developer who intimately knows every byte of code tied to an application still persists, but this perception may be more myth than reality these days. Restructuring IT along specialized, functional lines such as this model proposes may deliver the final blow to this earlier model and ultimately result in the loss of important knowledge and experience as the innovative spirit of older developers are lost to retirement, downsizing, and decisions to outsourcing major pieces of the department's functionality.

These risks are possible throughout all four of these models.

2. *Business Process-based model.* This model draws upon many of the same characteristics of the IT Process-based model, except that the IT functions are actually embedded within the business unit and report directly to the Chief Operating Officer or head of the business operations unit, rather than the Chief Technology Officer. This model is common among financial services groups and has a long track record especially within customer service and claims processing units. It has proven a very scalable and efficient model with high satisfaction ratings from the business units, but low ones from IT.

The primary disadvantage of this model is that it perpetuates the silos between IT and the business unit and could lead to increased risk for the organization as "[i]t's not at all clear that informal buyers [from within the business units] truly understand data protection, disaster recovery, recoverability, or compliance…" (Staten, 2011, p. 2). It is interesting to note, however, that in a May 2010 Global Future IT Structure Online Survey, Forrester found that 64% of the respondents rated this model as one they'd be very interested or very highly interested in using as their primary structural framework for their future organization (Cecere, et al., 2010).

3. *Demand-Supply model.* As with the Process-based model, the Demand-Supply model is also structured around the function being performed rather than which system is being supported. However, in this model the delineation is made between client-facing functions, i.e. those strategic functions tied to planning and requirements identification, and those more traditionally IT

ones, such as building and maintaining the application. This model is popular among many IT leaders because it divides the process of application development into two different skill sets: the soft-skills needed to work with the client, and the hard, technical skills needed to build, test and maintain the code.

Some find this division advantageous. Those on the Demand side don't have to worry about coding; those on the Supply side are free from interactions with the client. It is also cost efficient because much of the Supply side functionality can be outsourced, and yet it also provides job security for those on the Demand side. That being said, accountability is very low and information that could be of importance to either side of the equation may be lost due to the lack of clear and consistent communications across the divide. This could lead to increased client dissatisfaction and inefficiencies. Also, moving some strategic functions such as planning and requirements development into IT may cause additional friction between IT management and the business units.

4. *Plan-Build-Run model.* The Plan-Build-Run (PBR) model is similar to the Demand-Supply one in the way it separates the IT functions according to client-facing and implementation, but it takes the extra step of dividing implementation into two distinct groups: applications development and infrastructure maintenance. A typical PBR structure might break out accordingly:

1) Architecture, vendor and client management, and strategy functions will fall under Plan,

2) Application development and project execution under Build, and

3) Application maintenance and infrastructure under Run.

The advantages of this model are the same as those for the IT Process-based and Demand-Supply models as it encourages specialization and simplifies the development process by delineating roles and responsibilities. On the negative side, it amplifies the lack of accountability issues exhibited by both by further separating those who are building the solutions from those maintaining them. In addition, clear and consistent communications between the three groups is now much more important – and therefore much harder to achieve.

It is not surprising that Marc Cecere and his team at Forrester Research do not find much opportunity for dramatic change evolving out of any of these four top operational models being considered by IT management for rollout over the next three to four years.

As William Bridges shows us in his seminal work Managing Transitions: Making the Most of Change, there are three phases of transition one must go through in order to change. Phase one is ending, losing and letting go of the past. Phase two is the neutral zone, that in-between phase when the old is gone, but the new is still unformed. The final phase is the new beginning. In order to get to the new beginning, you have to know what that new beginning means.

> Beginnings involve new understandings, new values, new attitudes, and – most of all – new identities (Bridges, 2003, p. 58).

It is possible to argue that the four most popular near-term options currently under consideration by IT leaders may appear to the business unit and the organization-as-a-whole as the type of support they are looking for from their

technology partner. But it may be equally possible to see these options as only a veneer layer applied on top of the traditional IT organizational structure. Assuming the business unit is looking for true change from their technology partner, than the source of their dissatisfaction and the impetus for any decisions they may make to take control of their own technological environment is understandable.

The challenge for the organization-as-a-whole today is to recognize the need to change and then choose a method by which to enact this change. The method I am recommending is Systems Thinking's Interactive Planning and Idealized Design as proposed by Russ Ackoff. In the following chapter I will examine the larger economic and philosophical forces at play across all aspects of our society spurred on by the recent shift from a Neoclassical and Analytic mindset to a more Systems and Systems Thinking perspective.

CHAPTER 4

SHIFTING PERCEPTIONS AND CORE BELIEFS

One of the core components of the IT function is to thoroughly test all new technological solutions, whether purchased or built in-house, for possible risk to the purpose and objectives of the organization-as-a-whole. In today's highly competitive, first-to-market environment pressures coming from the business units to speed up this vetting process are common, especially when it involves digital technology and cloud computing solutions. As discussed earlier, this pressure may manifest itself in the form of an unresolved paradigm shift around the role of IT within the organization and could lead to increased tension and even internal conflict between the individual business units and the Information Technology department. This tension and conflict could ultimately spread throughout the organizational structure and threaten the organization's ability to survive within a disruptive external environment, such as that created by the recent explosion of digital technology and social business tools.

If not handled properly, the organization could fail on two fronts. First, because it is unable to adapt quickly to changing external forces; and second: because it acts too quickly and makes decisions that lead to the loss of control over what is quickly becoming its most valuable asset: its information, data, and knowledge. Finding the best means of resolving this conflict before it even

occurs is of paramount importance to an organization striving to survive and succeed in today's volatile marketplace.

One approach is to view this internal friction from a Systems Thinking perspective and to identify a solution accordingly. This is the approach taken by this examination. In order to understand this perspective, it is important to define Systems Thinking in context with other prevalent contemporaneous models and concepts active at this juncture point between of the 20th and 21st centuries. This foundation will be used as a launching pad for discussing the importance to the organization-as-a-whole of being adaptable when faced with trying to survive within a disruptive environment such as that found in today's digital world.

Neoclassical Economic Theory and the Machine Age Perspective

Neoclassical Economic Theory. Competition, Capitalism, and Natural Selection' are the three core components of the Neoclassical Economic model. They are central to the commonly accepted American understanding of what made things tick during the early part of the 20th century.

> The beneficial results of competition in neoclassical economic theory seemed to reinforce reliance on the "survival of the fittest" in the "struggle for survival." "Competition in economics," asserted Richard R. Bowker, "is the same as the law of … 'natural selection' in nature" (Hunt, 2003, p. 129)

The combination of more sophisticated mechanical tools, experience, tacit knowledge and a labor force segmented by capability, this Neoclassical perspective was grounded upon an economic model that rewarded based upon the individual's level of effort and personal ability within a highly mechanized

production environment (Hunt, 2003). Individual workers, led by the romantic myth of the 'Inventor/Business Man,' were the tools that made the Great American Engine of the early 20th century roar. *Standardization, control, anticipated demand, finite resources, efficiencies of process,* and *repeatability* are buzz words for this economic model. It is the marketplace of the *one-size-fits-all*. Choice exists, but it is the exception, not the rule (Hunt, 2003). Russell Ackoff, one of the pre-eminent pioneers in the fields of Systems Thinking, Management Science and Operations Research, refers to this understanding of the universe and the individual's collective position and role within it as 'Machine Age Thinking' (Ackoff, 1999).

When we entered the 20th century, the prevailing mindset of this Neoclassical Economic model rotated around the dual concepts of efficiency and process. Central to creating an efficient process is the concept of analysis through dissection: in order to understand how something works, you must first understand the parts that comprise the whole. From the new knowledge gained about the whole as a result of breaking it down to its individual parts, a repeatable process for creating that whole can be established and used when and where needed. For Frederick W. Taylor, the father of Systems Engineering and the grandfather of Total Quality Management, analyzing the parts comprising the whole was the only means for maximizing efficiency within the work process:

> And this one best method and best implementation can only be discovered or developed through scientific study and analysis... This involves the gradual substitution of science for 'rule of thumb' throughout the mechanical arts (Taylor, 1972, p. 25).

From an organizational perspective, reducing variation by standardizing the individual elements comprising the whole was viewed as the key to success when operating within this model. If you can control what comprises the components making up the organization, then you can control the organization. Any problems with the organization, therefore, had to derive from problems within one or more of the parts comprising it. If an organization was not successful, then the search for the reason why centered on an internal evaluation. Absent from this model was any attempt to understand the role the external environment within which the organization existed played in its ability to ultimately succeed. In fact, one popular belief held that analysis should occur within isolated and controlled environments, such as laboratories, as a means for reducing the potential for external influences impacting the results of the evaluation (Ackoff, 1999).

Systems and Systems Thinking

Systems and Systems Thinking. For many, the movement beyond the Neoclassical and Machine Age mindset began in 1946 with the invention of the first electronic, digitalized computational tool: the ENIAC (Electronic Numerical Integrator And Computer). This man-made device was capable of generating symbols that could be analyzed for patterns and relationships. Unlike other man-made devices, it did not produce a physical end product. Instead, it produced information; and this information could be generated without the influence of preconceived notions or personal biases.

In 1934, biologist Ludwig von Bertalanffy introduced his Individual Growth Model that viewed an organism (be it a single-celled amoeba or a large, multi-national organization) as a self-contained, holistic system with permeable boundaries that enabled it to interact with its environment while maintaining its own autonomy (Hunt, 2003). This perception of a self-contained universe interacting openly within a larger one had long-term implications on the evolution of a systemic view of the Universe.

> Our civilization seems to be suffering a second curse of Babel: Just as the human race builds a tower of knowledge that reaches to the heavens, we are stricken by a malady in which we find ourselves attempting to communicate with each other in countless tongues of scientific specialization... the only goal of science appeared to be analytical, i.e., the splitting up of reality into ever smaller units and the isolation of individual causal trains...We may state as characteristic of modern science that this scheme of isolable units acting in one-way causality has proven to be insufficient. Hence the appearance, in all fields of science, of notions like wholeness, holistic, organismic, gestalt, etc., which all signify that, in the last resort, we must think in terms of systems of elements in mutual interaction... (Ludwig von Bertalanffy as quoted in Hake, 2009).

In contrast to the Machine Age's reductionist emphasis upon understanding the individual elements comprising a whole, the Age of Systems, or '*Systems Thinking'*, focuses instead upon the functioning of the parts together as a whole as the means for understanding the functioning of the whole. Once reduced down to its individual elements, the whole, or system, becomes something entirely different from its original form and can no longer exist as it had originally. It is through the combination of the parts - the unique set of characteristics and properties that are created through the interaction and relationships between the composite parts - that enables this particular and

unique system to exist. It is a whole that cannot be divided.[4] Russell Ackoff emphasizes this point:

> The essential properties of the system taken as a whole derived from the *interactions* of its parts, not their actions taken separately. Therefore, *when the system is taken apart, it loses its essential properties.* Because of this – and this is the critical point – *a system is a whole that cannot be understood by analysis.*(Ackoff, 1999, p. 16, emphasis provided in original)

Systems Thinking follows a two-phased approach for identifying and solving problem and/or conflicts within the organization-as-a-whole. Unlike the Neoclassical and Machine Each mindset which follows an analytical process based upon dissection, analysis and then understanding, Systems Thinking begins by identifying the external containing environments, or systems, within which the object being observed exists and then evaluating those containing systems to identify those forces that may be disruptive as they flow through the porous boundaries of the observed object. Once an understanding of what the external forces are that affect the organism, then the Systems Thinking approach provides the means for observing the object-as-a-whole as its parts respond and interact with each other from within an external and potentially disruptive containing environment.

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[4] See Appendix 1 for a discussion of Ackoff's definitions for a System; the importance of Environment to a System; the role of an Organization within a System; and why an Organization needs to be Adaptive to its Environment

With Systems Thinking, the objective is to look for influencing forces outside the object that may be responsible for the conflicts occurring internally. The emphasis placed by Systems Thinking on the exploration of these external influences and forces is important to this discussion of the disruptive effects of digital technology upon today's organization-as-a-whole. With the introduction of digital technology and social media business tools, new means for improving collaboration and the exchange of ideas now exist beyond the safety net of an organization's firewalls and may lead to the increase in tension and the potential for a new paradigm shift impacting the relationship between IT and the individual business units.

CHAPTER 5

AN ADAPTIVE ORGANIZATION FOR A DIGITAL FUTURE

IT's Challenge and Systems Thinking

The introduction of digital technology and social business tools has enhanced the means by which we interact with each other, especially from a distance. Today we can literally speak with anyone anywhere. We can text them; poke them on their Facebook page; see their physical proximity to ourselves; play a virtual game with them; have a video chat with them -and do all this using a single device that can fit in a pocket. The benefits are innumerable, especially for those organizations that are decentralizing and expanding geographically.

The transformational possibilities of digital technology within the workplace are rapidly evolving as workers actively utilize and explore its potentials on a daily basis. The introduction of digital technology and social business tools into the organizational system has the potential for generating uncertainty and tension as the organizational parts redefine their roles and relationships relative to this changing environment. We see evidence of this possibility within the relationship between IT and some of the more customer facing business unit functions such as Marketing and Customer Support.

Take for instance this example of how a business unit uses digital technology to advance its strategic initiatives. The Customer Relationship

Management (CRM) group of a large cereal company wishes to deepen its relationship with customers who have previously requested product coupons for a particular brand of cereal which they regularly purchase. The CRM group reaches out to a third-party vendor who has developed software that uses the GPS function on a smart phone to sense when the customer is within proximity of a grocery store. Once pinpointing the customer, the software instantaneously texts the customer a product coupon that can be used instantaneously to purchase the product. Assuming the customer acts upon the text, the data relative to this purchase is then captured by the vendor and sent to the Customer Retention group to be saved to their database for usage in future marketing campaigns. Depending upon the terms of the original contract, this information may also be retained by the third-party vendor and used by them for other reasons outside of the original intent requested by the CRM group.

This is an example of a business decision to use digital technology being made by an individual business unit without any involvement by the Information Technology department, outside of their operational role of maintaining the databases. With the advent of digital technology and cloud computing, IT is no longer solving the problem of how to capture, retain, and then analyze information pertinent to the success of the organization. In an example such as this, the organization has decided not to develop this GPS functionality in-house, but instead to look outside for someone else to solve the problem. Once looked upon as a valuable resource responsible for providing such functionality to the organization, ITs' role, in many cases, is being limited to supporting services

identified, developed, and managed by external third parties. This is a new role for IT and is indicative of why so many IT departments are experiencing severe cuts in budget and personnel, and seeing more functions outsourced to external partner organizations.

The importance of an independent IT department to the organization-as-a-whole still exists as there are functions that only a dedicated technology-based department can perform. But in order to do so, IT management needs to understand what ITs' new role is in relationship to the other parts of the organization. Central to gaining this knowledge, is ITs' ability to understand the external forces influencing the actions of the organization-as-a-whole. According to Russ Ackoff, an organization must respond to the changing forces coming from both within and outside the organization's system by continually adapt to the changing nature of a multitude of external and internal environments.

In Chapter Two, we discussed the forces external to the organization-as-a-whole; it is now time to take a deeper look at ways for dealing with these potentially disruptive forces in light of the four near-term models most popular among IT management and a more adaptive approach proposed by Russ Ackoff.

The Value of Adapting to Disruptive Environmental Forces

When faced with potentially disruptive forces generated by a change within a larger external environment, an organizational system must consider the value of making internal adjustments to core concepts and beliefs in order to remain viable and successful. If not, then the organization risks reducing its

ability to function efficiently within this environment and wasting valuable energy and resources as it tries to manage the internal tensions and conflicts created by these potentially disruptive forces. [5]

Following an adaptive approach may prove the most effective and efficient strategy for an organization to pursue when planning for a future within such a disruptive environment. Russ Ackoff developed an Idealize Design and Interactive Planning approach as a means for being responsive and adaptive to external environmental influences. This methodology is grounded on the identification of what the future ideal organization should look like. This is achieved through a series of checks and balances which evolve out of a persistent internal observation, feedback, and adjustment loop focused upon achieving that ideal end state. By continuously adjusting internal parts based upon information gleaned through this constant monitoring of perpetually changing external, containing environments (such as that provided through digital technology and social business tools), an organization is in a position to quickly tweak and adjust internally when and as needed in order to adapt and succeed.

In this chapter I discuss Idealized Design and the three types of Interactive Planning identified by Ackoff: Reactive, Preactive, and Interactive. I also analyze the appropriateness of the four near-term IT operational models

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[5] See Appendix 1 for a discussion of Ackoff's definitions for a System; the importance of Environment to a System; the role of an Organization within a System; and why an Organization needs to be Adaptive to its Environment.

introduced earlier in light of these Systems Thinking concepts introduced by Ackoff. This is followed by a discussion of the elements an adaptive organization should consider when planning for a future within the potentially disruptive digital technology, containing environment.

Designing for an Interactive and Idealized End State

When faced with a need to change as a result of external pressures such as those stemming from digital technology, Russ Ackoff found that many organizations, responded by either reacting to the stimulus or proactively trying to predict its impact. For Ackoff, neither of these approaches successfully prepare the organization-as-a-whole.

Reactive Planning is a bottom-up approach based upon the identification of deficiencies within an organization's performance and the development of various initiatives tasked with either removing or undoing the negative impact of decisions already made by the organization. The overall emphasis is on maintaining the current status quo – not planning for the future (Ackoff, 1999). It is reductive in nature and considers the problem solved when the source of the problem is removed. It is indicative of the analytical approach of dissecting the problem into unique components in order to identify its root cause. It does not address the interactive relationships that exist between the various parts within the whole, or which of these relationships may be disrupted or affected by the removal of identified source of the problem. This reactive approach may actually lead to different, potentially worst, systemic problems down the road.

Reactive Planning focuses on increasing an organization's ability to undo changes that have already occurred. *Preactive Planning,* on the other hand, looks to increasing the organization's ability to forecast, or predict, changes within the containing environment that have yet to occur (Ackoff, 1999). The objective is to evaluate the current environment and predict what the future will be in order to optimize the organization's ability to grow within that particular future. The problem with this method is its assumption that with good planning and forecasting the organization can predict, and therefore to a degree control, the effects of a particular future state or series of conditions upon the organization. This approach does not lend itself easily to the uncontrollability of the future or to adapting to a future that has not been predicted. It also does not address the possibility of the organization actively designing and planning for a future it may want.

Interactive Planning does address these two final points: adapting to an uncontrollable future; and pro-actively creating its own desired, or Idealized, future end state. This final point is actually the first step of Interactive Planning. Ackoff recommends planning for the future by identifying what you want the organization to be today - assuming you have the freedom to replace the current state with a better one. Once identified, the next step is to begin adjusting the current state in order to "change the system in such a way that more efficient behavior follows 'naturally'" (Ackoff, 1999, p. 110).

The Challenge to the Organization Today

One inherent problem with Ackoff's *Idealized Design* is that an idealized end-state is innately unachievable. The concept of an *ideal* is a relative one. What is ideal today may not be ideal tomorrow. The concept of what is ideal is continuously shifting, just as the conditions upon which this *ideal state* is based are continuously shifting. Therefore, the organization must become *adaptive* to its environment and build continuous feedback and adjustment into its process in order to act and react quickly to a state of constant change. Critical to the success of this endeavor is the organization's ability to:

- Quickly learn from and adapt to internal and external changes that affect how efficiently it performs;
- Anticipate future changes based upon what it has learned and to adjust accordingly in order to maintain its ability to perform efficiently;
- Remain open and receptive to continual redesign by both internal and external stakeholders (Ackoff, 2001).

In order to quickly learn from and establish an adaptive relationship with an environment, the organization must design into its new, idealized end-state organization a managing system that is resilient to the uncontrollable changes that have to be expected when trying to predict the actions of a larger, external containing environment.

Environmental forces. Critical to the success of this Interactive Planning methodology is the ability of the organization to accurately identify 1) the larger

containing environment (the containing system) relative to the condition being addressed, and 2) those specific external forces affecting the internal operations of the organization. As discussed earlier, the forces within the larger digital technology environment within which the organization must respond to are:

1. increases in the level of technological savviness throughout the workplace as younger generations enters the workforce;
2. the influx of more affordable digital devices, along with improved telecommunication access to the Internet from virtually any place in the world;
3. the evolution of a ubiquitous, global network that enables a universal sense of community and a ‘communications everywhere’ sense of entitlement;
4. the pervasiveness of cheaper, more accessible collaborative solutions that enable distributed and global connectivity; and
5. the increased prevalence of decentralized, online web services (i.e. via the ‘cloud’) that reside outside the an organization's firewall and are replacing traditional licensed software.

Assuming it is the desire of most organizations to quickly adjust and adapt to today's rapidly changing technological environment, then none of the four most popular near-term options described in Chapter 3 adequately addresses their needs.

Near-Term IT Operational Models and the Adaptive Organization

As noted above, Russ Ackoff believes there are three ways an organization can plan for the future. The first is to be reactive, the second preactive and the third interactive. As described above in Chapters Two and Three, the four near-term organizational models considered by IT leaders all appear to address the challenges presented to the organization-as-a-whole by

the key external forces presented by digital technology and social media. What they don't provide is a vision which permanently resolves the tension created within the organization by the business unit’s desire for ownership of the technology tied to new and constantly evolving revenue opportunities.

IT Process-based model. As described earlier, at its core, the IT Process-based model is a response by IT leadership to the fact that the potential value of information management and information technology to the organization no longer resides within the IT department. This model restructures the IT department around a new core competency: developing the applications and technological processes needed by the business units to compete in a digitally driven environment. It acknowledges that organizing IT functionality around infrastructure is no longer warranted now that business units can circumvent it through cloud-based computing and other digital technologies; and it opens the door to outsourcing infrastructure, network functionality, and client services.

This IT Process-based model is reductive in nature and does not address concerns that technology tied to cloud computing is potentially risky and could ultimately lead to larger problems for the organization-as-a-whole. Emphasizing specialization places individual workers into tightly defined roles; thereby restricting the ability of the parts to view the whole process and increasing the risks of miscommunications and missed opportunity. Removing the importance of infrastructure and network management as the focus of the IT department may provide cost savings in the short term, but it could lead to potential inefficiencies

and lost opportunities as control over the means by which information is distributed throughout the organization is dispersed. This model also does not address potential threats to the IT department posed by the business units continued interest in owning, developing, and managing their own applications. Eventually, new tensions will occur because the relationships between the IT department and the business units are still not clearly defined or understood.

Business Process-based model. Unlike the IT Process-based model, the Business Process-based model directly addresses the desire by the business unit to be independent of the IT department when it comes to managing the applications and programs tied to the creation of its work product. In fact, trend analysis of IT leadership led 64% of those responding to a Forrester survey to predict that this particular model will most likely be implemented by their organization within the near future (Cecere, et al., 2010). This model has the potential for success simply because of IT management's acceptance of this possible future outcome. However, it represents IT's rather passive acceptance of what might be perceived as the inevitable rather than an attempt by IT to actively engage and influence what this end state might actually look like.

The Business Process model does not address some of the core problems the IT department faces, such as the high potential for a lack of trust between IT and the business units, and the existence of poor communications between the two groups. Instead, it actively promotes the continuation of these problems by institutionalizing the embedding of technology solutions within

organizational silos. Most importantly, this model does not see the value to the organization of an overall systemic technology strategy - a situation that could lead to increased inefficiencies and redundancies of roles and resources. All of these issues may ultimately lead to problems for the organization that could have long-term and far-reaching implications if left unaddressed.

Demand-Supply and Plan-Build-Run models. The Demand-Supply and Plan-Build-Run models formalize the split between the applications development and infrastructure sides of the IT paradigm shift proposed by the IT Process-based model. The primary difference between these two models and the IT Process-based one is that the split is along the lines of client-facing and service-end management. The client-facing piece represents the 'sexy' side of information technology: working with the business unit to identify needs and solve problems. This is the side of the paradigm that has the most potential for getting IT managers the exposure and access to funds traditionally found within the business units. These models are pre-active in the sense that they foresee a new potential role for the IT department as a result of the growing influence digital technology will have in the business decisions and strategies of the organization. However, both models are also reactive in their reliance upon specialization and the segmentation - even outsourcing - of key IT functions such as infrastructure, network management, and client services.

An Adaptive Approach to Planning for the Future.

An alternative to the near-term IT models is to address the potential tension between IT and the business units from a Systems Thinking perspective by following Ackoff's Idealized Design and Interactive Planning process. The first step is to envision an ideal end state. This idealized end state organization must be able to adapt to the changing and uncontrollable forces of external environments. By following the Interactive Planning methodology's mechanisms for observing, adjustment and feedback - adaptability is possible.

When faced with a potentially disruptive technology environment such as that provided through digital technology and social business tools, an organization needs to determine for itself what role this disruptive technology should play within the organization. For our purposes, central to this is the organization-as-a-whole visualizing what the ideal relationship between the IT department and the business units should look like. Once the desired interplay between these effected parts has been identified and the desired end state defined, then an organization can evaluate the difference between the desired ideal and the current state of the organization by:

- Identifying what problems they currently know will be faced by the new organization;
- Reducing or removing the gaps between the two states of the organization by determining what actions, changes, and adjustments to current practices need to be addressed and when;
- Identifying what resources will be required to achieve the ideal organization;

- Planning the implementation by determining who will do what, when and where; and
- Designing those controls, such as incentive plans and aligning individual with organizational objectives, which will monitor how well the organization is implementing the plan in relationship to the changing internal and external environments (Ackoff, 2001)

Taken together, these steps create what Ackoff referred to as the Ideal Design and Interactive Process - an approach that can provide an organization with the tools necessary for becoming adaptive to a changing and potentially disruptive environment, such as the digital technology one we are currently experiencing.

Idealized Design and Interactive Planning Process

The purpose of Idealized Design and Interactive Planning is to design the desired present in order to choose, or invent, the means by which to get there. Interactive Planning has two phases which are not necessarily sequential, but usually follow this order: the Idealization Phase and the Realization Phase.

Idealization phase. In the Idealization phase, the organization evaluates its current, or *messy,* state through the development of a *reference scenario*. This reference scenario identifies how the organization could eventually self-destruct if it were allowed to continue behaving as it currently is; and is to be used as a 'reference' point for identifying what the organization collectively wants to avoid. For example, one such scenario might be the business decision to not support distributed teams. By requiring all workers to work together in the same physical location, the organization can avoid many of the potential pitfalls tied to

using digital technology and social business media. Yet, the cost of limiting its workforce to only those who can easily access the physical corporate facility may ultimately limit the organization's ability to compete on an equal footing with competitors who do not have such a requirement.

This Idealization Phase also identifies the desired end-state based upon what it would like to be now - assuming it could be anything it wanted to be. This idealized end-state, or *idealized redesign scenario,* is based upon the goals, objectives, and ideals the current organization wishes it could have.

Realization phase. Resource planning, along with the design of the means for implementation and control, are all part of the Realization phase. It is during this phase, that the organization determines how to achieve its ideal state in as best a fashion as it possibly can. Assuming an organization wishes to take advantage of the best resources available, regardless of location, then it is at this phase that the organization begins answering some of the questions around 'how' to change its current operations and culture to accommodate a more distributed workforce. Following the completion of this Realization phase, the organization identifies gaps between the *Reference* and *Idealized Redesign Scenarios* and develops a plan for removing them. Once the gaps have been identified and the plan implemented, the organization enters a continuous monitoring, observation, and feedback phase.

Continuous monitoring. As mentioned above, the objective of Interactive Planning is to design for an idealized future state and to continuously monitor

and adjust the operations of the organization. Based upon the feedback it receives in response to the shifting nature of this ideal future. Central to this monitoring process is the creation of a cross-functional monitoring team whose responsibility it is to, according to Ackoff, monitor both the internal functioning of the organization-as-a-whole as it works towards the idealized end state. And the continuously changing nature of the various external containing environments it operates within.

Based upon the information this cross-functional monitoring team gains through these observations, the team is responsible for reaching out to the organization-as-a-whole for feedback and using what it learns from their observations to adjust the internal operations of the organization to better meet the constant change coming out of the larger containing environments. It is through this continuous loop of observation, feedback, and adjustment that the organization continues working towards its common idealized end state in an efficient manner while constantly self-adjusting, adapting, and responding to the uncontrollable changes within its larger containing systems.

By following this process, the organization ensures that it is a learning system capable of reacting quickly and efficiently to unforeseen changes such as those provided by the growing prevalence of digital technology and social business tools.

With a built-in monitoring function such as this, the organization can adapt quickly to external forces by being able to adjust to the shifting nature of its ideal

state. In this way, Systems Thinking's Ideal Design and Interactive Planning process provides a more flexible methodology that should be considered by any organization unsure of how to deal with the internal tensions and conflicts that inevitably occur when dealing with a disruptive environment such as the one we are currently experiencing as a result of the rapidly changing nature of digital technology and social business tools.

If William Bridges is correct and "[c]hanges of any sort – even though they may be justified in economic or technological terms – finally succeed or fail on the basis of whether the people affected do things differently" (Bridges, 2003, p. 6), then this methodology comprised of many small adjustments may have greater success at accomplishing systemic change than any of those four short-term methods currently under consideration by IT management.

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APPENDIX

SYSTEMS THINKING DEFINITIONS

In 1974, Russell Ackoff began adding structure to the concepts of Systems Thinking by defining common terms(Ackoff, 1999). Keeping within the spirit of this need for common understanding of abstract concepts, below is a listing of common Systems Thinking terms along with Ackoff's definitions.

A System

A System is set of interrelated elements, or subsets, and is comprised of at least two elements held together by a common relationship. This subset of elements shares a common relationship with at least one other element outside of the subset. All subsets of the System are related, either directly or indirectly.

The Environment of the System

The Environment of the System is a set of elements, or variables, residing outside the structure of the System, that can, when changed, produce a corresponding change within the System.

An Organization

As for an Organization, Ackoff identifies four essential characteristics of an organization:

- An Organization is a '*purposeful system'*, a system that actively evaluates its environment and adjusts its means and objectives

accordingly in order to reach its objective. It is a system that contains at least two purposeful elements (such as humans) which are held together by at least one common, organizing, or objective purpose.

- An Organization is a System that pursues its common purpose(s) through a functional division of labor based upon the subset of elements which comprise it. Each of these functional subsets is purposeful and therefore can choose its own course of action when evaluating how best to achieve the common objective.

- Each functionally distinct subset can observe and communicate with the other subsets within the Organizational System and respond accordingly, thereby enabling each subset to have the capability of influencing other subsets or functions within the System.

- At least one subset within the Organization monitors the functioning of the System as a whole as it works towards the common purpose(s) and can adjust the System based upon observed behaviors, deficiencies and feedback.

An Adaptive System

And finally, a System is *adaptive* if it can modify itself, or its environment, in response to a change that actually or potentially reduces the ability of the System to function efficiently. This change may be either internal or external to the System. There are two types of adaptive responses:

Passive, when the System changes its behavior in order to respond to its changing environment; and *Active*, when the System changes its environment in order to make its own current or future behaviors more efficient.