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## **The Impact of Technological Innovation Cycles on Organizational Learning**

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## Abstract

In today's constantly changing business environment, the ability to acquire knowledge, and to do it quickly, is often the difference between surviving and not surviving. Organizational learning is therefore being recognized as a critical organizational function of considerable interest to corporate leaders. This interest in organizational learning has been encouraged by the perception that learning and innovation are essential for the survival of organizations due to the dynamics of external environments. Despite continued interest by researchers in innovation and organizational learning, there is a gap with regard to considering both issues concurrently. This paper describes how information technology (IT) innovations have brought new capabilities to E-commerce which can potentially improve individual and organizational learning. Focused training programs can ensure organizational learning is realized, and that staff members have the requisite skills to update products and services to keep pace with the market place as new innovative technologies are introduced.

Successful organizations are considered the ones that can learn, and learn quickly. Knowledge has become an organizations most important intangible asset since it is accumulated through organizational learning. New tools are available that can support collaboration efforts, but the organization must eliminate policies that inhibit information sharing and collaboration among team members. If an organization has a structural problem due to norms and values that discourage the sharing of information, innovative IT approaches will not improve the organizational performance since the underlying institutional problems will still be in place. The need for organizations to develop dynamic capabilities that can span innovation cycles is clear. If IT investments must be tied to strategic business plans and legitimate value propositions, then individual and organizational learning programs should focus on developing the skill to integrate business value propositions into product investment strategies. Organizations must assess which learning techniques will ensure staff can adapt the firm's products and services as new innovative technologies are introduced. Ongoing, focused, training can ensure staff has the capabilities to implement product updates that achieve value propositions tied to the new technologies.

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## **1 Introduction**

In today's constantly changing business environment, the ability to acquire knowledge, and to do it quickly, is often the difference between surviving and not surviving. Organizational learning is therefore being recognized as a critical organizational function of considerable interest to corporate leaders (Huber, 1998). This interest in organizational learning has been encouraged by the perception that learning and innovation are essential for the survival of organizations due to the dynamics of external environments (Sampai & Perin, 2004). Despite continued interest by researchers in innovation and organizational learning, there is a gap with regard to considering both issues concurrently. This paper describes how information technology (IT) innovations have brought new capabilities to E-commerce which can potentially improve individual and organizational learning. Focused training programs can ensure organizational learning is realized, and that staff members have the requisite skills to update products and services to keep pace with the market place as new innovative technologies are introduced. The human relations aspects of managing an organization and guiding it into the future are also important. Only through teaching staff members how to interact and collaborate effectively, will training be successful at creating what the literature refers to as a "learning organization" (Senge, 1990). Ultimately, when the training has been conducted, and the learning has been absorbed, the organization must be able to adapt to an ever changing market place as waves of new innovative technologies are continuously introduced, one after the other.

## **2 Assessing E-commerce from a Learning Perspective**

### **2.1 E-commerce Defined**

E-commerce involves the buying and selling of goods and services on the internet. Any physical store can become an E-commerce business by adding a virtual storefront with an online

catalog, and then conducting on-line transactions. New cycles of IT innovations are now opening up new business opportunities and making E-commerce more accessible, and causing it to grow rapidly. By leveraging the work of Wu and Hisa (2008) we can model IT in terms of the cycles of technological innovation that have led to our current E-commerce capabilities.

Viewing IT in terms of innovation categories enhances our understanding and management of the transition tasks businesses must perform during periods of innovative advancement. These tasks are critical to the survival of a firm and provide them the adaptability skills organizations need to keep their products and services up-to-date with available technology. As it turns out, some of the most challenging tasks an organization faces, have to do with developing dynamic E-business capabilities that can span IT innovation cycles. Since these are the capabilities that need to be learned, they are investigated below.

## 2.2 Individual and Organizational Learning

Individuals are said to learn by using their attention to become receptive to information, receiving the information, which is then processed together with prior knowledge until they arrive at a conclusion or understanding, which is then applied and tested for confirmation. This is known to be a personal, reflective process that varies greatly from person to person. As Klas Mellander, author of *The Power of Learning: Fostering Employee Growth*, has said, "[t]he purpose of training is to make learning possible" (Mellander, 1993). Training individuals to acquire the skills that the organization needs them to have, therefore, is a good start for the learning process. Many businesses now implement professional development programs to ensure employee training is compatible with the organization's strategic business objectives. Organizations, in contrast, are said to learn in one of three ways: from their experiences, by interacting with, and observing, their environments, and by buying knowledge outright, as when

forming an alliance with a firm already possessing the knowledge (Huber, 1996). Organizational learning has become more important in modern organizations because the learning unit is the team, rather than the individual (Senge, 1990).

Although organizations learn from their experiences, they do so in a haphazard manner (Huber, 1996). What they really need is to transform their experiences into available knowledge. Everyday activities, for example, if recognized for their potential usefulness, can be captured, stored for future use, and distributed to decision makers. Most organizations made no systematic attempt to capture, organize, and disseminate the knowledge gained from their project experiences (Huber, 2004). This is an enormous waste. While some businesses at least make a weak effort to capture lessons learned at the completion of projects, more has to be done to make the information useful to managers. Huber (1996) concludes that “[a]ll organizations possess huge untapped bodies of experience that if stored, retrieved, and interpreted could lead to considerable improvements in their performance” (p. 827). IT tools are available to perform these functions. All the organizations need to do is to define data repository structures that map the knowledge they acquire through learning to a logical directory structure.

### **2.3 Why Organizational Learning is Important**

The importance of organizational learning is directly related to today’s dynamic and complex business environments, and the challenging demands it puts on businesses. Organizational learning involves “acquiring, distributing, storing, and interpreting information” (Huber, 1996, p. 822). The manner by which organizations acquire new skills and knowledge, exploit useful, and discard obsolete knowledge is related to how it learns (Bhatt & Zaveri, 2002).

Although learning is necessary for knowledge creation, it does not guarantee that acquired knowledge is useful and adaptive to a business’s future market environment. On the

contrary, “exploitation of past knowledge can be useful only when environments remain stable” (Bhatt & Zaveri, 2002, p. 298). When environments change, like industry anticipates for the foreseeable future, it can be difficult to unlearn a well-learned process, and start all over with a new set of skills, and learn new methods (Bhatt & Zaveri, 2002). Thus, it is important to continually learn and acquire new knowledge, or businesses run the risk of getting locked into stale products and services. Since knowledge creation is a dynamic process addressing a dynamic environment, unlearning existing processes and learning new sets of capabilities has become essential in order for businesses to adapt to changing market conditions (Bhatt & Zaveri, 2002). Organizations need to learn since “they are open systems,” and “continually interact with external environments to sustain their long-term viability” (Bhatt & Zaveri, 2002, p. 298). If organizations become closed systems, their long-term survival becomes questionable as external markets change around them. As the knowledge they draw from to sustain their operational performance becomes more and more obsolete, they will be forced to embrace new learning initiatives (Huber, 2003).

## **2.4 Characterizing E-commerce in Terms of IT Innovation**

The use of IT in E-commerce has been characterized in terms of the significant innovative advances that have been experienced in recent times, such as the implementation of the internet and the adoption of wireless telephone networks (Wu & Hisa, 2008). Wu and Hisa (2008) developed a systematic model to analyze E-commerce innovations to enhance our understanding and management of transitions during periods of innovative advancement. Recent innovations have included: the creation of the internet and its emergence as a mechanism for conducting business transactions (referred to as I-commerce), the development of mobile phone networks and conducting transactions over a wireless telecommunications network (M-



commerce), and an emerging innovation referred to as ubiquitous commerce (U-commerce), which will see the total integration of all existing network infrastructures to “provide a universal service channel that enables users to stay connected anywhere, anytime, using any device” (Wu & Hisa, 2008, p. 97). Ubiquity refers to leveraging all network infrastructure through development of interoperability approaches that will result in a “dynamic convergence of physical, digital, and traditional commerce with computing technologies that will support personalized, uninterrupted communications and transactions” (Wu & Hisa, 2008, p. 97). This research is significant because it demonstrates that technical and business impacts to a firm’s product offerings must be considered collectively. Product improvements must be tied to value propositions identified by the organization. Possessing the ability to learn and anticipate market environmental conditions is currently considered a core-competency because organizations face the process of introducing new products with shorter half-life’s, with increased competency, which requires a rapid response capability born from a learning initiative tailored to the firm’s market area (Ramirez, Morales, & Rojas, 2011).

### **3 Characteristics of a Learning Organization**

While it is certainly possible to develop dynamic capabilities that span anticipated innovation cycles, not all innovative improvements are anticipated. In either instance, the job is a difficult one that requires an organization to draw synergy across cross-function teams. As such the characteristics of a learning organization lend itself to performing this task.

#### **3.1 Dynamic Capabilities can be developed to Span Innovation Cycles**

Dynamic capabilities, include “[t]he ability to recognize and identify a firm’s new market opportunities, determine the potential strategic importance of these capabilities and resources,

and renew its competencies” (Wu & Hisa, 2008, p. 99). The ability of an E-business to exploit new E-commerce innovation rests on an organization’s technological capabilities, which include planning IT-infrastructure, integrating software platforms, designing content, and delivering new services, and their corresponding business capabilities. The latter includes envisioning customer value, implementing new business innovations, matching new products with economic opportunities, and building relationships in a new market place defined by the latest innovation (Wu & Hisa, 2008, p. 106). These are skills, including the relationship and team building ones, which organizations have to learn. Firms must strive to develop such dynamic capabilities, which can be defined as the ones that are adaptable and can span the introduction of innovation (Wu & Hisa, 2008). By incorporating dynamic capabilities into their businesses, firms will be able to adapt as industry experiences new innovative advances. Developing dynamic capabilities is a challenging task, which requires coordination of technical and business objectives that are tied to value propositions. Due to their emphasis on collaboration and collective learning, a learning organization is the right approach for this task as well.

### **3.2 Characteristics of a Learning Organization**

Perhaps the first to gain recognition talking about organizational learning was Senge (1990). According to Huber (1996), the world is experiencing a rapid increase in the amount of scientific and technical knowledge, which is driving advances and improvements in information and transportation technologies, which in turn, are causing more complex and turbulent business environments. The sum of these influences indicates a greater need for organizational learning to be able to cope with the increased environmental turbulence (Huber, 1996). The primary enabling characteristic of a learning organization is to create an organizational culture that encourages collaboration and knowledge sharing. If an organization’s culture does not

encourage innovation, then the organization is not likely to have it. Organizational culture has been defined by Pascale and Athos (1982) as the philosophy that guides an organization's policies toward employees and customers. The positive effect of organizational culture on performance has been demonstrated by profiling successful innovative organizations (Belassi, Kondra & Tukul, 2007). To support a contention that organizational culture influences project success, Belassi et al. (2007) did a survey of existing research with respect to "strategic-level variables" that have been found to impact the success of new product development projects, and then noted each one of the factors were positively influenced by organizational culture (p. 20).

Another essential characteristic of a learning organization involves the acquisition of collective knowledge. *Individual knowledge* is embodied in the person, is vital for creation, and can be the sustenance of collective knowledge (Ramirez, et. al., 2011). *Collective knowledge* is more than the sum of individual knowledge, is shared by members of an organization, does not depend on any particular individual, and is critical for the survival of the firm (Ramirez, et. al., 2011). Knowledge is created when the tacit knowledge of individuals is transformed into the explicit knowledge at the group and organizational level, and then each member of the group, in turn, internalizes it (Ramirez, et. al., 2011). Internalization of the knowledge is the key to organizational learning. It is not enough that a few members of a group learn something; it has to be internalized for the collective via a knowledge mapping process or its equivalent.

One persistent question that keeps arising is how can organizations make their knowledge useful? To do so, the organization must consider how it retains knowledge from all of its processes, and where the knowledge is mapped to, and stored. For this knowledge to be really useful, decision makers must know where to find it. Configuration management tools can be set up to accommodate storage of the information, but team collaboration, like that possible in a

learning organization, is required to make it useful. Comparing the characteristics of a learning organization, which include a positive organizational culture that encourages collaboration and sharing of useful information, innovation, and collective learning, to the capabilities required to compete in a dynamic market place, we see the value of an organizational culture that encourages learning.

## **4 Improvements IT Tools can bring to Learning**

Up until the 1980s research techniques were employed where researchers frequented libraries and manually tracked down hard copies of manuscripts with the help of the Dewey Decimal system, a librarian, or both. Internet-based search technologies have changed how research is conducted, and how knowledge is acquired. This section discusses the improvements that IT technologies like the internet have contributed to how learning is now conducted.

### **4.1 Improvements IT Bring to Individual Learning**

With the advent of search engines like Lexis and Westlaw in the legal field, which were later migrated to distributed web-based network servers in the form of yahoo, google, and other search engines, the internet advanced the art of research significantly. Researchers could sit at their computer and conduct legitimate research online in the comfort of their own home. With the evolving use of wireless and telephone-based networks and their continual performance improvements (i.e., like 2G, then 3G, and now 4G, etc.), an individual researcher can now conduct research on any number of computing devices (desktop PC, laptop PC, netbook, iPad, Kindle Fire, iPodTouch, iPhone, Blackberry, Android, etc.), while connecting through a multitude of network technologies (Ethernet networks, wireless networks, commercial telephone networks, satellite communications networks, encrypted radio networks, etc.). For someone that

started out using a slide ruler in high school, this technology is nothing short of amazing. An individual can connect to the internet from almost anywhere, and have access to an unlimited amount of research material to search, capture, and utilize. Materials can be posted on course websites, or in collaboration tools, and students can get unlimited access to training and research products whenever and however they need.

Although our current internet-based research procedures are a significant improvement over those days of manual research, there is still room for increased efficiencies. A top-level look at our current research processes indicate a topic of interest is typically typed into the search query line in a search engine like google, and up to several thousand or more links to websites are displayed. Further refinement of the search parameters can eliminate some of the potential websites, but a trial-and-error process is required on the remaining ones. Each link is selected, investigated, and must be assessed with regard to whether it contains desired content. The trial and error part of this process is where there are inefficiencies that can be improved. As ubiquitous computing evolves into a new U-commerce category of E-commerce, it will provide context-aware search parameters that will get researchers to the desired content quickly and efficiently. The inefficiencies associated with trial and error assessments on websites will be eliminated. Research will be more efficient, more focused, and more rewarding.

## **4.2 Improvements IT Brings to Organizational Learning**

### **4.2.1 Improvements to Online Courses and Educational Websites**

The internet is a powerful tool that we are only beginning to use effectively from a learning perspective. The ranks of online students have risen from only a few in 1993, to over 4 million by the beginning of 2007, and are currently increasing at a rate of 13 % per year (Barrett, 2011). There are a number of successful delivery approaches that are being utilized for online

courses. Improvements include better online content with research sites like EBSCOHost, desktop encyclopedias, online educational collaboration tools specifically targeted for providing an online classroom environment (i.e., Blackboard.com, MyPerson.com's Course Compass, etc.), advanced internet search engines, and cloud storage and computing. EBSCO provides over 350 full-text and secondary research databases, and content for the databases include full-text journals, magazines, books, monographs, reports, e-books, business book summaries and various other publication types. Course content in online classroom environments can support multi-media file types, and class lecture notes and briefings can be stored online and accessed by students wherever they are located. Lectures can now be videotaped and stored online so students can review them in accordance with their own schedule. Video clips of interviews with Chief Executive Officer's (CEO's) are readily available on U-Tube and routinely included in Masters of Business Administration (MBA) programs. Finally, live video and/or audio feeds with shared whiteboards can be offered to students that are travelling via Skype and collaboration tools like GoToMeeting.com.

#### **4.2.2 Improvements to Data Storage and Retrieval**

Organizational learning requires storing and retrieving from memory the information acquired from the learning. Computing technology can facilitate organizational learning to a degree not generally recognized, nor acted upon (Huber, 1996). To compute the lead times necessary to receive shipments of ordered materials to support just in time manufacturing, for example, the key data items (needed as input for the calculation) can be captured, during the business's procurement process, stored, retrieved, and then later used to compute the lead time. Such business processes are supported by characterizing data resident in organizational databases as transaction artifacts, and retrieving them when needed (Huber, 1996). In addition to improved

processing power which speed up data retrieval operations, advances in indexing, knowledge mapping, and data tagging can be employed to facilitate retrieval of average values, ranges, and trends to support path forward planning. The limiting factor for using computing technology to make an organization's acquired knowledge usable is not the IT system capabilities, but rather, is the imagination of the management team on how to define and capture the right metrics to support operations.

#### **4.2.3 Improvements to Organizational Decision Making**

Organizations routinely process information, make decisions, and implement them. Recent IT advances in computing and communications technologies have change the way organizations make decisions (Bhatt & Zaveri, 2001). Decision support systems (DSSs) are utilized by organizations to support and enhance its decision making activities. Artificial intelligence (AI) based techniques are now being embedded in many DSS products, enhancing the decision support making capabilities. Such tools have application potential in both individual and organizational learning contexts (Bhatt & Zaveri, 2001). Bhatt and Zaveri (2001) demonstrated that DSSs can enhance organizational learning by:

- Providing efficient access of data
- Enabling experimentation of variables for sensitivity analysis
- Facilitating the generation of alternate approaches
- Conducting trend analyses
- Supporting simulation studies
- Providing justification for proposed solutions to problems
- Exploring and exploiting knowledge, and
- Supporting the generation of ideas (Bhatt & Zaveri, 2001, p.304).

## 5 Influence of E-commerce on Creating a Team Learning Environment

E-commerce spurs the development of implementation technologies that, in the absence of a commercial business application, would not be worth developing for learning environments due to the limited returns that would be anticipated. Since the business case related to development of commercial applications has, in general, larger forecasted returns, they can be the basis for developing capabilities that can later be converted to learning environments.

Like learning environments, the products and services of commercial enterprises are geared at allowing consumers to search, find, capture, evaluate, store, retrieve, and use data they are interested in, from any location, on any platform. These same services are required to support the collaboration, file sharing, and credential exchanges necessary to conduct and operate team learning environments. Leveraging these products and services can provide the tools necessary to support a learning organization. Collaborative web-based tools like *ShareCenter* or *LiveLink* offer leading collaboration and knowledge management software for the global enterprises. Their richly featured enterprise services include virtual team collaboration, business process automation, enterprise group scheduling, and information retrieval services, all tightly integrated into a solution that can be customized and extended. Similarly, *Blackboard* and *MyPearson* educational tools can establish learning environments which have leveraged these same capabilities. The end result is that both the commercial and the learning market spaces have the tools necessary to establish a collective, collaborative, learning environment.



## 6 Conclusions and Summary Recommendations

Like the products and services that are offered by businesses, advances in IT innovation will result in specialization and diversification to how learning is conducted. To be competitive, firms in the future will have to learn collectively as an organization, which means they will have to communicate and collaborate effectively. Successful organizations are considered the ones that can learn, and learn quickly. Knowledge has become an organizations most important intangible asset since it is accumulated through organizational learning. New tools are available that can support collaboration efforts, but the organization must eliminate policies that inhibit information sharing and collaboration among team members. If an organization has a structural problem due to norms and values that discourage the sharing of information, innovative IT approaches will not improve the organizational performance since the underlying institutional problems will still be in place. The need for organizations to develop dynamic capabilities that can span innovation cycles is clear. If IT investments must be tied to strategic business plans and legitimate value propositions, then individual and organizational learning programs should focus on developing the skill to integrate business value propositions into product investment strategies. Organizations must assess which learning techniques will ensure staff can adapt the firm's products and services as new innovative technologies are introduced. Finally, ongoing, focused, training can ensure staff has the capabilities to implement product updates that achieve value propositions tied to the new technologies.

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