Chapter 1
Technology Integration in Work Settings

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ABSTRACT

Technology integration is gaining preeminence in the workplace. While plentiful definitions exist, researchers have attempted to answer many questions related to technology. Most of the issues dealing with technology in the workplace address, but are not limited to, technological entry, technological adoption, technological adaptation, technological appropriation, and technological invention. This chapter delves into the concept of technology integration in work settings. Starting with definitions, the chapter examines the nature of technology, its interrelationship with knowledge and the learning organization, its importance in the workplace, and its association with innovation.

WHAT IS TECHNOLOGY INTEGRATION

'Technology' has become a commonplace word. But what exactly is technology? How is technology integrated in work settings? What different types of technology exist? How does technology tie in with knowledge and the learning organization? Is there a philosophy of technology that affects the workplace? How are technology and innovation related? This chapter attempts to answer these questions in an effort to integrate prior research and provide practical implications for the workplace.

History of Technology

Definitions of technology have been vague and rife with confusion. There is no single globally accepted definition of technology. Misa (2009) notes that for many years historians have refrained from giving a prescriptive definition of the term 'technology'. It is not possible to talk about tech-

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nology without understanding what it is and what it does (Barney, 2000). According to Lake (2002), lack of understanding ails technology. Technology is formed by the combination of the Greek words techne and logos (Lake, 2002). Techne (art or skill) refers to the professions and fields that produce devices we see as technological. Logos is the logical discussion or reasoning that accompanies techne. Hughes, a noted historian of technology, states that "defining technology in its complexity is as difficult as grasping the essence of politics. Few experienced politicians and political scientists attempt to define politics. Few experienced practitioners, historians, and social scientists try to inclusively define technology" (2004, p. 2). The term 'technology' itself is fairly recent. Recent research has productively treated the term as an emergent and contested entity (Misa, 2009). As cited by Misa (2009), Jacob Bigelow, a medical doctor and Harvard professor, is often credited with coining the term in his 1829 book Elements of Technology. Prior to that, the term was almost always used to describe various technical crafts as opposed to the 'application of science' Bigelow referenced.

Definition of Technology

The vast number of definitions of technology demonstrates its different perspectives. Naughton (1994) defines technology as "the application of scientific and other knowledge to practical tasks by organizations that involve people and machines" (p. 12). Allen and Wircenski (1998) define technology in the context of education and training as "the utilization of theory, processes, information, and materials to improve the knowledge, skills and attitudes of a society" (p. 36). White and Bruton (2011) define technology as "the practical implementation of learning and knowledge by individuals and organizations to aid human endeavor. Technology is the knowledge, products, processes, tools and systems used in the creation of goods or in the provision of services" (p. 15).

According to White and Bruton (2011), a few major definitions include the following perspectives on technology:

- "The processes used to change inputs into outputs;
- The application of knowledge to perform work;
- The theoretical and practical knowledge, skills, and artifacts that can be used to develop products as well as their production and delivery system;
- The technical means people use to improve their surroundings;
- The application of science, especially to industrial or commercial objectives; the entire body of methods and materials used to achieve such objectives." (p. 15)

The aforementioned definitions share common elements. First, all three definitions imply that there is a process involved in technology. Second, they imply that change is an outcome of technology. Third, they indicate that technology involves a systematic approach to deliver the desired outcomes (White & Bruton, 2011). Last, but not least, these definitions refer to the human element – that people are involved in the process of harnessing knowledge, theory, and information to aid individuals, organizations, and society at large.

According to Spector and Wang (2002), technology includes methods and techniques as well as tools and equipment. They postulated that "a broad interpretation of technology is vital to the development of a scientifically sound and socially progressive perspective with regard to technology integration" (Spector & Wang, 2002, p. 3). In his book Technology in Schools, Naughton (1986) noted that technology has two aspects: technology as things and technology as social process. Both of these are applicable to the workplace.

Technology as Technology

Volti (2006) defined technology as "a system that uses knowledge and organization to produce objects and techniques for the attainment of specific goals" (p.6). Volti also stated that technologies were instruments and practices that were established and used by people so that they can do things that would not otherwise be possible. This statement serves to broaden the discussion of technology as technology. Fifteen years later the struggle to identify "technology" as a singular object of study remains elusive to both researchers and practitioners.

But, for a moment, let's ignore the overarching philosophy of technology as a broader, more comprehensive idea of changes, advancement, and innovation. Today we must remember that the present basic technologies were our advanced technologies of yesterday.

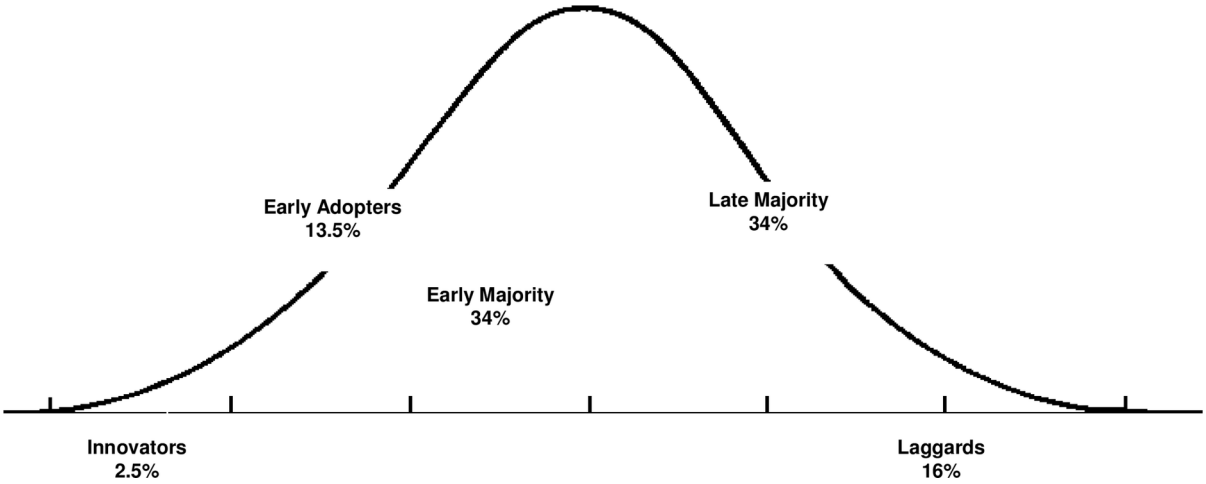
According to Tynan (2010), the following 12 technologies changed the world:

1. Zenith Flashmatic TV Remote, 1955.
2. Sputnik, 1957.
3. Atari Pong, 1972.
4. IBM PC 1981.
5. Motorola DynaTAC 8000X, 1983.
6. IBM ThinkPad 700C, 1992.
7. Broadband, 1995.
8. Slammer Worm, 2003.
9. Apple iTunes, 2003.
10. Wordpress, 2004.
11. Capacitive touchscreen, 2006.
12. The Cloud, 2010.

Tynan (2010) further states that these technologies may not have been the first, but they certainly changed the ways we viewed life, or the way we interacted with the world "in a simple and profound way" (p. 1). For example, the IBM PC revolutionized the world of personal computers and turned it into an industry and business tool. Similarly, the Motorola DynATAC 8000X was the grandfather of all mobile phones. Broadband lets us surf the internet at speeds that were initially unimaginable. Hannafin and Peck (1988, p. v) referencing the National Taskforce on Educational Technology, 1986, stated that by "1984 there were more than a million microcomputers in elementary and secondary schools in the United States alone, and in the near future it is estimated that it will grow to approximately 2.8 million." Becker (1984) describes that between 1981 and 1984 computers in schools grew from 10% to over 60%. In 2012 we cannot fathom a school in the United States without this basic technology today.

Advanced technology to one person is considered basic technology to another. The adoption of technology depends on people's background and experience with a particular technology and, in some cases, their acceptance of new technologies. Rogers (2003) describes five types of adopters: Innovators, Early Adopters, Early Majority, Late Majority, and Laggards. Innovators are those who kickstart the adoption process. They spend time, effort and energy to develop new ideas and devices. They are venturesome. The innovation's probable benefits excite them and they are willing to give it a try. Being an innovator has certain prerequisites - control of financial resources (if there is an unprofitable innovation), the ability to understand and apply complex technical knowledge and the ability to cope with a high degree of uncertainty about an innovation. The innovators are gatekeepers in the flow of new ideas into a social system. Early adopters use the data provided by the innovators' implementation and ratification of the innovation to make their own adoption decisions. They leap in once the benefits are obvious. These are the people who are 'consulted' before using a new idea. They are also vital because they serve as independent test beds to iron out the innovation to suit mainstream needs. The early majority adopt new ideas just before the average member of a social system. They are those who won't act without solid proof of benefits. They are an important link in the dif-

Figure 1. Adopters of technology according to Rogers, 2003



fusion process. They however are followers and not leaders in adopting innovations. They are also cost sensitive and risk aversive, they look for uncomplicated, established, improved ways of doing what they already do. Late majorities adopt new ideas after the average member of a social system. They approach them cautiously and are skeptical of them until they are persuaded about the utility of new ideas. Laggards are the last in a social system to adopt an innovation. They are either traditional or isolates in the system. It takes much longer than average for laggards to adopt innovations. Their point of reference is the past and they have no opinion leadership. They are people who see a high risk in adopting a new innovation. Figure 1 represents Rogers' bell curve and the percentages of the five adopters.

The rules of technology as technology are very simple indeed:

- You cannot keep up with new technology.
- Keep up with the principles of technology.
- Don't sweat the small stuff. It's simply advanced at the moment.
- Basic Technology is the technology that YOU know.
- Advance Technology is the technology that YOU don't know.
- Technology will change.
- Technology will soon become a tool.

Advanced technology adoption, integration, and advancement will be an ongoing issue for both education and the workplace. Yet, at the beginning of the computer revolution Hannafin and Peck (1988, p. v) eloquently stated "although computers are capable of contributing to the educational process in many ways, the computer, by itself, is of little value. It is merely a tool."

Technology as Social Process

Lake (2002) explains two major misconceptions about technology. Firstly, technology is automatically thought of as hardware. Secondly, everyone is directly involved in technology. It is easy to think of the engineer, mechanic, and scientist as examples of those who influence technology. However, all citizens have an impact on technology. If you find that hard to believe, here are some reasons that will convince you. We are consumers of technological products, we are voters who determine the election of parties with a policy platform, we are investors in technological enterprises, or we are victims of technological impacts on the environment. We can safely conclude that all employees

in different organizations impact technology in some way. From the prior definitions of technology, we realize that technology is more than the tools, machinery and other devices of society. It is the logical organization of societal conduct to achieve a given goal.

Technology can refer to the body of technical knowledge, regulations, and theories. It can refer to the practice of technological professions such as the sciences, which includes approaches, rules, and suppositions about its application. It can refer to the physical tools resulting from the practice of technological professions. It can refer to the organization of the above into large scale social systems of various institutions, both private and public. Finally, technology can refer to the quality of life that results from the introduction of these technologies, or the character of social life that results from technological activity (Lake, 2002).

Williams and Edge (1996) reviewed a growing body of literature that explored the social shaping of technology – how the design and implementation of technology are influenced by a range of social, economic, and technical factors. The generation and implementation of new technologies involves a set of choices between different technical options. Alongside technical considerations, a range of social factors affects the selection of new technologies, which therefore influence the content of technologies and their social implications.

The full impact of technology in human affairs becomes apparent when we consider technology as a social process (Lake, 2002). Technology has transformed individuals and society as a whole. We now have longer life spans, reduced infant mortality rates, overpopulated regions, and increased pollution. We have the world at our fingertips through the internet, instant communication tools, and advanced transportation. But the influence of technology on society has been a double edged sword having led to advances as well as conflicts and ideological failures. Gupta, Fischer and Frewer (2011) state that historically many technologies have been associated with public controversies, leading to public rejection of their use. It becomes imperative, therefore, to understand the psychological factors of societal acceptance of emerging technologies. The researchers reviewed the socio-psychological determinants of public acceptance of 10 contentious technologies. The results indicated that there has been an amplified interest in and emphasis on public acceptance of technologies in academia.

Technology represents both theory and action. Lake (2002) states that it is typical 'to do' technology in society. Technology has permeated our social, political, and cultural lives. The absence of technology is a very rare exception rather than a norm. To gain a better understanding of the social impact of technology, Wenk (1986) proposes the idea of technology as an amplifier. Technology amplifies many aspects of human behavior. Technologies allow us to see things otherwise invisible, to hear things otherwise inaudible, and to measure things otherwise undetectable (Lake, 2002). However, the social amplifiers of technology are less apparent.

Technology has a powerful influence on culture. Nevertheless, culture does have a powerful effect on technology as well. Flew (2012) examined how the culture of cities, that is the rapid urbanization occurring in the developing world, can act as a promoter to innovation and the development of new technologies. He described culture as the arts, the way of life of people and communities, and the entrenched edifice supporting socio-economic relations. In addition, he considered technology as including devices, practices and 'logics' of technology, or what the Greeks termed techne.

In the workplace, organizational culture immensely dictates and influences which technology is integrated and adopted and which technology is ignored. Organizations adopt and integrate technology by determining beneficiaries (employees and the organization), by adopting tradeoffs, and by determining the ethical course of action. How-

ever, not all organizations use these guidelines. Human nature has been amplified by technology just as technology has magnified social impacts (Lake, 2002). For instance, the large scale availability of small, light, and affordable tools for communication and consumption, particularly the mobile phone, have transformed society. Hynes (2012) states that the major views of the relationship between society and technology among policymakers and business leaders, however, are frequently production-oriented and pay less attention to end-users and pressing issues of usage. He argues for a practice theory approach to allow for the greater integration of social factors into technology development and adoption processes, in particular that of telework.

Technology has impacted the world of work to a very large extent; whether it is used positively or negatively remains unknown. Technology in the workplace permeates the physical as well as the social world, albeit in different ways. Research on technology in the physical world is plentiful; after all, technology changes rapidly and necessitates the constant updating of skills and knowledge. However, technology as a social process is still evolving. While there is a lot written about technology integration in educational arena, there is very little research on technology at work or corporate settings. This, nonetheless, does not mean that technology does not impact the workplace. On the contrary, it impacts the workplace tremendously – companies keep updating technology and invest in training their employees on the latest technology. However, prior literature lacks research on how technology is actually integrated into the workplace and its effects on productivity. This brings us to the term 'integration'.

Definition of Integration

Spector and Wang (2002) state that 'integration' (from Latin) involves the idea of restoration to wholeness. Drejer (2000) states that the term 'integration' is popular in the research environment, but that there seems to be very little consensus on what it constitutes. This is probably because it is necessary to integrate technology in many different ways. Broadly speaking, the Oxford English Dictionary defines integration as the making of a whole by adding together or combining separate parts or elements. In the context of work, we need to ask ourselves - what is to be integrated? In this case, technology and the workplace need to be integrated. Spector and Wang (2002) note that integration refers to a process of combining various distinguishable parts to create a complex whole.

Hansen (1992) defines integration as coordinating, linking, or joining activities in a system with the purpose of achieving a set of goals. Gulledge (2006) reiterates that 'integration' has multiple and misunderstood meanings. He states that there is a general consensus that the term 'integration' refers to "making applications work together that were never intended to work together by passing information through some form of interface" (p. 5). He further explains that in a broad sense the term has been used to describe a process, a condition, a system, and an end-state. So what is integration in the context of technology in organizations? The answer at the simplest level is that it depends on the context it is used in.

Technology Integration

Reverting to Hansen's definition of integration, technology integration in the workplace refers to coordinating, linking, or joining activities in an organization with the purpose of achieving the set of goals set by the organization. The purpose of the technology integration, therefore, is to achieve organizational goals.

Iansiti (1998) defines technology integration as "the set of investigation, evaluation, and refinement activities aimed at creating a match between technological options and application context" (p. 21). He also emphasizes that technology integration requires knowledge. We will discuss this later on in the chapter.

IS THERE A PHILOSOPHY OF TECHNOLOGY?

Jonas (1979) notes that there are philosophical aspects to technology just as there are to all things of importance in human endeavor. Modern technology invades almost all aspects of human existence in the present world, including the world of work. The way we live our life, work, and interact with the world is influenced by technological pursuits. Franssen, Lockhorst and van de Poel (2013) contend that the philosophical contemplation on technology is older than most would consider. They further explain that there is an analytic philosophy of technology where science and technology, while related, also have differences. Design is central to the technological process. Technology aims to change the world through the innovation process that is so intrinsic to it. Therefore, the origins of technology are important to those who want to understand it as well as to those who are concerned about its role in society (Franssen, Lockhorst & van de Poel, 2013). To make his point, Jonas (1979) distinguishes between modern technology and previous technology. Is there really a difference between the technology of 'now' and technology of 'then'?

He differentiates modern technology as an enterprise and process from earlier technology as possession and a state. This differentiation continues to be true in the new millennium. He emphasizes two major themes in technology – firstly, the formal dynamics of technology as a continuing joint venture which advances by its own 'laws of motion'; and secondly, the substantive content of technology in terms of what it puts into human use, the powers it confers, the novel objectives it opens up or dictates, and the altered manner of human action by which these objectives are realized. The first theme considers technology as an abstract whole of movement; the second considers its concrete uses and their impact on our world and our lives. Not surprisingly, we have made a case that technology has permeated and affected both our personal and work lives. Technology is constantly changing and both researchers and practitioners have been involved in gauging how that impacts human beings at work.

He also listed four traits of modern technology. First, modern technology does not tend to approach an equilibrium or saturation point. It serves, in fact, as a means to achieving a future step and there is some fluidity in the process. Second, every technological innovation spreads quickly through the technological world community, as do theoretical discoveries in the sciences. It is important to note that the spread occurs in terms of knowledge and practical adoption. Third, the relation of technological means to an end is certainly not linear but circular. Old technologies give birth to new technologies. Technology adds to the objectives of human desires, including objectives for technology itself. Fourth, progress is inherently a part of modern technology. Although we can find faults with it, we use it even if we do not truly accept it. For example, the onset of social media has raised a hornet's nest about privacy issues; however, this has not impeded people from using it.

TECHNOLOGY, KNOWLEDGE AND THE LEARNING ORGANIZATION

Neale (1984) references Abramovitz and Solow's point that much of the increase in America's output should be attributed to technological change. The problem arises because of treating people as individuals who can know how, independently of social organizations and processes. "Productive knowledge is using things in an integrated system in which no person knows enough to accomplish anything worthwhile alone. Knowledge is technology and they are social" (Neale, 1984, p. 573). Knowledge of technology does not exist separately from the integration provided by institutions.

Technology and globalization have led to a knowledge-based economy (Marquardt & Kearsley, 1999). We are therefore now in the era of

knowledge workers. These workers have recognized that continual learning is not a prerequisite of employment, but a major form of work. Organizations need to make a shift in order to adapt, survive, and succeed in the present environment. This entails that they become learning organizations. Technology serves as the stimulant and supporting beam in building the learning organization. A major and rapidly growing resource engaged to meet these learning and knowledge needs in the workplace is learning technology (Marquardt & Kearsley, 1999). Organizations can only adapt to a rapidly changing environment with the solid use of technology. Therefore, learning organizations can exist and succeed with the intelligent application of technology (Marquardt & Kearsley, 1999). Marquardt and Kearsley (1999) listed four subsystems of the learning organization supported by technology – organization, people, learning, and knowledge.

Organization

The organization subsystem of the learning organization has its own subsytems: *culture*, *vision*, *strategy* and *info-structure*. Figure 2 depicts the four subsytems of the learning organization. *Culture* refers to the beliefs, values, practices, rituals, and customs of an organization. In a learning organization, learning is recognized as the pillar of success in corporate culture. *Vision* refers to an organization's hopes, goals, and direction for the future. In a learning organization, that refers to a future where learners build the company's continuously new and improving products and services. *Strategy* refers to the action plans, methodologies, tactics, and steps employed to reach a company's vision and goals. *Info-structure* includes the departments, levels, and configurations of the organization. As opposed to a traditional, hierarchical organization, a learning organization is one that is streamlined, flat, and boundary-less. This helps maximize contact, information flow, local responsibility, and collaboration both within and outside the organization.

People

The people involved in a learning organization include employees, managers, customers, suppliers/ vendors, and community groups. All the shareholders are valuable to the learning organization, and are empowered and enabled to learn with the help of technology (Marquardt & Kearsley, 1999). Figure 3 portrays the different shareholders in a learning organization.

Learning

Learning represents the core of the learning organization. There are three levels of learning – individual, group or team, and organization learning. Similarly, different types of learning add value to the learning organization. *Adaptive, anticipatory, and generative learning* summarize learning from experience and reflection. *Single loop, double loop and deuteron learning* are differentiated by the amount of reflection placed on action that has occurred in the organization (Marquardt & Kearsley, 1999). *Action learning* involves reflection on real problems where learning is equal to existing knowledge plus questioning insight. Senge classified different key skills to initiate and maximize organizational learning. *Systems thinking* represents a conceptual framework. *Mental models* are ingrained assumptions that help us understand the world and how we take action. *Personal mastery* is a high level of mastery in a subject or skill area. *Team learning* focuses on the process of streamlining and developing the capacity of a team to create the learning and results its members desire (Senge, 1990). *Shared vision* involves sharing a vision for the future that fosters commitment instead of compliance. *Dialogue* denotes open communication between people.

Figure 2. Dimensions of a learning organization according to Marquardt & Kearsley (1999)

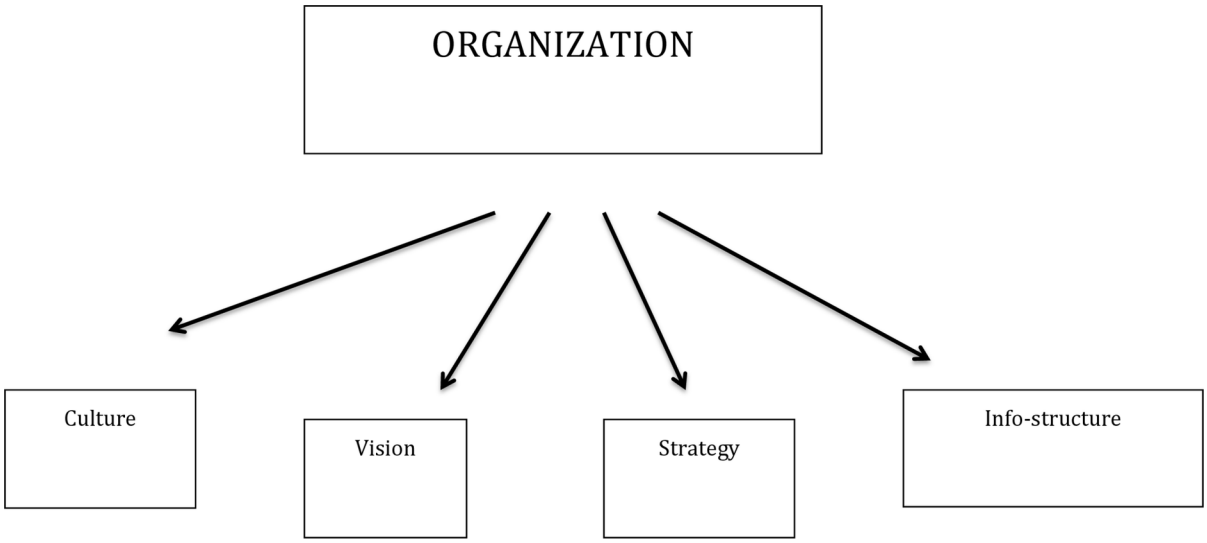
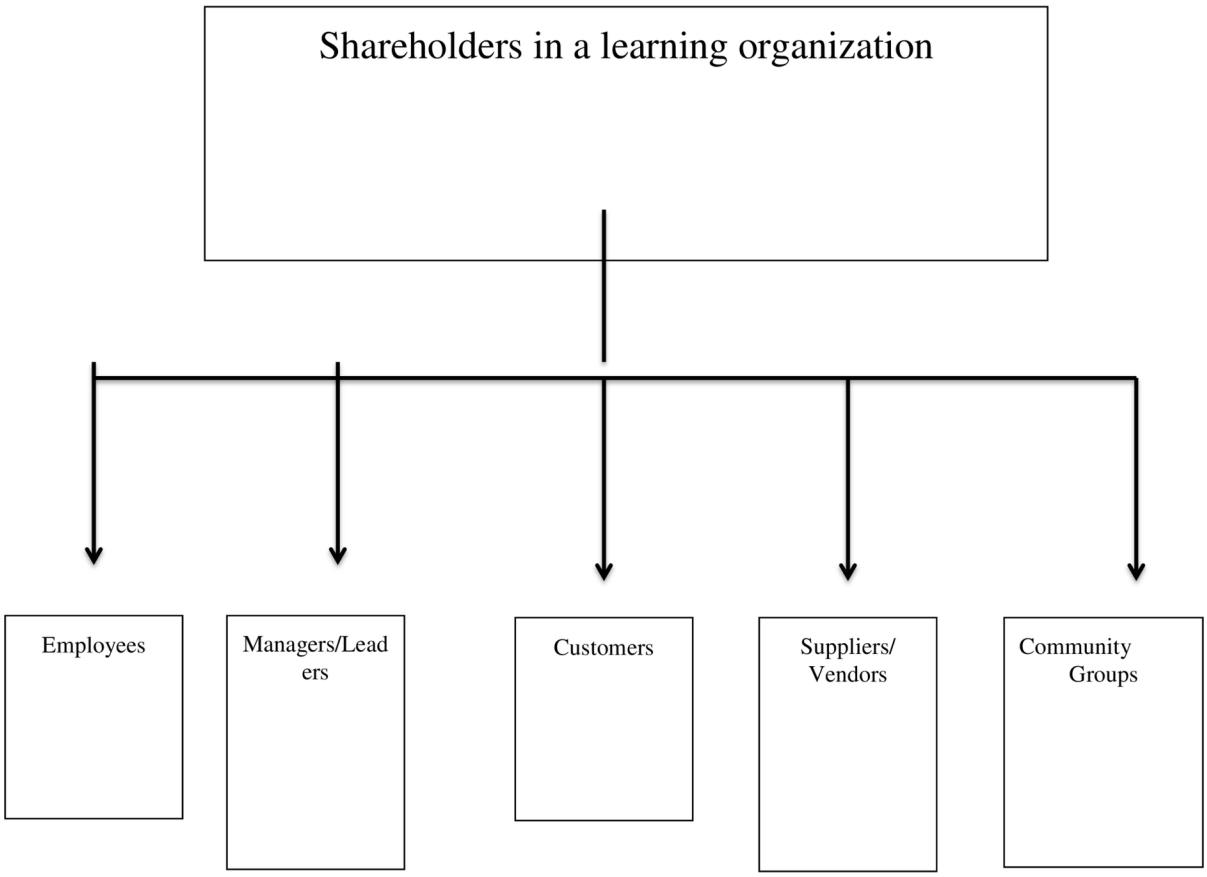


Figure 3. People in learning organizations



Knowledge

The knowledge subsystem refers to the management of acquired and generated knowledge of the organization. It includes the *acquisition*, *creation*, *storage*, *transfer* and *utilization* of knowledge (Marquardt & Kearsley, 1999). *Acquisition* is the collection of existing data and information from both internal and external sources through benchmarking, conferences, environmental scans, internet usage, staff suggestions, etc. *Creation* is the new knowledge produced within the organization through problem solving, projects, etc. *Storage* is the coding and preservation of the organization's knowledge. *Transfer and utilization* represent the unrestricted mechanical, electronic, and relational movement of information and knowledge throughout the organization.

Organizations articulate, expand on, and integrate the knowledge created by individuals (Nonaka, 1994). Grant (1996) refers to the firm as the one providing the tools to integrate knowledge. A learning organization is recognizable by the existence of an atmosphere of knowledge sharing and learning systems (Griego, Geroy & Wright, 2000).

Technology in the Workplace

Spector and Wang (2002) view technology integration as primarily about human use. They emphasize that a human-centered perspective is critical in understanding why particular technologies fail or succeed in various situations. According to Sandholtz, Ringstaff, and Dwyer (1997), technology integration includes five stages: entry, adoption, adaptation, appropriation, and invention. Each stage has its own patterns of change and support requirements. This is true of the classroom as well as the workplace. While examining the relationship between technology and organizations, we find that 'technology' and 'organization' cannot be treated as separate categories. Their social settings shape technologies just as much as technologies shape their social settings; thus, the mutual relationship is very apparent (Williams & Edge, 1996). Technology integration is an important area of consideration for people working in different contexts, including academicians, government and non-profit agencies, and private and for-profit organizations. Technology integration at the workplace is essential to success.

To reiterate, integration implies abandoning the preoccupation with technology as 'equipment' or 'hardware' alone. Instead, we require a plan which acknowledges all those institutions, artifacts, and arrangements within which the adoption, configuration, and use of those technologies take place - including the knowledge and expertise which have created technologies and are embedded within them (Dosi, 1982), and the processes of learning and experience which inform innovatory activity (Sahal, 1981). The link between technology and innovation needs to be explored. Technologies are inclusive phenomena. Their development involves the interaction of various social and technical elements. These different components cannot be separated from one another, or treated as distinct variables; they are in constant mutual tension (Williams & Edge, 1996). As briefly discussed in the 'technology as social process' section, there is no linear effect of technologies upon society. The shaping of technologies by social factors is not a simple one-way process. Technologies, once developed and implemented, not only influence their environments to generate new forms of technology, but also generate new environments (Williams & Edge, 1996). That is the circular nature of technology.

The workplace today is inundated with technology. The increased intelligent use of technology has become critical for the continuing economic development of organizations (Marquardt & Kearsley, 1999). Sadly though, Orlikowski and Scott's (2008) analysis of four leading journals confirmed that over 95% of the articles published in top management research journals do not take into account the role of technology in organizational

life. Toffler mentions how the advanced global economy cannot run for thirty seconds without the technology of computers (as cited in Marquardt & Kearsley, 1999). The workplace will continue to demand and require technological advancements and innovations. Surprisingly, what is considered technologically advanced today can and will become outdated in few months or years. These technological advances have become necessary to manage the huge amounts of data being processed in organizations every day. Marquardt & Kearsley (1999) state that "being informed, being in touch, and being there first" (p. 1) can make a difference between success and second best while working in a global economy. And technology provides that needed advantage.

Orlikowski (1992) developed a theoretical model to examine the interaction between technology and organizations. She proposed a reconceptualization of technology considering two different perspectives – an earlier perspective that assumed technology to be an objective, external force that had deterministic impacts on organizations and a later view that focused on the human aspect of technology, viewing it as the outcome of strategic choice and social action. Either view is incomplete; therefore, the author proposed the new conceptualization. She calls this theoretical model the structurational model of technology. Orlikowski recommends that the reformulation of the technology concept and the structurational model of technology allow a deeper and more rationalistic understanding of the interaction between technology and organizations. "This understanding provides insight into the limits and opportunities of human choice, technology development and use, and organizational design" (Orlikowski, 1992, p. 398). In defining the concept of technology, Orlikowski (1992) restricted its scope to material artifacts. She distinguishes "between the material nature of technology and the human activities that design or use those artifacts" (p. 403). This distinction also facilitated the author's framing of the role of technology in terms of a mutual interaction between human agents and technology, and hence as both structural and socially constructed. In the theory, Orlikowski (1992) posits structuration as a social process that involves the reciprocal interaction of human actors and structural features of organizations. The theory recognizes that human actions are enabled and constrained by structures, yet that these structures are the result of previous actions.

Various industries have been impacted by technology, and in fact, there is an explosion of technology in the world of work. The use of the internet is one of the fastest growing phenomena in the business world, building from a base of fewer than a 1000 connected computers in the early 1980s, to over 10 million host computers in the late 1990s (Marquardt & Kearsley, 1999). The increased and intelligent use of technology has, therefore, become critical to the survival of organizations and their ultimate economic development and success.

Marquardt and Kearsley (1999) list 14 ways in which technology has transformed the workplace:

- Technology has changed the way work is done, whether it be production, coordination, or management work.
- Technology has enabled a fuller integration of business functions.
- Technology has created the possibility of truly global companies.
- Technology has forced basic changes in organizational structure.
- Technology has enabled organizations to transform from bureaucratic to network and federated ways of operating and thinking.
- Technology has required skills and competencies on the part of all workers.
- Technology has impacted where workers work.
- Technology has provided more opportunities and power to customers.
- Technology has allowed for the emergence of virtual organizations.

- Technology has affected reward systems of workers.
- Technology has transferred knowledge faster and more efficiently between workers and throughout the organization.
- Technology has affected how training is designed and delivered.
- Technology has affected how knowledge is managed.
- Technology has affected how organizations learn.

It is amply clear that technology has impacted the workplace. More important, however, is how individuals in the workplace use physical technology. Marquardt and Kearsley (1999) identified four different levels of interaction. Figure 4 depicts the different levels.

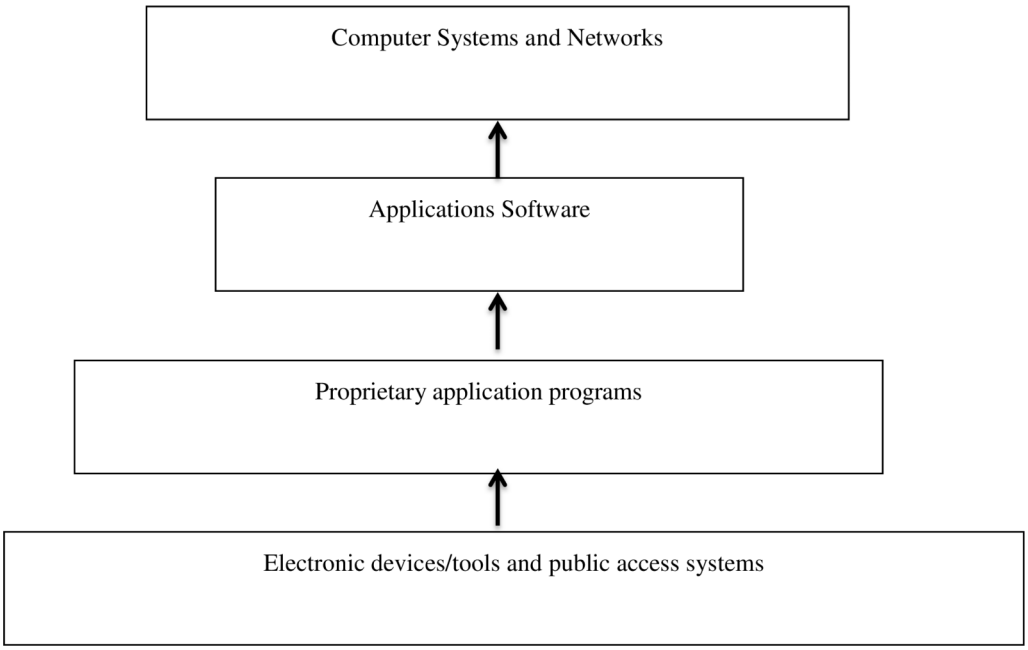
The first level involves the use of electronic devices or tools and public access systems. This includes use of computer-based equipment like bar code scanners, electronic cash registers, etc. More hardware based, this is typical in service-oriented professions. The second level involves interaction with one or more proprietary application programs. This includes processing transactions, information processing, decision-making, record keeping in databases, etc. It requires formal training and can range from simple to complex. The third level involves the use of commercially available application software such as word processing sheets, statistical software, spreadsheets, presentation software, etc. These programs usually come with in-built tutorials, online tutorials, etc. The skills obtained in this kind of applications are transferable across organizations and jobs. The fourth level includes knowledge of computer systems and networks themselves. This is the domain of information technology specialists. The skills required here are very extensive and diverse. Moreover, they change all the time, and therefore, need updating on a fairly regular basis.

Lawless and Price (1992) define technology champions as members of organizations who present new technology to fellow members who are potential users. These technology champions are widely accepted as instrumental in many implementation settings. They are viewed as technically up-to-date. Technology champions go beyond organizational boundaries and break down apathy with enthusiasm. Ideally, technology champions can reduce cost to users of screening and implementing new technologies (Lawless & Price, 1992; Leonard-Barton, 1987).

Iansiti (1998) states that technology does not work in isolation. He emphasizes that different technologies act in conjunction and add value as integrated systems. Humans make the choices about what, how and for which purpose technologies should be integrated. Technology integration is a process of choosing between possibilities to solve a product problem.

A valid point with regards to integration of technology in work settings is whether it is possible to overdo it. Do organizations suffer if technology is integrated in the workplace? While everyone gushes about the integration of technology in work settings, is there possibly a dark side to it? Baptista, Newell and Currie (2010) attempted to uncover the 'dark side' of the institutionalization of IT in business routines in a case study. The study was with regards to IT alone, but it can be generalized to other technologies as well. In the case study, the researchers followed the development of an intranet in a bank in the UK over a period of five years. In the process, they identified six characteristics of institutionalized systems and highlighted five risks for a business. They suggest that a paradox emerges where the taken-for-granted nature of emergent infrastructure technology combines with reduced collective awareness at the senior management level. The speed at which senior executives and others can identify and respond to internal and external pressures to adapt technology to meet changing business conditions is highly important. The researchers pointed out that the consequences of the dark side of institutionalization may be that

Figure 4. Levels of technology interaction according to Marquardt and Kearsley



organizations become less competitive and agile where technologies become removed from the 'radar screen' of key decision makers (Baptista, Newell, & Currie, 2010). On a practical level, their findings indicate the need for senior management to be involved in continuously raising awareness about the strategic possibilities of established technology to ensure that they do not 'drift' away from business needs. Thus, organizational culture is such an important aspect of technology integration at the workplace. Technology integration is a management challenge that impacts the success of the institution as a whole.

TECHNOLOGY AND INNOVATION: THE FUTURE?

Where will technology be in 20 years? What a great question! The answer is: "We simply do not know". However, the last decade has provided a glimpse of the future by taking on a number of new aspects: mobile, global, information-centric, and personal. Davis' book (1987), Future Perfect, provided an overview of five types of communication. Included in these communications types was the idea of "Anytime, Anytime Place". This vision of the future is exemplified today with an iPhone or any other similar product – the ability to email, talk, teleconference, store information, etc., truly makes a conceptualized future 25 years ago into an everyday technology of today.

Further, Davis describes the idea, from a manufacturing standpoint, of "mass customization". This vision of 20+ years ago is now an everyday technology of our social media through products such as Wordpress, Wix, and Facebook. A temple of communications technology that can very easily be customized to fit the mood, face-of-business, or educational forum needed for not just everyone (the mass) – it will allow you to customize to the individual (customized for me). Innovation is aided by technology. This technology will assist in the spread of ideas across local and global communities.

The advancement of technology has considerably transformed the way people work. Specifically, the how, when and why of work life has altered. Nixon and Spector (2013) emphasize that information and communication technologies such as laptops, cellphones, smartphones, PDAs and tablets have enabled employees to work and learn remotely. For example, Nilsen (2011) researched the use of videoconferencing as a workplace learning tool among general practitioners and specialists in Norway. Myrick, Caplan, Smitten and Rusk (2011) studied how e-learning technology facilitated mentorship of nursing students. Globalization has also led to an increase in global virtual teams. Clear and MacDonell (2011) reviewed the use of technology in such teams.

Similarly, there is increased interest in the use of social media at work. While research points to training and different forms of learning using mobile devices (Pimmer & Pachler, 2014; Ally, Samaka, Ismail & Impagliazzo, 2013; Glahn, Specht & Wishart, 2011), organizations are still weighing the advantages of the use of social media (Treem & Leonardi, 2012; Thompson & Bluvshtein, 2010). While research posits advantages of technological adoption at work, there are also disadvantages that scholars are researching. Vitak, Crouse and LaRose (2011) discuss the concept of cyberslacking (also known as cyberloafing), which is essentially the use of internet and/or mobile technology during work hours for personal reasons. Liberman, Seidman, McKenna and Buffardi (2011) found that employee job attitudes of job involvement and intrinsic involvement were negatively related to cyberslacking. Studies like these have also brought into the forefront the organization's role in technology adoption at the workplace. Chelmis and Prasanna (2013) examined the impact of organizational hierarchy in adopting new technologies in the enterprise.

In the future, individuals will continue to interact in an attempt to organize and elicit such social behavior that will result in the overall betterment of society. The ultimate goal of innovation is to continuously improve society as a whole. Information, knowledge management, and communication will become cornerstones of technology study as we move 25 years into the future. The tools of technology are not yet known, but we have some glimpses.

CONCLUSION

The importance of integrating technology, learning, and organizational life has become increasingly important and definitive to organizational leaders around the world. Irrespective of the type of organization, the following reasons have increased exploration with regards to technological integration and innovation:

- The rate of change of technologies in work settings.
- Evaluation of the effectiveness of new technologies.
- Knowledge of the application of new technologies.
- Integrating new technologies with existing technologies.
- Organizational culture and how top management introduces and supports new technologies.

It is critical to understand how technology can be integrated into the workplace so that individuals and organizations can achieve desired results. Technology has emerged as a social process that incorporates aspects of human behavior. From an organizational culture standpoint, technology facilitates the exchange of ideas, beliefs, and ceremonies throughout the organization. Future technological advances will continue to shape organizational and individual daily life and society can benefit from the emergence of learning organizations facilitated through technology. It is up to individual users to advance their philosophies, definitions, and models of technology in

the workplace for the betterment of both learning and performance.

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KEY TERMS AND DEFINITIONS

Innovation: Innovation refers to the introduction of a new and improved idea, method, device, product, process, service, or technology.

Learning Organization: A learning organization is an organization that facilitates the learning of its members and continuously transforms itself through collaboration and knowledge sharing.

Technology Integration: Technology integration in the workplace is the coordinating, linking, or joining of activities in an organization with the purpose of achieving the set of goals set by the organization.

Technology: Technology refers to the application of scientific and other knowledge to practical tasks by organizations that involve people and machines.