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# Technology Adoption and Disruption -- Organizational Implications for the Future of Work

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## Abstract

Effective use of various technologies in organizations is key to success in this age of rapid technological innovation. In particular, during the last 20-30 years we have seen that the pace of technical innovation has significantly increased. Many of these technologies have created substantial and positive disruptions in organizational processes and operations. Some organizations have been struggling with this rapid technological disruption. Managers are uncertain about when and under what conditions they should adopt a new technology. A Technology Acceptance Model was developed by Fred Davis in 1985 as his Ph. D. dissertation submitted to the Sloan School of Management at M. I. T. Since then, other researchers have developed and applied various versions of this model and similar models for adopting new technologies in organizations. In this commentary, we briefly review the history of technology adoption models and discuss disruptions created by these technologies. We summarize organizational implications and describe the technology adoption curve. During a Global health crisis and pandemic, it is timely to think about the impact of technology adoption and the implications for the future of work.

**Keywords:** Technology adoption, disruptive technologies, technology adoption models, technology adoption curve

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## 1. Introduction

Effective adoption and use of various technologies along with modern business processes in private, public, and not-for-profit organizations are essential for them to become and remain successful enterprises. Rapid and significant technological changes and newer business models and processes often make it difficult for managers to determine what new technologies to use and under what circumstances it is appropriate to adopt them. The technology acceptance model (TAM) is the most widely applied theoretical Information Systems model. It was originally developed by Fred Davis (Davis, 1985; Davis, 1989) to facilitate information technology adoption decisions. Other versions of TAM such as TAM2 (Venkatesh & Davis, 2000) and TAM3 (Venkatesh and Bala, 2008) have been developed as well.

TAM (Davis, 1985; Davis, 1989) was developed to examine end-user acceptance of information systems based on characteristics of such systems. Venkatesh & Davis (2000) developed an extension to the original TAM that is referred to as TAM2 by including characteristics such as "perceived usefulness" and "perceived ease of use" (p. 186). Venkatesh & Bala (2008) expanded the model further by including the concept of intervention by managers regarding technology acceptance. Dishaw and Strong (1999) extended TAM by including the task-technology fit constructs in their model.

TAM and its different versions have been applied to different technologies over the years such as Internet banking and user behavior (Chan & Lu, 2004); e-learning (Cheung & Vogel, 2013); e-mail usage (Gefen & Straub, 1997); ERP use (Gumussoy, Calisir, and Bayram (2007); and telemedicine technology acceptance by physicians (Hu, Chau, Sheng, & Tam,1999) to name a few technology areas.

The effectiveness of TAM as a predictive model has been studied by a number of researchers. Lee, Kozar, and Larsen (2003) examined accomplishments and limitations of TAM by reviewing 101 articles published from 1986 until 2003. The authors divided their study period of eighteen years into four stages of "introduction, validation, extension, and elaboration." A major finding of this study is that TAM has evolved over the years. During its introduction, TAM received significant attention. This was followed by a period of validation of the model, in particular, validation of the TAM instruments that were used. This period was followed by an extension phase when researchers focused on external variables including individuals, organizations, and tasks characteristics. As stated above, many researchers extended the model during the elaboration period resulting in models such as TAM2 (Venkatesh & Davis, 2000) and TAM3 (Venkatesh & Bala, 2008).

Other researchers have used alternative concepts to those used in various versions of TAM to discuss technology acceptance and adoption. For example, Sun, Fang, and Zou (2013) suggested the importance of mindfulness when adopting a technology. They proposed that technology adopter's mindfulness is a critical factor that determines how a particular technology fits specific tasks. The authors focused their efforts on the concept of mindfulness of technology adoption (MTA) along with the task-technology-fit (TTF) model and suggest an MTA-TTF framework. Elaboration of TAM continues.

The technology acceptance and adoption literature are very mature after more than four decades of important research about this topic. As a result, some researchers have tried to look at technology and adoption using a different lens. Pauleen, Dalal, Rooney, Intezati, and Wang (2014) suggest that the IS community needs to look at various aspects of the individual, organization, and society to understand the interface and interaction between organizations and technology.

One way to look at the above concepts in more depth and to assess the wisdom of technology acceptance and adoption models is to delve into the underlying ideas behind the technology adoption curve phenomenon.

## 2. The Technology Adoption Curve

The technology adoption curve (TAC) explains how individuals, managers, and organizations behave in implementing innovative technologies. A quick examination of the framework shows some similarities to the product life cycle curve discussed in business marketing courses. The theory is however more sophisticated than a life cycle or a diffusion model. The underlying model of technology adoption identifies five types of adopters of technology with very different interests and buying characteristics. The companies and individuals that are first to adopt a new technology are called innovators. The second type is known as the early adopters. The third type is called early majority, then the late majority adopters and, finally, the laggards (Roger, 1995).

In general, technology refers to products including software that are based on scientific knowledge. As scientific discoveries are made innovators often apply the new scientific findings to create useful products. Adoption of new innovative technologies seems to occur following a pattern. The technology adoption curve pattern is presented as a traditional bell-shaped curve with exponential growth in the beginning phase of adoption and a slowdown in adoptions occurring during the late adoption phase. When a new technology is introduced, it is usually hard to find, expensive, and imperfect (even flawed). Over time, the new technology's availability increases, cost decreases, and features improve to the point where many organizations and individuals can benefit from adopting the technology. The technology diffuses and spreads to general use and application.

Adoption occurs in phases and adopters in each phase have similar characteristics. In the initial phase innovators are technically oriented users and "visionary." In the final phase, laggards are practical and conservative. The early adopters are seeking a competitive advantage. Productivity issues and conformity influence the early and late majority adopters. Some technology innovations reach a "dead end" early in the adoption cycle. These immature or premature innovations "flame out." The technologies that change industries and even society are the "killer applications" like the VisiCalc spreadsheet.

Innovators are enthusiasts who adopt a new technology for its own sake, with no clear purpose in mind. Early Adopters have the vision to adopt an emerging technology and apply it to an opportunity that is important to them. Early Majority adopters are pragmatists who do not like to take the risks of pioneering, but are ready to see the advantages of tested technologies. They are the beginning of a mass market for the new technology. Late Majority adopters are also pragmatists and this group represents about one-third of available customers. This group dislikes "discontinuous innovations" and believes in tradition rather than progress. The late majority buy high-technology products reluctantly and do not expect to like them. Traditionalists (or laggards) don't really like technology. This group performs a "reality testing" service for the rest of us by pointing out the discrepancies between the day-to-day reality of a technology product and the often-exaggerated claims made for it.

The Technology Adoption Curve (TAC) model is relevant to understanding the adoption of various information and decision support technologies. For example, model-driven DSS are probably at the late majority stage, but Web technologies have reinvigorated that type of decision support and changed its adoption curve. Data warehousing and analytics are probably still in the hands of the early majority. Customer Relationship Management (CRM) may be at the late majority stage. Communications-driven DSS have been adopted quickly. Knowledge-driven DSS and Artificial Intelligence are probably still in the early adoption stage. Document-driven DSS are evolving with the Web technologies. Analytics are extending and expanding the statistical and quantitative technologies used for decision support. Some decision support technologies like virtual reality have however been dead ends and disappointments. Don Norman is often credited with first explaining the technology adoption curve model. Gordon Moore, co-founder of Intel, also helped popularize the technology adoption curve.

## 3. Disruption, Organizational Implications – Future of Work

There is no doubt that adoption of technological innovations over the years has had a positive impact on the personal and professional life of individuals and on organizations. Technology innovation will continue to do so. An obvious example that is cited often is process automation. Technical innovation not only has affected organizations and how we work but also has created a boundaryless environment between professional and personal life. Chen and Karahanna (2014) articulate the notion that technology disruption has impacted our work and personal life on two fronts – "work-to-nonwork" and "nonwork-to-work" (p. 16). One finding of their study is the negative impact of technology interruptions on our daily personal lives (p. 30). The authors suggest that to minimize the number of messages we should combine messages as much as possible to reduce the number of interruptions. They also propose the idea of using "intelligent interruption management" (p. 31). Their study classifies interruptions caused by communication technologies as negative. The study also articulates the impact of technology on flextime and teleworking. Although this study was published back in 2014, it is particularly relevant in the current pandemic period where a very large segment of knowledge workers is teleworking from home. One wonders if this study were repeated during the current pandemic would similar negative implications of technology be among the findings.

Long-term implications of the COVID-19 pandemic, especially the rapid and widespread adoption of technology to do telework are difficult to predict. There is however little doubt that the ongoing and continuous use of telework technologies by organizations would be transformative. If technology companies, in particular, follow steps taken by Twitter which recently announced some employees will be allowed to permanently work from home, the implications of such decisions are very significant. For example, if people telework regularly from their homes this has impacts for commercial real estate prices, and potentially long-term positive sustainability implications.

In a recent presentation, a Gartner (Gartner Inc., 2020) analyst highlighted long-term implications of pandemics such as COVID-19 for the human resources units in various organizations. Among their major recommendations is the need for rebuilding business models. This recommendation obviously has broad and impactful consequences for not only the organizations, but also for business partners. Gartner estimates that teleworking will increase significantly, reaching about 48% of employees compared to about 30% prior to COVID-19. This telework phenomenon, they predict, will result in expanded data collection due to monitoring of remote workers. Also, as remote work increases, employees need a new skill set to be able to digitally collaborate.

Two major consequences of technology innovations are the organizational impact and the implications for the future of work, and in particular, impacts on employment. A common technology example that is often cited is the automation of the regular voice phone system which was originally a manual system. Phone company employees were doing phone line switching manually at a central office location. When the phone line switching was automated, serious concerns were raised that these individuals were losing their jobs and their livelihood. Imagine how many telephone operators we would need today if line switching was still manual. Some technology changes are inherently necessary.

As we continue to experience the implications of the digital revolution and the use of newer technologies such as the Internet of Things (IoT) (Ashton, 2009), Artificial Intelligence (AI), Fifth Generation (5G) mobile technology, Blockchain technology, and advances in big data analytics techniques, we also hear some concerns about future employment opportunities – the same concerns expressed before about the automation of telephone line switching. Innovative technologies impact the future of work for individuals and they create other more impactful and disruptive consequences. For example, the integration of AI and Blockchain technologies makes it possible to replace the existing disjointed supply chains with smart supply chain networks.

As French and Shim (2016) point out, the Internet of Things (IoT), in particular, has had and continues to have an impact on many products and services including design of home appliances and security, human health, and clothing. Smart security systems, smart lighting, and remote door locks are increasing in adoption. Similarly, smart appliances such as TVs, refrigerators, dishwashers, stoves, and air-conditioning are already in common use. Examples of innovative technology adoption in healthcare include automated blood pressure and cholesterol monitoring systems. Physicians are able to monitor and adjust medical devices that have been surgically installed in the body of a patient remotely. Examples of innovative clothing and accessories include smart watches and glasses, and socks with sensors.

Casual observation of younger or so called "digital natives" with their parents verifies the significant impact of technology adoption. The work and life habits of these two generations are different in many ways. The baby boomer generation tried to separate their work and home life and their means of communication was primarily face-to-face. The "digital natives" generation behavior is quite the opposite. For "digital natives", work and home life are very much integrated. The primary means of communication is not face-to-face rather it is often by means of chat, email, social media, video calls or other digital means. It is not surprising that the technology adoption curve for innovative technologies by the digital generation is more exponential.

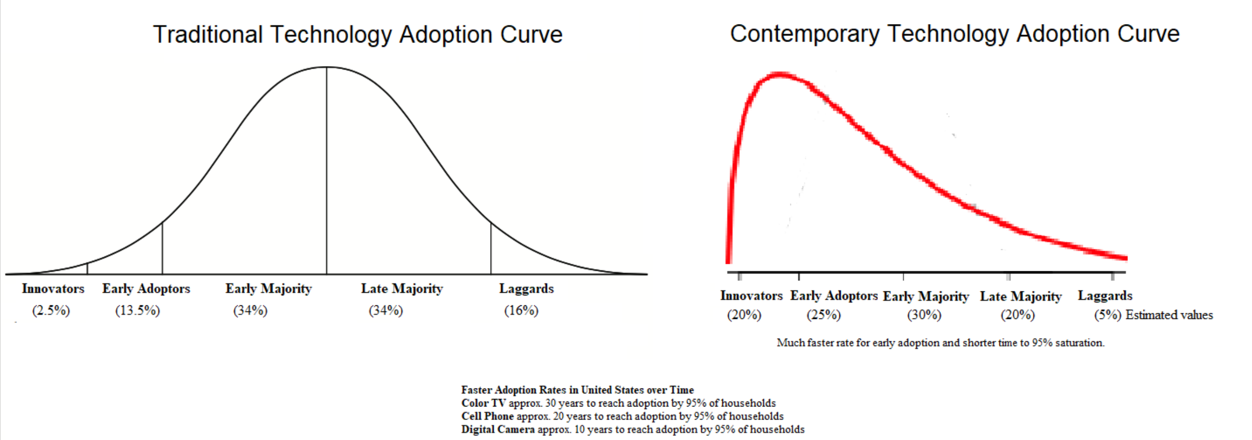


Figure 1. Changes in Adoption Rate and Skew

As Figure 1 depicts, we are asserting the technology adoption rate is now much faster and that the technology adoption curve has changed from an approximately normal curve to a skewed curve with more people adopting new technology quickly. The health crisis has encouraged and promoted faster adoption of innovative technologies.

## 4. Overview of the contents of this issue

This issue of the journal includes a traditional research article, a research note, and a historical article about the creation of the Midwest Association for Information Systems and the *Journal of the Midwest Association for Information Systems.*

Yi Maggie Guo and Barbara Klein in their interesting and unique article describe Chin's adoption and implementation of the Internet as an economic engine. They further describe how the Chinese central government has controlled access to information over the years. Their study examines users' perception of information quality in China during the decade of 2007 to 2017.

Neetu Singh, Apoorva Kanthwal, Prashant Bidhuri, and Anusha Vijaykumar Munnolli in their informative research note use a data set from SMART BRFSS to predict the chances that individuals will pursue a health checkup and identify which factors potentially play a role that leads to deciding to pursue a health checkup.

In the detailed historical article, Chinju Paul, Bryan Hosack, and Kevin Scheibe describe the creation of the Midwest Association for Information Systems (MWAIS), its journal (JMWAIS), and provide a summary of the annual conferences.

We appreciate and wish to acknowledge the contributions of reviewers for this issue of the journal, including Queen Booker, (Metropolitan State University), Omar El-Gayar (Dakota State University), Joey George (Iowa State University), Yi "Maggie" Guo (University of Michigan, Dearborn), Bryan Hosack (Penske Logistics), Barbara Klein (University of Michigan, Dearborn), Jeffrey Merhout (Miami University), Kevin Scheibe (Iowa State University), and Troy Strader (Drake University). Thank you.

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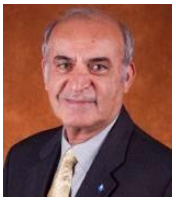
# Author Biographies



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