Timing and Assimilation of New Technology Adoption in Healthcare

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Abstract

Background and Objective: Over the last two decades, substantial researches have focused on the factors influencing the success and failure of technology adoption. However, there is little to no research on the optimal time to adopt technology concerning the lag time between its availability and adoption. This paper explores the optimal timing for technology adoption.

Methods: The study involves a qualitative inquiry based on semi-structured interviews conducted with individuals who have worked with or have served as information technology executives, managers or business users in mid-sized and large healthcare industries in the United States.

Results: From these interview results, a comparison was made between the institutions that have successfully adopted technology and those that have not.

Conclusion: Furthermore, this work seeks to understand the technology assimilation effects of individual motivations, organizational readiness, external environmental factors, and the timing of adoption.

Keywords: Technology adoption; Technology assimilation; Technology deployment; Behavioral intention; Timing of adoption

Introduction

The Project Management World Journal reported a failure rate of 75% of businesses in adoption of technology. In 2017, for every one billion dollars of technology adoption investment made in the United States, $122 million were wasted. Gartner projected that worldwide information technology (IT) spent $3.7 trillion in 2018 [1]. These studies stated an average wastage of $300 billion on technology adoption annually. There are numerous cases of technology adoption failures that have resulted in huge financial losses. For example, software failure in 2017 resulted in a $1.7 trillion financial loss as well as 268 years of downtime [2]. Other high profile technology adoption failures include Hewlett-Packard in 2004, with a financial impact of $160 million. Likewise, Nike in 2000 had lost $100 million in sales which accounted for 20% dip in its stock value [3].

Organizations that consistently ignore adoption of new technology in a rapidly disrupting technological time period are entering into less competitive situations, which might present a risk for their future existence [4]. If they act too early, they may exhaust their resources before technology adoption begins; if they act too late, they might miss the revolution [5]. Other companies may identify optimal technology but delay the strategic timing of its adoption due to uncertainty about its perceived value or after observing the experiences of first movers and rival corporations [6].

Over the last two decades, significant research has been conducted on technology adoption, such as the utilization of diffusion of innovations (DOI) theory, assimilation of complex process technologies, technology-organization-environment (TOE) framework, technology acceptance model (TAM), and the unified theory of acceptance and use of technology (UTAUT) [4,7-10].

A majority of the literature suggests that technology adoption has been conducted from the viewpoint of availability of the technology and its adoption. However, there is little or no research conducted on the timing of technology adoption from the perspective of the individual, organizational, or environmental readiness [8,11].

Research Questions and Situational Map

• What factors influence the timing of technology adoption?

• To what extent do organizational alignment, organizational readiness and advanced technology influence the technology assimilation outcome between the successful and unsuccessful firms' in the healthcare industry?

The situational map shown in Figure 1 suggests that technology adoption by firms may be affected by technological, organizational, and environmental factors, as well as adoption timing [6-8].

This research aims at helping the organizations to better understand the optimal timing of new technology adoption in the individual, internal organizational and external environmental contexts. This study also seeks to understand how organizational readiness and alignment as well as understanding of advanced technology may fit a business' needs and influence the successful deployment of new technology.

Literature Review

Rogers, Medina, and Rivera explored complex adaptive systems and the diffusion of innovations [12]. Tidd, Bessant and Pavitt investigated about the integration of changes in the technology, market, and organization [13]. This led to development of the technology-organization-environment (TOE) framework [8]. Finally, the model proposes the extent to which these organizational and environmental factors may influence the assimilation of cloud computing in the United States, as well as the extent to which these factors may change between the private and public firms [14-16].

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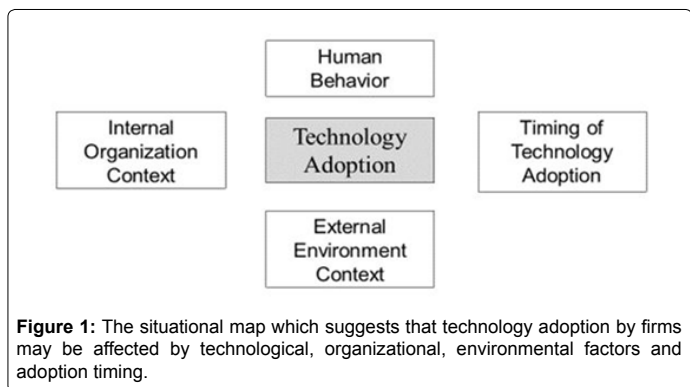
Figure 1: The situational map which suggests that technology adoption by firms may be affected by technological, organizational, environmental factors and adoption timing.

The theoretical framework that supports this research draws from four key management theories: the Diffusion of Innovations (DOI) theory, the TOE framework (Tornatzky and Fleischer, 1990), the technology acceptance model (TAM), and the unified theory of acceptance and use of technology (UTAUT) model [7,9,10].

The TOE framework explained the innovation in the context of an enterprise [8]. In this study, the context of technology deals with the internal and external technology that holds relevance for the organization and its capabilities (such as availability and characteristics). The organizational context deals with the descriptive characteristics of the firm (formal and informal structures, size, communication, and slack). The environmental context deals with the industry characteristics, structure of the market, infrastructure for technology support, and government regulations.

Venkatesh and Bala proposed the TAM3 model in order to explain how experience moderates the relationship between (1) the perceived ease of use and usefulness, (2) computer anxiety and the perceived ease of use, and (3) the perceived ease of use and behavioral intention [17].

DOI and TOE have been combined and utilized extensively in case of IT adoption studies, with consistent empirical support [14]. Very little research has addressed the assimilation of cloud computing in the US from an organizational and environmental perspective. Kim, Jang, and Yang studied environmental factors as predictors of SaaS adoption by manufacturing and retail firms in the US [18]. Moreover, Wu et al. evaluated the predictors of adoption intention for cloud technologies in various American firms. This research narrowly focused on technology adoption at the firm level through application of DOI theory and TOE framework [19].

The research suggests that intrinsic and extrinsic motivations play an addictive role in explaining intention and behavior. Perceived usefulness as an extrinsic motivator and intrinsic motivation would influence one's intention to use new technology in an addictive manner [10,20].

Human behavior

Venkatesh et al. developed the UTAUT as an extension of prior technology acceptance research [10]. The UTAUT is based on performance expectancy, effort expectancy, social influence, and facilitating conditions as key constructs that influence an individual's behavior in adopting and using technology. Venkatesh, Thong, and Xu roposed and tested UTAUT2 with three additional constructs (i.e., hedonic motivation, price value, and habit). They found that 74% of consumers intended to use technology, whereas 52% actually used it [21,22].

According to UTAUT, performance expectancy describes the adoption of technology as well as its benefits to consumers in performing certain activities. Effort expectancy is the technological ease of use for consumers. Social influence is the perception of others' beliefs regarding technology. Facilitating conditions refer to the available resources and support to perform certain functions. Additionally, performance expectancy, social influence, and effort expectancy influence the adoption of technology, whereas behavioral intention and facilitating conditions determine the use of technology [10].

According to UTAUT2, hedonic motivation is a key predictor of consumer behavior. This includes effort expectancy, employee access, time and effort in forming views on adoption, and the use of technology. Additionally, unlike organizational settings, price plays a vital role in justifying the related costs and consumer behavior when making purchasing decisions for products and services. To conclude, various models argue that habit is a key predictable factor of technology use after making the initial decision to adopt it [21].

Timing of adoption

Hoppe reveals key factors that influence the timing of a firm's decision to adopt new technology [6]. In times of uncertainty, firms tend to learn from others' experiences, which typically delays new technology adoption; during strategic interactions with product markets, firms may decide to take either early-mover or late-mover advantages that suit their business needs.

Hoppe's study provides further research that is relevant to the timing of technology adoption, including that on

- Factors that determine the lag time between technology availability and its commercial use.

- Whether the timing of technology adoption decisions are based on the availability of other alternative technologies, internal structure of the firm, and enhancing choices.

- The extent to which public policies and welfare issues affect the timing of new technology adoption.

Milliou and Petrakis explored key factors that influence the timing of technology adoption, such as the mode of market competition, the degree of product sustainability, the intensity of product market competition, and competitive pressure [23]. Key findings state that product sustainability or the mode of competition generates significant differences in a firm's technology adoption patterns. Additionally, an increase in competitive pressure in regard to price, quantity, or product sustainability may discourage technology adoption.

Research Design: Methodology

The aim of this study is to investigate the factors that influence the timing and assimilation of technology adoption by comparing institutions that were successful with those that were not. It also seeks to understand individual motivations, organizational readiness, external environmental factors, and the timing of adoption.

The qualitative aspect of this study is primarily based on semi-structured interviews to develop grounded theory [24]. Grounded theory is an explorative, iterative, and cumulative method to build theory [25].

This approach involves theoretical sampling and a constant comparison of data. Constant data comparison includes rigorous analysis to identify emerging ideas and themes and involves constant

interactions with the data. Data collection and processing continue until theoretical saturation is reached.

Sample

The sample consists of twenty-one IT and non-IT executives, who are the part of decision-making processes for a new technology adoption in the United States healthcare industry. Eleven interviews were conducted with IT executives (e.g. CIO, CTO, or top members of the IT division) and ten interviews were conducted with non-IT executives (e.g. CEO, CFO, or top members of the business unit). Each interview consisted of a successful and a less successful technology adoption narrative for a total of forty-two technology adoption narratives. Industries and their sizes were identified, as defined by the NAICS. These organizations were small, medium, or large, and all were located in the United States. The delivery of the technology adoption project is categorized as follows: 1) successful adoption 2) unsuccessful adoption or 3) discontinued in the middle, i.e., innovation did not complete the full cycle of product development. Table 1 shows the interview distribution according to the new technology adoption delivery type and role.

The industries and interview candidates were selected based on the primary researcher's professional network. The interview candidates were from two different levels within a given organization: IT executives and non-IT executives who have been pre-screened for previous experience in working with technology adoption in the past 12-36 months. Candidates were also asked to describe said experience in detail. In accordance with the grounded theory approach of continuous comparison and theoretical sampling, the data guide the sampling process until theoretical saturation is achieved [24,25].

Data collection

Consistent with the grounded theory approach, data collection was conducted from mid-May to October 2018. The data collection approach consisted of eight in-person and thirteen telephone interviews. Each confidential interview lasted approximately forty-seven minutes. Two hundred sixty-nine (269) pages of data were collected. Interviews were conducted under minimal work distractions, such as in reserved work conference rooms or non-work environments. Audio recording was used to capture the conversation and collect data. Subsequently, the audio recordings were transcribed into a written text document by a professional transcriptionist. The researcher also took notes immediately after the interview to capture key ideas, nonverbal cues, and feedback.

The interviews utilized an interview protocol and primarily studied whether technology was successfully or unsuccessfully adopted in a timely manner. Questions were open-ended to elicit rich and specific narratives of the experience. Further questions were asked to clarify and elaborate on the responses. The interviews consisted of three parts: 1) an introduction and explanation 2) the participant's background and an icebreaker and 3) his or her experience in technology adoption.

Each interview began with an introduction to the research project and interview process. Questions regarding the participant's personal and work background and experience were also asked. The participant was then asked to describe his or her specific experience with the most recent technology adoption in his or her firm. Finally, the participant was asked to describe in detail a successful or unsuccessful technology adoption project from the past 18-36 months. The aim was to gather experience-based practitioner perspectives on the organizational factors that influenced a firm's technology adoption. Further details are given on the interview questions and protocol.

Data analysis

Using the grounded theory approach, data analysis was conducted simultaneously with data collection [24,25]. The audio recordings and transcripts were reviewed multiple times, and coding began upon the completion of the third data review cycle. Coding was primarily based on Saldaña's three-step approach [26]. Open coding identified 797 codes that were later grouped into 48 categories related to the timing and implementation of technology adoption, benefits of adoption and the desired state of the customer. During axial coding, or the second phase of analysis, emergent themes were refined and reduced to seventeen main themes after defining their properties and dimensions. Selective coding, the final analytical phase, further reduced the data to eleven themes that supported our key findings.

Findings

This study suggests that the factors that influence the timing of technology adoption and successful deployment vary between organizations. While seemingly apparent, our findings relate to the details of where and how these differences occur. Consequently, the sequencing and ordering of events is the basis for our emergent findings. Figure 2 for a summary of the emerging conceptual four-stage model. To communicate our findings in a clear and logical way, we present explanations on the organizational numbering of Figure 2.

Timing of technology adoption

An organization's rationale in adopting new technology is primarily event-driven. Our data present five key events that influence the timing of new technology adoption decisions in the healthcare industry.

New resonant leaders: As the first subcomponent, these data provide strong evidence that resonant leaders bring new ideas, fresh perspectives, and a greater ability in influencing others toward the successful adoption of new technologies. The data suggest that approximately 52% of new technology adoption decisions were made when new resonant leaders were introduced to the organization. Additionally, approximately 10% of these decisions were made when people within the same organization were promoted into decision-making leadership roles. This is supported by evidence from an interview (below). Most forward-looking organizations hire new leaders when they seek to implement change and adopt innovative thinking. This approach is often intended to keep up with rapid technology innovations and intense competitive pressure. The importance of new leaders in an organization was apparent in the interviewers and was therefore considered an important development.

"I want one patient, one record for the community. How can we be better connected and how can we ultimately get to one patient, one record, to allow a more seamless care of that patient. Which includes, our own physician offices, our outpatient clinics, our hospitals and any other location of care." (Interview 2).

Retire legacy technologies: The primary reason for retiring legacy systems and adopting new technology is to improve operational efficiencies, reduce costs, integrate digital systems, gain a competitive

Roles	Successful	Not Successful	Total
IT Executives	11	11	22
NON-IT Executives	10	10	10
Total	21	21	42

Table 1: Interview distribution by new technology adoptions in the healthcare industry.
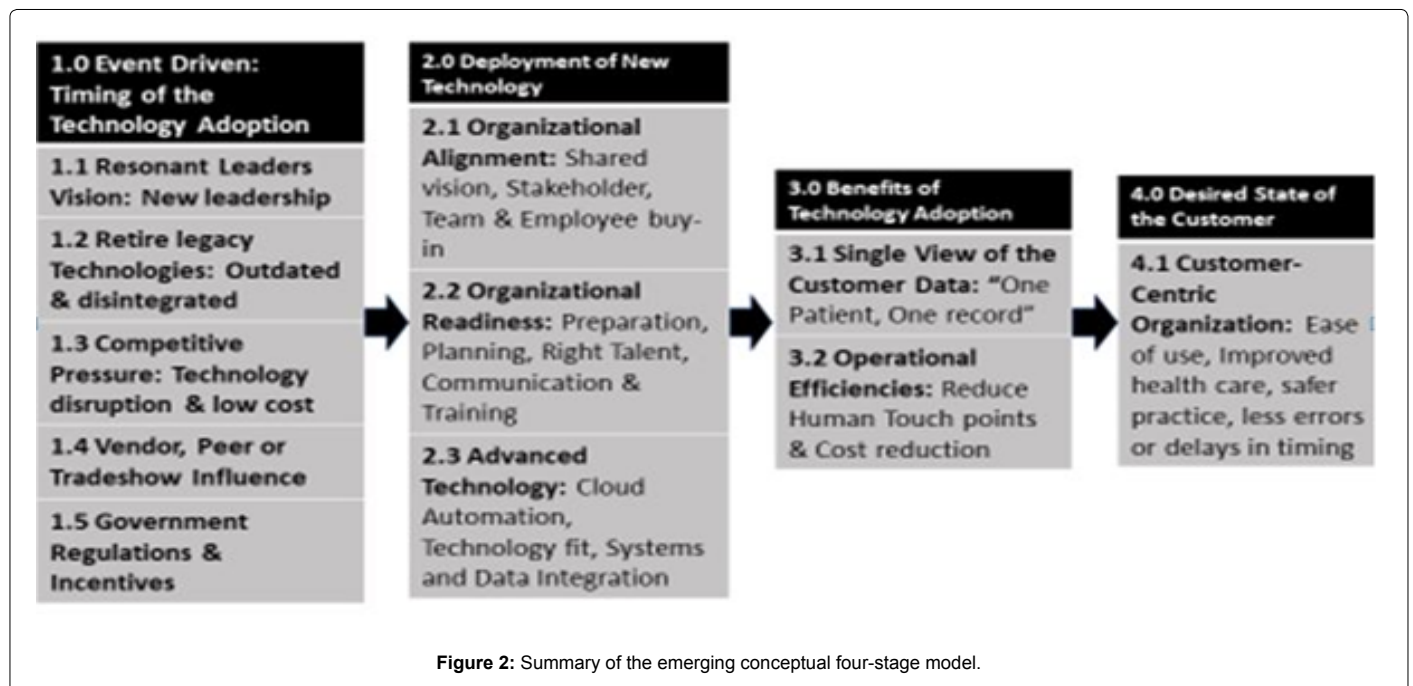
Figure 2: Summary of the emerging conceptual four-stage model.

advantage, and to become a customer-centric organization. The data suggest that 64% of healthcare organizations that adopted new technology had either outdated or disintegrated legacy systems. However, they adopted new technology because of the influence of new organizational leaders (62%), regulatory compliance and incentives (29%), competitive pressure (33%) and vendor, peer or tradeshow influence (31%).

"Decided to adopt Robotic Process Automation. The reason is all these technologies which don't integrate with each other and the state, local, and federal policies which force us to document everything." (Interview 3).

Competitive pressure: Our data in the healthcare industry indicate that competition forces firms to face intense pressure from technology innovations, price reduction, government regulations, customer acquisition, and retention costs. The data suggest that 33% of organizations adopted new technology because of declining margins, regulations, or in hopes of gaining a competitive advantage. The adoption of a digital cloud and integrated systems provided firms with more accurate data, operational efficiencies, educated business decisions, and improved patient satisfaction and retention. Additionally, regulations influenced the competitive landscape, margins, and consolidation in the healthcare industry.

"This highly competitive market. As we see other states on the east coast and west coast getting hit with that, and their margin dropping from 10% to 13%, to 2% to 3% margins."(Interview 2).

Vendor, peer or tradeshow influence: Thirteen percent of the organizations in healthcare are pressured by software vendors or peers in the industry to adopt new technology. Most adoptions were induced by learning about improved practices from peers and software vendors, as well as from tradeshows or industry publications. Additionally, smaller organizations may closely monitor an industry leader's early adoption and results before they commit to it themselves. The data state that approximately 80% of early adopters encountered challenges and would have preferred to wait until the technology was mature. They also wanted more test cases within the industry.

"We looked up the Cleveland Clinics Tele Health program on demand kind of video. So I talked to a few vendors, I put together some presentations for our executive committee. Met with them several times." (Interview 7).

Government regulations and incentives: Our data suggest that 24% of healthcare firms adopted new technology because of mandatory government regulations or incentives. Government regulations forced certain laggards to adopt new digital technology. Additionally, the top-down approach to be compliant with public policies forced others in the organization to agree with the management's decisions. Consequently, these organizations not only became compliant but also more operationally efficient. These organizations are typically small to medium in size and, when compared to their larger counterparts, are more likely to adopt new technology innovations.

"The government was driving adoption as it started out as a carrot, then leading up to the stick, meaning if by a certain date you had not adopted an electronic medical record system and demonstrated what they called meaningful use, then they would start withholding payments from Medicare and Medicaid. It started out as a carrot and turned into a stick." (Interview 4)".

Deployment of new technology

Adequate planning, preparation, and alignment, as well as factors related to integration, processes and technology can be a substantial differentiator when it comes to new technology adaptation. The success or failure of new technology assimilation depends on the three critical factors of deployment.

Organizational alignment: Our data provide strong evidence that 90% of the successful technology deployment teams were clear on expectations as well as goals and objectives, whereas 71% of the failed technology adoptions lacked team buy-in and overall organizational alignment. The data suggest that organizational alignment begins with converting a leader's vision into a shared vision by involving key stakeholders and their buy-in as part of the decision-making process.

Additionally, setting clearly defined goals and expectations while explaining the benefits of new technology adoption and alignment between the business users and technology teams is vital for successful deployment.

"Successful Deployment: The first thing was the communication was always about vision; what we want to accomplish with the change and how it will be better for company, how it will help our customers, a lot of things like the politics side of things." (Interview 15)

"Failed Deployment: The communication; people communication was the biggest problem we had. We had the technology people working on the technology side of things, business users doing their own things." (Interview 30)

Organizational readiness: Our data strongly suggest that 90% of firms with successful technology deployment took initiatives towards organizational readiness, which includes preparation, resource planning, change management, and training to ensure that their organizations are prepared to adopt new technology. Consequently, 42% of failed technology adoptions lacked organizational readiness. The data also suggest that the key to achieving complete organizational readiness is a firm's ability to acquire the proper talent and technology partners in a timely manner and to retain these partners.

"Successful deployment: It goes back to the old traditional organizational change model, because that's all this is. It's an organization change. The first thing is we absolutely stress this is not an IT project. Again, anybody how interacts with the system needs to understand it's got full support of the organization, and they need to understand why we're making the change." (Interview 4)

"Failed Deployment: Where we could have done a better job is to find a reason of answering those questions of "why," why the change and trying to get people more on board with the changes and make them more a part of the decision process." (Interview 28)

Advanced technology: Our data provide strong evidence that 52% of the firms chose to adopt advanced technologies, e.g., a digital cloud and integrated systems, to be in compliance with government regulations and to take advantage of incentives. Advanced technology deployment resulted in improved collaboration and communication, a single view of customer data, and a scalable platform to meet future business needs.

"Successful Deployment: From the pre-analytic perspective, the number of errors that were produced with missing data points, with an integrated system substantially reduced lot of errors, and quality improved. If you view it from the quality of the outcomes for the patient, it makes a huge world of difference, so it's eliminating a lot of entries" (Interview 15)

"Failed Deployment: We didn't anticipate the migration challenge when you move from one system with the history of the data. So, when we moved over to the new technology platform that we were trying to adopt, there was lot of issues with the data, with the history of the data or the data migration and all of that." (Interview 36)

Benefits of technology adoption

Although the timing and initiation of new technology adoption decisions are event-driven, our study suggests that the leaders of an organization justify their decisions to others based on their past experiences and the benefits of technology adoption.

Single view of customer data: Our data strongly suggest that 43% of a firm's decision to adopt new technology is to obtain a single view of customer data, i.e., *"One Patient, One Record."* The data suggest that substantial consolidation in the healthcare industry has created multiple disintegrated legacy systems that are isolated and do not communicate with each other. The inability to access a patient's up-to-date information across hospital systems has resulted in operational inefficiencies and a decline in patient satisfaction. Upon successful adoption of advanced technology and a single view of customer data, firms increased their ability to provide more seamless care for patients with improved efficiencies and relative advantages. Based on personal experience, the most innovative companies rely on technology to obtain up-to-date and relevant customer information in a single screen to make informed decisions. The concept of becoming a technology-driven company was apparent in the interviews and was therefore considered important.

"I want one patient, one record for the community. If I get a CT scan at the ED, and then I show up at my doctor's office and he wants to have a look at it, or go to a different hospital for something, if we're all on this integrated network I don't have to order a CT scan again." (Interview 2)

"How can we be better connected and how can we ultimately get to one patient, one record? That is what is going to allow a more seamless care of that patient. Which includes, our own physician offices, our outpatient clinics, our hospitals and any other location of care." (Interview 13)

Operational efficiencies: Our data provide strong evidence that 50% of a firm's decision to adopt new technology is based on achieving desired operational efficiencies. The data suggest that the firms sought to make the integrated systems more automated with less human touch points in the operational aspects, e.g., patient, physician, and hospital management. Additionally, they sought to increase transparency and visibility and to obtain cost reduction and a competitive advantage.

"Reduced cost from a clinical care management, increased transparency and visibility. We saved over $400,000 a year moving to a cloud-based solution for the laboratory information system". (Interview 1)

"If you were to click on something to open another area that you were going to, it took two to three clicks to get into that. With new technology adoption, it was a click and go. It was a timesaver that way". (Interview 12)

Customer-centric organization: Our data strongly suggest that 86% of a firm's decision to adopt new technology is based on becoming a customer-centric organization. The data suggest that these organizations place more emphasis on patient experience and believe that organizational success relies primarily on being patient-centric. Consequently, it is important for a firm to provide improved healthcare, safer practice, fewer errors or delays, and patient care while also offering an easily accessible platform for patients, physicians, nurses and other stakeholders within the organization.

"The patient experience is the central focus for the practice to become a success. If the patient walks in and have the good experience, he knows all the answers, then he will be very happy. The patient-centric. If end user is happy, then the success, already we are getting this stuff. It is all about the patient easiness and patient comfort." (Interview 11)

The next section introduces a discussion of the results and their implications.

Discussion

This research had three primary objectives: first, to identify the factors that influence the optimal time to adopt new technology from

organizational, environmental, and individual standpoints; second, to identify critical elements that affect successful technology deployment in an organization; third, to determine the benefits of technology adoption that allow organizations to gain operational efficiencies and customer centricity. We accomplished our objectives by developing a new conceptual model (Figure 2).

Timing of new technology adoption

Common characteristics of leaders in the traditional models of technology innovation adoption include professionalism, higher degrees of education, and a number of technical specialists, managerial tenure, and receptivity towards change [27]. The decision of particular technology adoption timing depends on other strategic choices, such as related technologies, R&D investments, the firm's internal structure, and financing decisions.

For many years, researchers studying innovation adoption suggested that information sources and communication channels (e.g., peers in the industry, periodical subscriptions, external seminars, and internal technology groups) are the primary reasons for technology adoption [28]. Our data expanded the understanding of the adoption characteristics of leaders and their influence on the timing when new leaders were brought into an organization. From the author's personal experience, organizational leaders may also influence change or adoption by continuing their education or learning about the technology and industry trends. This contributes to a greater understanding of the organization's needs and new technology offerings. New resonant leaders also bring new ideas, fresh perspectives, and a greater ability to influence others to successfully adopt new technologies.

Additionally, the transformation of multiple, independent legacy systems into a single, integrated system increases an organization's efficiency by eliminating redundant activities. It also reduces operating expenses. Additionally, this transformation provides timely and accurate information that may gain competitive differentiation [29]. Our findings are relatively consistent with prior research. These data suggest that in the healthcare industry, the retirement of outdated legacy systems is primarily influenced by government regulations and incentives, as well as operational efficiencies, competitive pressure, digital automation, systems integration, and customer-centricity. However, based on previous experience, healthcare companies are more likely to adopt new technology compared with other industries, e.g. finance, insurance and retail.

This research suggests that competitive pressure leads to intense consolidations in the healthcare industry, which impacts prices, costs and the quality of healthcare. Additionally, competitive pressure is an essential driver for technology diffusion. Intense competition and attempts to maximize industry profits lead to new technology adoption by US hospitals [30]. In line with prior research, our data suggest that competition in the healthcare industry caused firms to face intense pressure due to technological innovations, reduction in prices, government regulations, customer acquisition, and retention costs. As a result, technology disruption in healthcare resulted in low-cost care, intense competition, and industry consolidation.

Fourth, several managers noted that demonstrations and presentations by vendors helped them learn about new features, functionality, and the potential value of technology; most importantly, it showed them how their peers had utilized the technology. A majority of users adopted new technologies as a result of IT conferences, subscriptions to IT journals, joint ventures, and vendor demonstrations [31]. In line with prior research, the data suggest that 33% percent of technology adoptions were influenced by learning about improved practices, features, industry transformation from their peers, software vendors, and demonstrations at tradeshows.

Business managers who focus on daily operations often consider new technology adoption as an extra burden and do not think they will improve the bottom line. Only regulations and consequences of noncompliance forced them to take action [32]. This study's findings are fairly consistent with prior research. The data suggest that most healthcare industry technology adoption is due to government regulations and incentives, especially for small and mid-sized firms. However, various large organizations are more innovative and forward-looking in regard to new technology adoptions and have created technology R&D departments to improve operational efficiencies, competitive advantages, and customer intelligence.

Deployment of new technology

The introduction of complex organizational technologies imposes a substantial burden on potential adopters because of the knowledge needed to utilize it effectively [33]. This suggests that three key elements influence successful technology deployment within organizations.

First, organizational alignment begins with implementing clearly defined goals and expectations that align with the leader's vision. According to the author's personal experience, shared vision is vital to organizational alignment, which influences the impact that new technology adoption will have on an individual level. Additionally, training and communication of its benefits should also be provided. The key element of technology deployment depends upon acceptance by the intended user and the individual perceptions of this new technology [34]. In agreement with previous research, our data suggest that a shared vision, a key stakeholder, and team and employee buy-in is vital to organizational alignment and successful technology deployment.

Second, organizations may exhibit a tendency to adopt technology innovations but still lack proper deployment because of inadequate organizational needs, strategies, resources, and capabilities. Organizational characteristics that capture the relative gap between innovation and organizational readiness are instrumental to successful technology deployment [4]. Consistent with prior research, our data suggest that a firm's preparation, resource planning, change in management, and training are imperative to organizational readiness in adopting new technology. While many organizations have a plan, the ability to acquire and retain talent is vital to successful deployment.

Digital technologies allow firms to build a platform of digital capabilities, such as electronic patient records and enterprise resource planning systems, and then integrate these with other systems or tools as a single, integrated source. This provides firms with access and control over multiple products or subsystems [35]. Adopting advanced, integrated cloud technologies improves a firm's ability to provide better and faster services to its patents and help physicians make educated decisions to improve patient satisfaction. Additionally, advanced technology aids in obtaining overall operational efficiencies and cost reduction and in gaining a competitive advantage.

Benefits of technology adoption

Companies collect data on their customers from various sources to create customer intelligence and to better profile and classify them. A unified view of the customer requires the integration and real-time optimization of data among the customer, firm and the extended

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enterprise. This enables companies to predict customer behavior, conduct targeted marketing, and cross and upsell products and services [36]. Consistent with prior research, our data suggest that the inability to access a patient's updated information across a hospital system resulted in operational inefficiencies and a decrease in patient satisfaction. Upon gaining a single view of customer data (i.e. "one patient, one record"), the firm's ability to make timely and informative decisions enabled them to provide more seamless care with improved efficiencies, customer satisfaction and loyalty.

Second, the pressure felt from the industry becomes strategically necessary to adopt new technologies in attempts to compete in the marketplace and to increase operational efficiency, market visibility, and obtain more accurate access to real-time information [14]. Our data suggest that operational efficiencies enable less human touch points, increase transparency and customer satisfaction and lead to cost reduction.

Third, customer-centric organizational actions are driven by customer needs and an adequate focus on customer integrations. Frequent and open communication with customers who understand the firm's attempts to respond to their needs may enhance customer satisfaction and loyalty [37]. The data suggest that customer-centric organizations focus more on patient experience. Consequently, a firm's ability to provide improved healthcare, safer practice, and fewer errors or delays in serving the patient's needs may lead to satisfaction and loyalty.

This study's most significant contribution is the conceptual model (Figure 2). "The timing and assimilation of new technologies" is a combination of prior research and previous experience on the timing of adoption and successful deployment. This study began with a situation map (Figure 1) to capture the broader understating of timing and assimilation of new technology adoption. However, the interview data and twenty-two years of personal experience as a practitioner enabled the development of a conceptual model that may help organizations achieve the optimal timing of adoption and deployment of new technologies in efforts to improve the technology adoption success rate.

Limitations

This study is based upon a relatively small and nonrandom sample of executives who are part of the decision-making process in adopting new technology in the healthcare industry. However, all interviews were in a combination of small, medium and large organizations from various locations in the United States. We caution against generalizing our results for non-healthcare industries or to a particular segment of the healthcare industry. Future research should include a broader representation of either small, medium or large organizations.

The principal researcher in this study is a technology entrepreneur, although a conscious effort was made to minimize potential positionality and bias from personal experiences, expertise, and opinions that could have influenced interview data interpretation and findings.

Implications for Practice and Further Research

Practitioners may benefit from our conceptual model on the timing and deployment of new technologies. Our findings have several implications that may benefit companies and their leaders in adopting new technologies. First, the conceptual model developed in this study will help organizations understand the optimal timing of new technology adoption in individual, internal organizational and external environmental contexts. Second, new resonant leaders in an

organization may bring new ideas, fresh perspectives, and a greater ability to influence others toward the successful adoption of new technologies. Third, the successful deployment of new technology requires a combination of organizational readiness and alignment, as well as an understanding of the proper technology for their specific business needs and for system and data integration. Our data suggest that the failure of one of these elements will lead to technological assimilation. While previous empirical studies have provided insight into technology adoption and deployment or their usefulness, few studies have researched integrated technology assimilation frameworks [38]. Additionally, there is little to no research on the optimal timing of technology adoption from the perspectives of individual, organizational, and environmental readiness [11].

Conclusion

The conceptual model provided in this study should be a starting point for future research on the timing and assimilation of technology adoption. Additional research and application in the real world are also required. A quantitative model to better understand the relationships between the emergent variables in this study will be formed through hypotheses testing in future research. Additionally, further studies may help broaden the scope of this study in regard to new resonant leaders and their influence on new technology adoption.

Disclosures of Conflicts of Interest

The author declares to have no conflicting interest for this paper.

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