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Exploring the Effect of Digital Investment on IT Innovation

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Abstract: Using the technology-organization-environment framework, this study examines three antecedents of digital investment as well as the influence of digital investment on IT innovation. The empirical evidence from a sample of Chief Information Officers (CIO) from US firms suggests that IT competence, competitive pressure and organizational agility are key factors that influence digital investment. Furthermore, the findings confirm the positive relationship between digital investment and IT innovation. Contrary to prior research, IT competence did not have a significant relationship with IT innovation. However, the results revealed that digital investment mediated the relationship between IT competence and IT innovation.

Keywords: IT Innovation; digital investment; IT competence; organizational agility; competitive pressure

1. Introduction

The emergence of new digital technologies and innovations has dominated our economic and business landscape, creating new opportunities for companies to integrate, exploit and leverage these new digital solutions and innovations [1,2]. As a result, companies are facing increased pressure to make digital investment a strategic priority and to transform these investments into innovative business processes, and new products and business models [3,4]. Such digital investments include new technologies such as the internet of things (IoT), artificial intelligence (AI), big data and analytics, cloud, mobile and social media [5]. Digital investment, which refers to a firm's strategic technology investment for exploring how cutting-edge digital technologies could potentially differentiate the firm's business, transactions and operations [4] is viewed as a key imperative for firms seeking to remain competitive and retain market positions [2]. More recently, many innovations in products, services and business models are attributed to the enabling role of new digital technologies such as social media and mobile platforms, the cloud, embedded devices, big data, analytics, and artificial intelligence. A Forbes insight study of C-level executives found that 50% believed that digital transformation is a strategic priority [6]. This strategic emphasis was bolstered by the findings from the same study that 51% of the C-level executives noted that the subsequent two years' focus was aimed at investing in digital initiatives and new technologies that would drive digitalization and data analytics capabilities.

While there is no contention that the disruption created by emerging digital technologies has led to new opportunities and provoked positive business changes, big challenges have arisen as firms grapple with how to integrate and transform these digital investments into information technology (IT) innovations that drive productivity. A growing research literature on IT business value has recognized IT innovation as a contributor to a firm's competitive success and performance [7,8]. IT innovation allows organizations to develop new capabilities, respond to an evolving business climate, and sustain market positions to enhance efficiency, resulting in economic benefits such as profitability and competitive advantages [7,9,10]. Yet, much remains unknown about the mechanism by which superior IT innovation is accomplished. Not surprisingly, the pervasive emergence and

penetration by digital technologies has reignited and elevated the importance of IT innovation on productivity. Despite significant progress in the current literature regarding our understanding of the business value of IT [11], the underlying conditions through which IT investments impact a firm's innovation remain equivocal. With the emergence of new digitally enabled innovation, IS scholars are increasingly seeking to understand how investments in digital technologies influence innovation [2,12–14]. Some anecdotal evidence suggests that digital investment initiatives can help improve a firm's innovativeness [15]; however, recent studies reveal that many firms that invest in digital transformation initiatives do not realize the desired outcome. For instance, Nwankpa and Datta [4] found that when digital business intensity does not complement existing IT capabilities, such digitization actions can usher in disruptive changes that undercut firm performance. A 2013 McKinsey study found that 70% of investments in digital transformation initiatives fail. A more recent survey of 400 U.S. firms found that only 50% report some level of success in executing their digital initiatives, whereas 20% report that digital investment has been a waste of time and resources [16]. Similarly, a global survey of over 16,000 companies by the World Economic Forum on these firms' investment decisions in digital technologies between 2015 and 2016 found that digital gains are not evenly distributed [5]. Surprisingly, research into the economic benefits of digital investment remains at a nascent stage. Little extant research exists on the antecedents of digital investment and boundary conditions that foster IT innovation. Such anecdotal evidence continues to highlight the success and failure of investments in digital technologies, prompting the need for empirical inquiry on how to approach firm-wide digital investment [17]. The high variance in outcomes of digitization initiatives motivates us to theorize digital investment, its antecedent mechanisms, and consequences.

Extant literature argues that digital technologies and platforms require a different mindset and conditions than previous waves of transformational technologies [18]. As a result, possessing information technology capabilities and IT adoption experience does not necessarily imply the ability to transition and integrate these emerging digital technologies and investments [19]. Investments in digital technologies increase the complexity, turbulence, and dynamism in the competitive landscape [20]. Prior studies show that embedding digital investments into an organization's core operations and business processes presents major challenges even for firms that have a strong track record of prior transformation and implementation [21]. Although both researchers and practitioners argue that investments in digital technologies should be a strategic imperative for companies seeking to remain competitive, research on how firms can enable or shape these investments and the underlying apparatus through which digital investment can drive IT innovation remains unresolved and equivocal. Directly to this point, companies such as Amazon have transformed the entire business landscape and industry by introducing innovative digitally enabled processes and business models, while firms such as General Electric have emerged as a cautionary tale of digital investment.

Understanding the factors that drive digital investment and the conditions through which IT innovation is attained remains an important phenomenon of interest for various reasons. First, recent years have seen organizations across industries engage in record investments in digital technologies in a bid to gain a competitive advantage and improve performance. Nevertheless, anecdotal evidence reveals that after investing in these digital technologies many firms continue to struggle to realize the innovative outcomes these digital investments were expected to deliver [17]. Indeed, extant literature has not thoroughly scrutinized digital investment and the organizational conditions that foster digital investment initiatives [2,12,22]. As a result, there is a need to empirically investigate the direct relationship between digital investment and IT innovation. Second, little literature exists on how firms should manage their digital investment in ways that deliver IT innovation and the capabilities needed to achieve IT innovation. Expectedly, there is a lack of theory-driven empirical research that examines the consequence of digital investment and how companies can enable or shape IT innovation with digital investment. Thus, it is important to understand the conditions under which digital investment influences IT innovation by examining both technological and organizational factors. Finally, as a recent global survey by The Economist Intelligence Unit (EIU) indicates that organizations are on track to overwhelmingly increase

their digital investments in a bid to succeed and compete in the present business climate, it is important to understand the antecedents of digital investment [23].

Our study recognizes that a major gap that exists in the digital transformation and business value of IT literature today is the absence of a theoretical framework that can be used to assist organizations in assessing their potential for undertaking digital investments. Motivated by the desire to understand how and the underlying conditions through which digital investment influence IT innovation, this study attempts to bridge the gap in the IT business value literature by developing and testing an integrated model that seeks to illuminate the key predictors of digital investment and the conditions that will foster IT innovation within the organization. Using the technology-organization-environment framework [24], the study illuminates three core antecedents of digital investment, namely, IT competence, competitive pressure, and organizational agility. The TDePietro et al. [24] model called technology-organization-environment (TOE) is an organizational level theory that explains the processes by which firms adopt, assimilate, and implement technological innovations. Further, our study examines the direct influence of digital investment on IT innovation. In addition to investigating the direct relationship of digital investment and IT innovation, this perspective enables us to evaluate whether digital investment mediates the relationship between IT competence and IT innovation. Similarly, the moderating roles of IT competence and organizational agility on the relationship between digital investment and IT innovation are also examined. In sum, this study aims to advance our understanding of digital investment and IT innovation by presenting a conceptual framework that investigates two fundamental questions:

RQ 1. What are the drivers of digital investment?

RQ 2. How does digital investment influence IT innovation?

This current study works to answer these research questions by empirically testing a developed research model with survey data collected from chief information officers (CIO) across US-based firms. Broadly, this study advances the knowledge within a recent Information Systems (IS) literature stream that argues the importance of emerging digital technologies and the need for organizations to develop a digital business strategy [4,25,26]. Furthermore, the study contributes to the business value of IT literature that seeks to reconcile the IT investments and firms' innovativeness [27,28]. More specifically, our research advances our understanding on how digital investment, a prerequisite to attaining digital business strategy, influences IT innovation. Moreover, investigating the consequence of digital investment should help offer initial insights to managers and top management facing the challenge of implementing a successful digital transformation in an increasingly digital business climate. In addition, investigating the antecedents of digital investment should provide insights to managers and executives who are dealing with the challenge of successfully transforming and integrating existing IT capabilities and processes with emerging digital platforms and technologies. Directly to this point, delineating an integrative view of digital investment will provide strategic guidance for managers and practitioners grappling with how to develop an effective digital transformation strategy.

The article proceeds as follows: the next section reviews the theoretical foundation, the background literature on digital investment, IT competence, competitive pressure, organizational agility, and IT innovation. The subsequent section introduces the research model and hypotheses. Then, we present the methodology and data analysis. The final section discusses the results of the empirical investigation, contributions to research and theory, as well as the study's limitations and future research.

2. Theoretical Background

In this study, we examine the antecedents and consequences of digital investment. In doing so, we theorize that digital investment enables IT innovation. Although various models have been developed within the IS literature to identify adoption drivers and predict innovation, the generic technology diffusion framework of TOE has received support for the model's ability to capture three

important contexts [29–31]. The antecedents in the proposed model are identified and linked to digital investment through the TOE framework. The three antecedents represent the core contextual underpinning of the TOE framework, namely, technology, organization, and environment [24,32,33]. IT competence, which refers to a firm's ability to apply IT assets and resources to support its operations and processes, represents the technological context. Similarly, organizational agility, which is a measure of a firm's ability to detect opportunities for innovation and follow through on those opportunities by assembling the necessary resources, is a vital organizational contextual factor. Lastly, competitive pressure represents the environmental contextual factor and measures the firms' overall competitive structure and industry posture. Furthermore, the study proposes that IT competence and organizational agility moderate the effect of digital investment on IT innovation while digital investment mediates the relationship between IT competence and IT innovation. The integrative framework that we present is theoretically ground using the technology-organization-environment framework [24]. A description of the TOE framework is presented next.

2.1. Technology, Organization, and Environment

The TOE framework [24] has been widely applied within the IS literature to explain contextual factors that influence innovation, adoption, and assimilation in an organization [34–36]. The TOE framework identifies three contextual factors that significantly influence technological innovation adoption and assimilation. The *technological* context identifies both the existing technology in use and the new technologies that are relevant to the firm. The *organizational* context refers to the firm's characteristics such as managerial structure, firm size, resources, and scope. The *environmental* context refers to the overall structure of a firm's industry, such as competitors and regulatory posture.

Given that digital investment is characterized by disruptive effects, process-induced changes in architecture, and complexity associated with the convergence of digital models with traditional business models [1], firms need to develop IT competencies and strategic organizational routines that would synthesize new resource configurations to match a rapidly changing business environment. The TOE framework provides the rationale for dealing with not just the technological characteristics, but also the organizational characteristics and environmental factors. The framework suggests that digital investment deployment and use is an outcome of how firms can develop, integrate, and configure these three factors. As a result, these factors can facilitate or inhibit a firm's digital investment and IT innovation abilities. The first stage of digital investment entails scanning the external environment for emerging digital technologies to invest in and identifying the subset of them that could potentially drive innovation ideas in the firm [37]. Yet, lacking the necessary IT competence to integrate and seamlessly deploy these emerging technologies can deter digital investment. Recent investigations on the drivers of digital transformation argue that the strength of digital investment lies in the integration of digital technologies to existing operational technologies and processes, the development of a clear strategy, and the creation of a culture and leadership that engender transformation [1,38]. In investigating the antecedents and consequence of digital investment, the TOE framework presents an appropriate lens through which one may gain insight and a better understanding of how organizations can foster digital investment in an increasingly digital business landscape characterized by emerging (and, in some cases, cutting edge) digital technologies, competitive actions, and dynamic business climate.

2.2. IT Innovation

IT innovation, as defined by Swanson [39], refers to “innovation in the organizational application of digital computer and communications technologies.” It encompasses the generation and development of new ideas, processes, and behavior that are related to information technology [40,41]. Thus, IT innovation is not just an isolated technological artifact but rather a combination of technological components, business processes, and structure [42]. The innovative use of IT is well established within the information systems (IS) and business strategy literature. In fact, within the last three decades, IT innovation has had a profound impact on organizations. For example, the 1990s witnessed the introduction of innovative

enterprise technologies such as Enterprise Resource Planning (ERP) systems, Customer Relationship Management (CRM), and supply chain solutions that radically transformed organizational operations, structures, and business processes, resulting in some cases in unprecedented operational efficiency and productivity gains. As the business climate grew more competitive, IT became more pervasive and strategically important and IT innovation emerged as a key enabler for firms seeking to create value and a sustainable competitive advantage [10]. Through IT innovation, organizations are better positioned to respond to a changing business climate and environment. Not surprisingly, much research has been done to understand factors that drive IT innovation and how such innovative IT use plays a pivotal role in a firm's performance and productivity. Indeed, researchers and practitioners alike agree that IT innovation plays a central role in creating and sustaining superior firm performance [8]. Directly to this point, firms with greater innovativeness have demonstrated a greater ability to develop new capabilities and respond to an evolving business climate, leading to better performance [7,43]. Moreover, in the era of dynamic business environment and ever-changing market position, IT innovation has gained strategic importance as firms struggle to sustain market positions and gain competitive advantage. Emerging cutting-edge digital technologies capable of simulating IT innovation within a firm have led to increased focus on how business can generate and sustain IT innovation and use. As a result, firms are continuously seeking ways to generate IT innovation.

2.3. Digital Investment

Digital investment is a measure of a firm's strategic technology investments for exploring how emerging digital technologies could potentially differentiate the business transactions and operations [4]. Similarly, the World Economic Forum defines digital investment as investment in digital technologies such as robotics, the internet of things, big data analytics, artificial intelligence, and social media applications [5]. A firm's digital investment relative to the digital investment of its industry peers determines the digital strategic posture and digital strategy of the firm [26]. With the pace of change accelerating, firms are faced with the obvious choice of embracing digital technologies while remaining agile and open to experiments and innovation. Anecdotal evidence suggests that digital investment can offer new ways for companies to grow and be more competitive [15]. Investments in digital technologies can reshape existing customers' value proposition and business operations resulting in greater integration and collaboration among a firm's value chain partners [44,45]. These new digital technologies are add-on investments that complement the existing IT capabilities [46]. Similarly, digital investment can complement existing IT capabilities [46], enhance business support functions [47] and foster IT innovation in business processes and services [12]. Prior research notes that firms with the necessary IT capabilities to support digital business intensity are better positioned to achieve superior performance [4]. Indeed, organizations such as Amazon and Starbucks have invested in new digital technologies, resulting in new products, improved business processes, and business models. For instance, Starbucks's investment in digital technologies has enabled it to create a digital platform that supports its Order & Pay and mobile loyalty programs, leading to improved customer experience and revenue.

2.4. IT Competence

IT competence refers to a firm's capacity for IT-based innovation as a result of the available IT resources and the ability to convert IT assets and resources into strategic applications [48]. According to Tippins and Sohi [49], IT competence is the extent to which a firm is able to effectively utilize and apply IT within the firm. Essential indicators of IT competence include the level of IT investments, IT infrastructure quality, IT human capital, and the depth of the IS/business partnership [50,51]. IT competence is non-routine and engenders the ability to cope with changing environments [52]. IT competence resides in various subunits within the firm in the form of work-related knowledge skills and abilities [53,54]. Prior research suggests that IT competence is required for organizations to sustain competitive advantage and prepare for the future [48,55]. Thus, firms that achieve high-level

IT competence are believed to be in a superior position to manage and convert invisible resources and assets into products, services, and business processes that create competitive edge [49].

The fundamental rationale of the TOE framework is that the process of adopting and implementing technological innovations is influenced by technological, organizational, and environmental contexts [24]. In line with this view, we conceptualize IT competence as the necessary in-house technological resources that enable the firm to successfully adopt and implement emerging digital technologies in response to a changing environment. Thus, an organization's IT competence enables the firm to take advantage of emerging digital technologies by designing products, services, and processes that better match the changing market.

2.5. Competitive Pressure

Competitive pressure is defined as the degree of pressure that an organization senses from rivals within the industry [36,56]. Competitive pressure is an important driver of innovation. Prior research suggests that firms respond in different ways to address competitive pressure. Organizations may undertake competitive actions such as new products or services and large strategic expenditures [57]. Similarly, organizations tend to perceive the adoption of new cutting-edge technologies and innovations as a way of strengthening competitive positions [58]. Over the years, companies have responded aggressively by adopting and implementing technologies, such as enterprise resource planning (ERP) systems, electronic data interchange (EDI), and data warehouses in a bid to respond to industry competitive pressure [56,59,60]. Furthermore, previous literature suggests that competitive pressure is a strong predictor of IS strategy within an organization [61].

2.6. Organizational Agility

Organizational agility refers to a firm's ability to detect opportunities for innovation and follow through on those opportunities by assembling the necessary resources, knowledge, and relationship with speed and surprise [48,62,63]. It involves a new way of doing business in a turbulent business environment dominated by change and uncertainties. At the core of organizational agility is the need for organizations to be alerted to perceive incoming signals from internal and external environments. This state of alertness is a product of the organization's ability to establish sets of processes within the business that allow an organization to discern changes in the environment and respond efficiently and effectively in a timely and cost-effective way [64–66]. Indeed, agile organizations respond quickly and are resourceful and able to explore and exploit competitive market opportunities.

The last decade has witnessed a turbulent business climate and organizational agility has emerged as a means of dealing with rapidly evolving environments. According to Mathiassen and Pries-Heje [67], agility mindset within an organization represents an attempt to develop a capability to respond to changing business environments while being productive at the same time. Sambamurthy et al. [48] noted that organizational agility is a dynamic capability that reflects a firm's ability to identify and take advantage of competitive opportunities with speed and surprise. In line with this view, we conceptualize organizational agility as a firm's ability to sense and seize the opportunities for competitive action with digital technologies through digital transformation of organizational products, services, and business models that create new competitive advantages.

3. Research Model

Building on the background literature discussed above, this study develops a research model based on the theoretical rationale of the TOE framework. To keep the model parsimonious and within a testable scope, the study considers the most salient antecedent and consequent variables identified from the extant bodies of literature [32,33]. Given that our survey targeted CIOs, the choice of variables in our model is consistent with prior literature that examined CIO strategic decision-making authority [68]. As suggested in the introduction, we believe that the three contextual factors identified in the TOE framework [24] should foster digital investment. Prior research and anecdotal evidence

suggest that technological context, organizational context, and environmental context can influence organizational technology adoption and innovation decisions [33,36]. Our research model suggests that specific factors within the technological, organizational, and environmental contexts can underpin digital investment which in turn results in IT innovation. Thus, our study delineates IT competence, organizational agility, and competitive pressure and shows how each of these factors influences digital investment. The choice of IT competence is consistent with prior literature that has identified and recognized the role of IT competence when a firm's top managers are placed in a decision-making capacity [52,55,69]. To incorporate the proposed role of the environment in IT innovation, we introduce competitive pressure as an additional input to digital investment. This operationalization is consistent with prior research that investigated new technology adoptions using TOE [70] as well as the equivocal results of existing literature on the influence of competitive pressure on a firm's technology adoption decisions [33,71–73]. The choice of organizational agility represents a firm's ability to sense changes and the dynamism to respond effectively in a competitive landscape [64]. Furthermore, our study investigates the role digital investment has on IT innovation as well as the moderating effects of IT competence and organizational agility on the relationship. Figure 1 provides the research model underlying our study. We explain the rationale for the key links in the model and discuss the specific hypotheses in the section below.

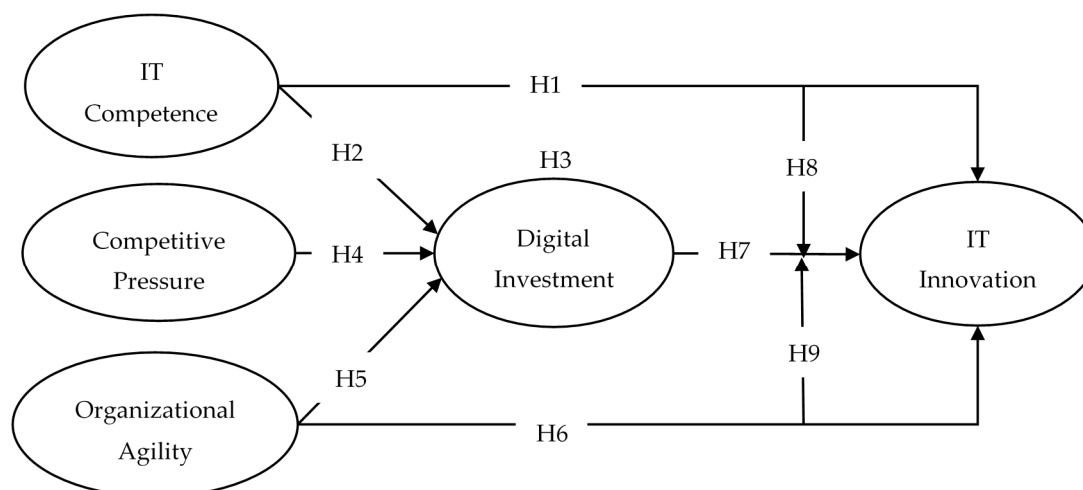


Figure 1. Research model.

3.1. IT Competence and IT Innovation

IT competence represents an organization's ability to effectively apply its technological resources or capabilities. According to Kuan and Chau [33], such organizational technological resources are critical factors in a firm's adoption of new technologies and innovations. It is no surprise that prior studies found that firms that adopt newer emerging technologies tend to perceive higher levels of technological competences [36]. Existing in-house technical knowledge, skills, and competencies lie at the heart of an organization's ability to effectively implement and deploy new technologies. Not all firms can effectively adapt to the business process changes and technological learning curve that accompany new technologies and innovations. Digital investment requires firms to transform from traditional systems that are typically dependent on physical processes to digital assets and information flow [72]. IT competence enables the integration of new infrastructure with newer applications leading to quick and effective utilization of applications, as well as the creation of innovative processes and business models. Hence, this study expects organizations with higher levels of IT competences to be better positioned to effectively apply newer digital technologies and investment leading to IT innovation. The following hypothesis is derived from these arguments.

Hypothesis 1 (H1). *IT competence is positively associated with IT innovation.*

3.2. IT Competence and Digital Investment

The TOE framework emphasizes the importance of relevant technologies and capabilities as firms attempt to adopt and implement technological innovations. One of the core underpinnings of TOE is that an organization's ability to adopt and implement technological innovation is shaped by the relevant IT resources and capabilities in the organization. Prior research suggests that IT competence is essential to delivering value through technology investment [48,49]. For one, IT-competent firms and managers are better equipped to identify and evaluate IT-based opportunities [52]. Furthermore, firms with greater IT competence are better positioned to successfully implement new technologies leading to increased user satisfaction [54]. Moreover, IT competence can foster knowledge transfer and post-implementation integration. Pavlou and El Sawy [55] emphasize that IT competence gives organizations the ability to effectively apply IT functionalities to support IT-related business processes, product development, and operational efficiency. IT competence involves evaluating the technical feasibility of deploying emerging digital technologies and assessing the potential disruptions and challenges associated with emerging digital technologies. As such, IT competence within a firm is the direct basis on which digital transformations are developed and sustained. While investments in digital technologies may require integration with existing technologies, IT competence provides the foundation on which the integration is built.

When viewed from a TOE perspective, IT competence gives a firm the capacity for IT-based innovations and transformations in response to the changing environment [48,53]. In the face of emerging digital technologies, organizations with superior IT competence are more likely to evolve from traditional IS applications and utilization to specific digital technologies such as social media, mobile, big data, and analytics. Arguably, firms with superior IT competence will be able to identify opportunities created by digital technologies. Investment in digital technologies represents an attempt to fully leverage organizations' core competences through digital technologies in a bid to realize a competitive edge [74]. Given that firms need to leverage IT competence to achieve digital transformation orchestrated by investments in digital technologies, this study argues that possession of IT competence will likely produce greater digital investment as firms attempt to respond to a radically evolving business environment. Thus, the following hypothesis is derived:

Hypothesis 2 (H2). *IT competence is positively associated with digital investment.*

IT competence is necessary to enable IT innovation [48], but in a dynamic and ever-changing digital landscape, it may not be enough to obtain the optimal benefits of IT innovation. Digital investment complements a firm's IT competence and IT portfolio with new cutting-edge digital technologies that can alter an organization's product and service offerings [4]. Thus, whether the firm can leverage its IT competence and foster IT innovation may depend on the availability of strategic digital investments on complementary technologies. If a firm adopts and implements the necessary complementary digital investments, it can effectively utilize the existing IT competence and increase the likelihood of increased IT innovation. Put differently, the enhanced business support function [47], digital platforms [4], and digitally based opportunities created by investments in digital technologies can complement prevailing IT competence and positively reinforce IT innovation. Therefore, the third hypothesis is that:

Hypothesis 3 (H3). *Digital investment mediates the relationship between IT competence and IT innovation.*

3.3. Competitive Pressure and Digital Investment

The degree of pressure that an organization senses from rivals within the industry has been documented as a strong determinant of adoption [75]. As such, in highly competitive industries, organizations view the adoption of technologies as a strategic necessity to compete in the marketplace [31,76]. According to Grandon and Pearson [58], organizations view the adoption of emerging technologies and innovations as a way of improving their competitive position. Similarly, empirical

inquiry suggests that institutional pressure is a strong predictor of radical technology adoption [77]. Indeed, firms recognize that changes in their environment are likely to trigger the pressure to assimilate new technologies. Similarly, competitive pressure can nurture an aggressive mindset whereby companies are constantly searching for emerging cutting-edge technologies that promise improved efficiency. In the context of digital transformation, organizations perceive investments in digital technologies as a way to solidify their competitive position. In response to the rapidly evolving business climate, organizations will embark on competitive actions such as strategic implementation and integration of digital technologies. Consistent with the TOE framework, this study argues that digital investment is a firm's response to competitive pressure within its industry. This study proposes, therefore, that increased competitive pressure will lead to digital investment, leading to the fourth hypothesis.

Hypothesis 4 (H4). *Competitive pressure is positively associated with digital investment.*

3.4. Organizational Agility and Digital Investment

While little is known empirically about the impact of agility on IT investment, there is a growing body of work that links strategic IT deployment and agility as well as the effect of agility on knowledge creation and use. Strategic IS literature views IT as an enabler of organizational agility [64,78]. In particular, firms need to strategically align their IT infrastructure to drive agility [79]. IT-led capabilities are needed to identify opportunities for competitive actions and marshal the necessary resources to seize those market opportunities. Furthermore, the integration of IT across functional areas of business eliminates the barriers to consensus that can typically impede organizational agility [80] while IT-based capabilities can help a firm organize external information exchanges to support competitive actions in the face of opportunities [64]. IT-based solutions, such as decision support systems and data warehouses, have helped firms retain agility by monitoring data in real time, recognizing patterns, and simulating a strategic course of action [81]. However, we argue that the unique nature of digital investments as add-on investments that complement the existing IT capabilities [46] presents a different and reversed role for organizational agility. In a competitive and dynamic digital business landscape with a plethora of new digital technologies, agile organizations are in a better position to sense and discern the appropriate digital solution to invest in. In accordance with the TOE framework, organizational agility enables processes that allow an organization to sense changes in the external and internal environment and to respond effectively in a timely and cost-effective way. Agility mindset within an organization represents an attempt to develop a capability to respond to a changing business environment while being productive at the same time [78]. Organizational agility enables firms to respond to the fast-paced and unpredictable character of digital disruption and transformation. Thus, digital investment can be viewed as an outcome of an organization's ability to respond to alerts and incoming signals such as emerging digital technologies. This study argues that agile organizations will move quickly in response to the changing and competitive business climate by implementing and investing in digital technologies. Thus, this leads to the fifth hypothesis:

Hypothesis 5 (H5). *Organizational agility is positively associated with digital investment.*

3.5. Organizational Agility and IT Innovation

The link between organizational agility and IT innovation has been suggested within the IS literature. Organizational agility represents the extent to which firms can detect, anticipate, and seize opportunities for innovation [48]. It signifies an important capability that enables firms to exploit opportunities and sustain innovation. In an increasingly competitive business landscape, organizations with the ability to constantly explore and exploit their business environments and IT resources are more likely to identify, apply, and pursue IT innovation opportunities [82]. Furthermore, firms that are agile are better able to react to changes in customer demands and the increased pace of innovation triggered by the digital business

landscape. According to Denning [83], agile firms recognize that competitive gains from single innovations are often short-lived. Thus, firms need to have an agile mindset to maintain customer-focused innovations. Such innovative outcomes can be a product of digitally enabled business models and offerings. As digital technologies usher in the era of rapidly evolving customer value proposition, an organization's ability to promptly respond to the changing product offerings, operating models, and process innovations will be critical. Thus, the sixth hypothesis is the following:

Hypothesis 6 (H6). *Organizational agility is positively associated with IT innovation.*

3.6. Digital Investment and IT Innovation

Digital investment enables organizations to take advantage of the pervasive digital connection of people, data, information, and knowledge. Anecdotal evidence suggests that investments in digital technologies nurture digital business strategy, leading to process improvement and modularization [25]. Similarly, empirical evidence found that digital transformation is a strong driver of innovation [84]. Organizations that integrate digital technologies are able to introduce new practices, routines, and innovative initiatives within their business operations and value chain [85]. Investment in digital technologies, such as analytics and big data, can facilitate the creation of new ideas and communications among business partners in the value chain. Building on the network externalities generated by using digital technologies or processes, organizations are able to achieve greater supply chain visibility, knowledge transfer, and operational efficiency [25,45]. Therefore, this study proposes the following hypothesis:

Hypothesis 7 (H7). *Digital investment is positively associated with IT innovation.*

3.7. The Moderating Role of IT Competence

Even though digital investment should influence IT innovation, this study also expects the predicted relationship to be moderated by the level of IT competence within the firm. The study further proposes that the strength of this relationship is not uniform across all contexts and will vary according to the strength of the IT competence. In an increasingly digital business landscape, organizations rely on digital technologies to connect to partners, add value for customers, and compete effectively in a digital economy. The combination of digital technologies, connectivity, and big data has created a digital network of people and huge quantities of data, information and knowledge that need to be harnessed [25]. For example, the growing volume of big data provided by interconnected digital devices, collaborative platforms (e.g., social media), and information systems requires firms to invest in digital technologies to remain competitive. As organizations transition to a digitally enabled marketplace, firms with superior IT competence would be better positioned to respond to market shifts and digital disruptions [18,45]. It seems logical to expect that the extent to which organizations can transform digital investment into IT innovation may depend on their IT competence state. Drawing from prior literature on IT capabilities and digital investments [4], this study argues that the level of IT competence residing within a firm affects the effective alignment of digital investment and IT innovation. Therefore, the study hypothesizes the following:

Hypothesis 8 (H8). *IT competence has a positive moderating effect on the relationship between digital investment and IT innovation.*

3.8. The Moderating Role of Organizational Agility

Past literature cites organizational agility as a factor that can explain an organization's innovative behavior [48,63]. For instance, agile firms are able to detect opportunities for innovation and follow through on those opportunities by assembling the necessary resources. As firms respond to the

changing market by investing in digital technologies, such digital investments may not necessarily foster IT innovation, particularly if such investments are not tied to emerging business opportunities. Firms would depend on the superior organizational agility to translate investment in digital technologies into IT innovation. As a result, it seems logical to expect that organization with superior agility would be more positioned to leverage strategic investments in digital technologies and capture insights and opportunities from a business climate dominated by digital platforms and thus bolster digital investment and its effect on IT innovation. Directly to this point, organizational agility can be viewed as an interplay between strategic investments in digital technologies and the transformation of processes, products, and services to achieve IT innovation. Therefore, this study expects the relationship between digital investment and IT innovation to be stronger for firms with greater organizational agility. The following hypothesis is derived from these arguments:

Hypothesis 9 (H9). *Organizational agility has a positive moderating effect on the relationship between digital investment and IT innovation.*

3.9. Control Variables

To minimize the confounding effect of spurious correlation, this study included firm size, type of industry, and IT industry intensity as control variables. Industry IT intensity was computed as the ratio of the software and the hardware stock values of the sector to the total equipment stock value of the sector [9]. Firm size is an important control variable because prior studies have found that it can impact innovation [86,87].

4. Research Methodology

4.1. Data and Sample

To validate the conceptual model and the associated hypotheses, a mail-based survey was conducted. The unit of analysis was the organizational level, as this study seeks to understand the enablers of digital investment and IT innovation within the organization. Therefore, the target population was CIOs and IT executives of US firms involved in the strategic decision process of digital transformation within their firms. Prior research has suggested the use of CIOs as respondents for questions on the deployment and implementation of IT within the organization [88].

4.2. Survey Instruments

The survey instrument was designed after exhaustively investigating existing literature, as well as using interviews with and reviews from individuals with extensive knowledge of digital investments and transformation. For each construct, the study adapted measures from previously validated scales. In some cases, we modified existing scales to make them suitable for the digital transformation context. Appendix A contains the final set of measurement items we used to measure each construct and the original source of these measurement items. The constructs were measured with multiple indicators coded on a seven-point Likert-type scale.

To ensure content validity of the survey instruments, the measures were reviewed and fine-tuned by five academics at a large public university and by three IT professionals with knowledge about the topic under investigation. Furthermore, these reviewers were invited to match the survey question to the appropriate constructs in order to determine whether the items represented our model's constructs. This step helped us to establish face and content validity.

During the review process, we modified existing construct instruments to remove ambiguities. The scale development followed Churchill's [89] procedure, and whenever possible, we used previously validated scales and adapted them to fit the research model's constructs and dimensions. After a series of iterations and modifications of the questionnaire, we undertook a pilot test to further refine the instrument. A version of the instrument was administered to a random sub-sample of 200 CIOs; a preliminary factor

analysis based on 51 responses indicated that the scale items displayed the same psychometric properties. As a result, no item was removed from the scale based on the preliminary factor analysis.

4.3. Data Collection Procedures

The study used a single informant approach of data collection and, consistent with prior research, we targeted CIOs. Dun and Bradstreet's Million Dollar database, a directory that provides contact information of executives in various positions in firms in the United States, was used to draw the sample, which is similar to other studies [84,90]. Our survey packet consisted of a cover letter that described our study and its purpose, the questionnaire, and a self-addressed stamped return envelope.

In choosing the sampling frame, this study ensured that each selected executive from each firm had CIO designation and in cases where such designation was not available, an executive with a position such as vice president of IT operations, executive director of IT, or any other designation that indicated that such an executive was in charge of the IT unit, was selected. Sample sizes for different industries were based on the population size in Dun and Bradstreet's database. The finalized survey was administered to a stratified random sample of 1000 CIOs. Of the possible 1000 firms, 167 (16.7%) declined participation for various reasons (e.g., "too busy," "company policy excludes participation in research projects"). After around three months of follow-up phone calls to non-respondents and two waves of mailing, we received 211 replies. However, we discarded 37 observations due to the high proportion of responses exceeding Hair et al.'s, [91] threshold of 25%. Out of the 174 responses, 157 were usable, which resulted in an actual response rate of 15.7%. Table 1 provides information on the sample's characteristics. Single-source respondents are capable of creating common source bias. To limit that, we advised respondents that results would be completely anonymous. Furthermore, the study applied Nunnally and Bernstein's [92] recommended questionnaire design strategies to minimize common source bias. First, in the framing of the responses, we avoided implying that one response was more acceptable than the other. Second, we made all the responses require equal effort. Third, we paid attention to item wording. Finally, we attempted to avoid socially desirable responses.

Table 1. Sample characteristics.

Classification	Number of Respondents	Respondents (%)
Firm's Size (Market Capitalization)		
Less than \$250 million	49	31%
25–500 million	33	21%
500–999 million	41	26%
1–4.9 billion	20	13%
5–9.9 billion	9	6%
10 billion or More	5	3%
Industry		
Construction	7	5%
Educational	9	6%
Transportation	9	6%
Financial services/banking	14	9%
Information technology	21	13%
Manufacturing	21	13%
Retail	27	17%
Service	24	15%
Telecommunications	16	10%
Other	9	6%
Job Title of Respondents		
Chief Information Officer	101	64%
Chief Technology Officer	33	21%
Chief Digital Officer	17	11%
Other	6	4%
Average number of years in position	4.9	-

4.4. Assessment of Informant Competency

Typically, it is necessary to solicit data from the most qualified and well-informed individual when using perceptual measures and single respondents [43]. As a result, steps were taken to ensure that the survey's respondents were adequately knowledgeable in digital business strategies and IT-related innovation activities. In choosing the sampling frame, we strived to ensure that executives selected from each firm had CIO designation; however, in cases where such designation was not available, the study opted for executives with such positions as vice president of IT operations, executive director of IT, or any other designation that indicated that such an executive was in charge of the IT unit. As a result, 64% of the respondents had chief information officer designation, while 21% had chief technology officer titles. Similarly, 6% of the respondents had chief digital officer titles, while 4% had the job title of other, e.g., vice president of IT or IT director. Furthermore, 71% of the respondents indicated having an organizational tenure of three or more years in the current position.

4.5. Dependent Variable

IT innovation captures the degree to which a firm's IT strategy is to be an industry innovator [7]. We asked respondents to indicate their firm's level of IT innovation in relation to other firms in their industry. We measured IT innovation with four items adapted from prior studies and modified to suit the current study [7,93].

4.6. Independent Variables

The independent variables were measured with multiple indicators coded on a seven-point Likert scale with anchors ranging from "strongly disagree" to "strongly agree". All constructs in the proposed model are based on a reflective multi-item scale. The scale of IT competence comprises four items developed by Kuan and Chau [33], and Zhu and Kraemer [72]. Similarly, the six items measuring organizational agility were adapted from Chakravarty et al. [64]. The four items we used to measure competitive pressure were derived from prior studies on the development of such items [31,33]. Finally, the digital investment construct was measured by adapting the four item measures of Nwankpa and Datta [4]. Appendix A contains the final set of measurement items used to measure each construct and the original source of these measurement items.

5. Analysis and Results

For data analysis, we used the two-step approach recommended by Anderson and Gerbing [94]. The first step involves analyzing the measurement model to determine satisfactory levels of reliability, convergent and discriminant validity. The second step examines the structural relationship among the latent constructs and estimates whether the hypothesized structural paths are statistically significant. The two-step approach is aimed at ensuring adequate reliability and validity of the measure before assessing the structural paths in the model. SmartPLS 3.0 (SmartPLS GmbH, Germany, 2014–2020) [95] was used for the analysis. Partial least squares (PLS) does not necessitate the assumption of multivariate normality [96,97], places minimal limitations on the measurement scales, sample size, and residual distribution [98] and is suited for complex models with latent variables. Although the sample size of 157 is acceptable, it is still considered small. As such, the choice of PLS was informed by the robustness in case of small samples. It is important to note that the reliable sample size for which PLS can be used is one that is at least ten times the number of the independent constructs impacting a single dependent construct [56,99]. Hence, the sample size of 157 is adequate for the use of PLS in our study. In addition, a bootstrap procedure was used to assess the statistical significance of the loadings and of the path coefficients [95]. To achieve increased robustness and statistical validity, we used a bootstrap resampling procedure [100]. The moderating relationship was examined using the product indicator method first recommended by Kenny and Judd [101] and later implemented by Chin et al. [96] and

Ringle et al. [95]. The product indicator method involves creating an interaction term by multiplying the indicators of the predictor and moderator constructs.

5.1. Measurement Model

The adequacy of the measurement model was assessed with confirmatory factor analysis, reliability, convergent validity, and discriminant validity. Table 2 presents the descriptive statistics of the indicators and the reliability and discriminant validity measures of all the constructs.

Table 2. Descriptive statistics of constructs.

Constructs	Mean	SD	Composite Reliability	Cronbach's Alpha	AVE
IT Innovation	4.91	1.14	0.90	0.87	0.81
Digital Investment	4.95	1.07	0.88	0.86	0.83
IT Competence	5.07	1.05	0.88	0.84	0.82
Competitive Pressure	5.17	1.29	0.89	0.87	0.81
Organizational Agility	4.91	1.11	0.90	0.89	0.80

The results reveal that all the constructs had Cronbach's alphas above the commonly accepted threshold of 0.70 [102]. Similarly, the composite reliability values were all above the commonly accepted threshold of 0.70. The average variance extracted (AVE) of every latent construct was greater than 0.70, which suggests that the principal constructs capture much higher construct-related variance than error variance [103]. As such, we can conclude that the instrument had a high level of reliability.

We performed a confirmatory factor analysis to establish the convergent and discriminant validity of the measurement model. Table 3 presents the factor loadings of the indicators on their latent factors. All item loadings were greater than 0.70 as recommended by Hair et al. [97], indicating that the items represented their respective constructs. Furthermore, item loadings were found to be much higher than all cross-loadings. Convergent validity is present when the scores of items used to measure a construct load significantly on their designated latent variables [94]. We tested convergent validity using two criteria [103]. First, all indicator loadings should be significant and exceed 0.70, and, second, the average variance extracted (AVE) by each construct should exceed the variance due to the measurement error for that construct. As Table 3 shows, all factor loadings were greater than 0.70; thus, the measures have acceptable convergent validity. We assessed discriminant validity by testing whether each construct shared more variance with its own measurement items than with the other constructs [103].

Table 3. Confirmatory factor analysis and cross-loadings.

-	CP	DI	ITC	ITI	OA
CP1	0.865	0.261	0.125	0.287	0.259
CP2	0.872	0.255	0.213	0.273	0.241
CP3	0.905	0.126	0.287	0.235	0.104
CP4	0.885	0.216	0.241	0.203	0.204
DI1	0.105	0.903	0.208	0.238	0.255
DI2	0.279	0.906	0.203	0.224	0.219
DI3	0.248	0.893	0.204	0.217	0.246
DI4	0.217	0.897	0.137	0.276	0.207
ITC1	−0.107	0.266	0.876	0.394	0.234
ITC2	0.022	0.282	0.887	0.211	0.238
ITC3	−0.193	0.252	0.892	0.281	0.233
ITC4	−0.086	0.323	0.902	0.366	0.202
ITI1	0.202	0.347	0.214	0.911	0.119
ITI2	0.198	0.345	0.225	0.903	0.117
ITI3	0.237	0.248	0.215	0.875	0.216
ITI4	0.221	0.217	0.223	0.886	0.199
OA1	−0.011	0.319	0.216	0.284	0.844
OA2	−0.116	0.322	0.238	0.378	0.853
OA3	−0.089	0.324	0.229	0.384	0.861
OA4	0.045	0.328	0.281	0.286	0.866
OA5	0.059	0.219	0.277	0.378	0.855
OA6	−0.097	0.228	0.221	0.169	0.841

Table 4 presents the correlation matrix among all constructs and shows that the square root of an AVE of each construct is greater than the correlations between the construct and all other constructs. Table 4 confirms that each construct's correlation values with other constructs were smaller than the square root of AVE for the construct. Thus, this provides evidence of the discriminant validity of the constructs.

Table 4. Correlation among constructs and the square root of average variance extracted.

Variables	ITI	DI	ITC	CP	OA	FS	ITI
IT Innovation	0.90	-	-	-	-	-	-
Digital Investment	0.35 ***	0.91	-	-	-	-	-
IT Competence	0.10	0.34 ***	0.91	-	-	-	-
Competitive Pressure	0.09	0.28 ***	-0.07	0.89	-	-	-
Organizational Agility	0.27 ***	0.31 ***	0.11	0.13	0.89	-	-
Firm Size	-0.04	-0.05	0.04	0.06	-0.08	n/a	-
IT Industry Intensity	-0.11	-0.07	0.06	-0.13	0.09	0.06	n/a

Note: Figures along the diagonal line in bold are values of the square root of AVE. Significant at *** $p < 0.001$.

5.2. Structural Model

In PLS, structural model testing examines the structural paths to determine the significance of the hypothesized paths, the R-squared scores of the endogenous variables, and the explanatory power of the structural model. We assessed the structural model by using the PLS statistical method (SmartPLS 3.0) to estimate the explanatory power of the structural paths. Furthermore, we used the bootstrapping procedure (1000 re-samples) to examine the significance of the path coefficient. In testing the moderation effect in PLS, we followed the procedure first recommended by Kenny and Judd [101] and later implemented by Chin et al. [96] and Ringle et al. [95]. This involves creating the interaction terms by multiplying the indicators of the predictor and moderator constructs. As recommended by Ringle et al. [95], prior to confirming the interaction, we centered each indicator of the moderator and the predictor. Figure 2 shows the results of the structural model.

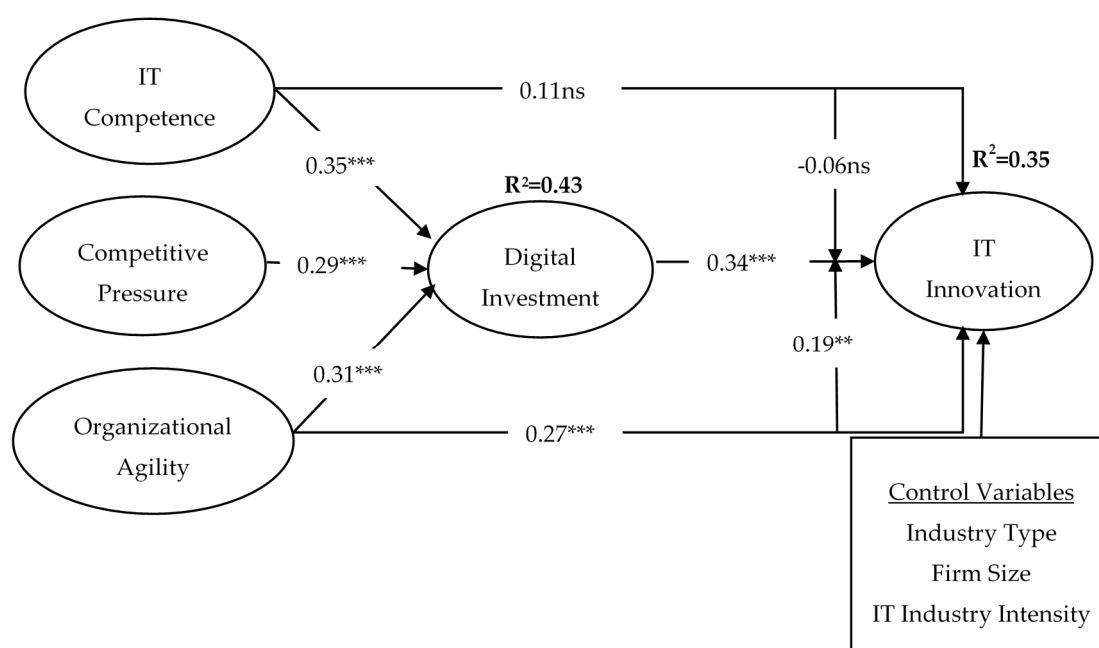


Figure 2. Research model with results (***) significant at $p < 0.001$, ** significant at $p < 0.01$.

The results suggest that the model is capable of explaining 35% of the dependent variable of IT innovation and 43% of the variance of digital investment. Overall, most of the hypotheses were supported. Surprisingly, our results did not find support for H1; IT competence did not have a significant relationship with IT innovation ($\beta = 0.11$, not significant). Interestingly, IT competence had a significant direct effect on digital investment ($\beta = 0.35$, $p < 0.001$), thus supporting H2. To test for the mediation hypothesis H3, that digital investment mediates the relationship between IT competence and IT innovation, we adopted the two-step procedures prescribed by Preacher and Hayes [104] and elaborated by Zhao et al. [105]. First, we tested the significance of the indirect effect of the mediating variable digital investment [105]. This step determines the extent to which digital investment mediates the effect of IT competence on IT innovation. Second, we examined the direct effects of IT competence on IT innovation to ascertain the degree of mediation. The results revealed the significant indirect effect of digital investment ($\beta = 0.19$, $p < 0.01$) on the relationship between IT competence and IT innovation. In addition, the results also revealed that the direct effect of IT competence on IT innovation in the presence of digital investment was also not significant ($\beta = 0.10$, not significant). Following Zhao et al. [105] and Hair et al.'s [100] classification of mediation, we concluded that digital investment fully mediated the relationship between IT competence and IT innovation.

H4 concerned the effect of competitive pressure on IT innovation. The results reveal that competitive pressure has a strong positive relationship with IT innovation ($\beta = 0.31$, $p < 0.001$), thus supporting H4. As hypothesized, the results reveal that organizational agility has a significant positive relationship with digital investment ($\beta = 0.31$, $p < 0.001$) and IT innovation ($\beta = 0.27$, $p < 0.001$), thus providing support for H5 and H6. Similarly, the influence of digital investment on IT innovation was significant ($\beta = 0.34$, $p < 0.001$), supporting H7.

In testing the moderation effect in PLS, we followed the procedure first recommended by Kenny and Judd [101] and later implemented by Chin et al. [96] and Ringle et al. [95]. This involves creating the interaction terms by multiplying the indicators of the predictor and moderator constructs. As recommended by Ringle et al. [95], prior to confirming the interaction, we centered each indicator of the moderator and the predictor. H8 concerned the moderating role of IT competence on the relationship between digital investment and IT innovation. However, this relationship was not significant ($\beta = -0.06$, not significant), so our data did not provide support for H8. As hypothesized, we found that organizational agility positively moderates the relationship between digital investment and IT innovation ($\beta = 0.19$, $p < 0.05$), thus providing support for H9. Table 5 below summarizes the results.

Table 5. Summary of hypotheses and results.

Hypothesis	Path	Predicted Sign	Results
H1	IT Competence → IT Innovation	+	Not Supported
H2	IT Competence → Digital Investment	+	Supported
H3	IT Competence → Digital Investment → IT Innovation	+	Supported
H4	Competitive Pressure → Digital Investment	+	Supported
H5	Organizational Agility → Digital Investment	+	Supported
H6	Organizational Agility → IT Innovation	+	Supported
H7	Digital Investment → IT Innovation	+	Supported
H8	IT Competence * Digital Investment → IT Innovation	+	Not Supported
H9	Organizational Agility * Digital Investment → IT Innovation	+	Supported

Note * denotes moderation effects.

5.3. Assessment of Potential Response Bias and Common Method Bias

To ensure that the responses were free from non-response bias, our study followed the approach suggested by Armstrong and Overton [106] and compared early and late responses. Early respondents were those who responded to the initial mail, while late respondents were those who responded after the second reminder and appeal. Results of the t-tests of the mean differences for each of the constructs did not reveal any significant differences ($p < 0.05$, two-tailed), suggesting that

nonresponse bias was not a serious threat to this study. Given that each of the survey questionnaires was completed by a single respondent, it was important to assess the potential of common methods bias. Following Podsakoff et al. [107], this study applied Harman's one-factor test on the constructs by simultaneously loading all items from the combined dataset in factor analysis with no rotation. Results showed that the most covariance explained by one factor was 24.14%, suggesting that common method bias was not likely present in the study. In addition, the study applied the Liang et al. [108] procedure to test the common method bias in PLS. The results revealed that method loadings were insignificant, and that indicator variances were considerably greater than their method variance. Thus, this leads to the conclusion that common method bias was not a serious threat to this study.

6. Discussion and Conclusions

Given the pace at which digital innovation is disrupting industries globally, it is not surprising that organizations are facing increased calls to invest and embrace the opportunities created by these pervasive digital technologies. Yet, we lack a comprehensive understanding of how organizations can strategically apply, leverage, and integrate new digital technologies to attain IT innovation. The objective of this research was to extend our understanding of digital investment, IT innovation, and its implications. Prior studies on digital business strategy and IS research have only examined the role of digitalization in the context of reshaping business models and IS strategy [25,109,110]. The present study adds new understanding of digital business strategy by integrating digital investment in a nomological network leading to IT innovation. Using the TOE framework, a research model explaining the antecedents and consequences of digital investment was tested using a survey of 157 CIOs from firms across the U.S. Consistent with the proposed model, the study finds that IT competence, competitive pressure, and organizational agility are the key drivers of digital investment. Taken together, results suggest that digital investment is not simply a matter of IT competency or a firm's technological shrewdness. Rather, it is about creating an agile organization that can detect what changes are necessary and respond swiftly with competitive digital solutions and by having the organizational awareness to deploy the right digital innovations in response to competitive pressure and digital threats.

Our results also show that digital investment is a key factor in a firm's level of IT innovation. By embarking on investment in digital technologies, organizations can take advantage of the pervasive digital connection of people, data, and information, leading to new ideas and innovations. Therefore, it is important for managers to understand that digital investment is a strategic undertaking. A well-aligned digital investment can foster innovativeness, while a misaligned digital investment can usher in disruptive changes that may limit IT innovation. In addition to the importance of digital investment, we found that organizational agility is a key factor in an organization's level of IT innovation. This finding provides support for largely anecdotal evidence that the investments in digital technologies create IT innovation opportunities [18,25].

Furthermore, we examined the mechanism within which existing capabilities that may influence IT innovation by investigating the moderating effects of organizational agility and IT competence on the link between digital investment and IT innovation. These findings lend support to various theoretical perspectives on strategic deployment of emerging digital technologies to achieve competitive advantage [76,110]. More specifically, the study demonstrates the moderating role of organizational agility. Our findings show that organizational agility moderates the relationship between digital investment and IT innovation. These findings build on prior work that argues that organizational agility enhances entrepreneurial competitive action by leveraging or facilitating existing organizational resource with a firm's strategic goals [48].

Although prior research suggests a positive role of IT competence on innovation [111], surprisingly, our study did not find a positive relationship, further highlighting how digital investment can provide valuable mechanisms to achieve IT innovation. We extend knowledge and insight about the interplay with IT competence, digital investment, organizational agility, and IT innovation through

our conceptualization and empirical investigation. This result is inferentially important because firms should not embark on digital investments in isolation, rather, digital investment choices should reflect existing IT competence, competitive pressure within the industry and the level of organizational agility.

6.1. Implications for Theory

This study makes key contributions to theory. This is one of the first studies to provide an empirical evidence on the interplay between digital investment and IT innovation. The proposed theoretical model identifies IT competence, competitive pressure, and organizational agility as key antecedents of digital investment, thus advancing our knowledge on mechanisms through which firms can use and strategically deploy emerging digital technologies into its operations. Hence, this study extends prior work in IS research that seeks to reconcile the underlying mechanisms through which firms can use existing IT capabilities to achieve competitive advantage [112]. Second, the study reveals that digital investment and organizational agility are also key enablers of IT innovation. Although prior research has demonstrated the importance of capabilities and digital technologies [18,25], less is known about investing in emerging digital technologies and how it relates to a firm's innovativeness. This study advances our theoretical model by developing and testing a more nuanced model of antecedents and consequences of digital investment.

Furthermore, identifying digital investment as a mediator of the linkage between IT competence and IT innovation is an important contribution, especially as researchers attempt to unlock the business value of digital transformation. This finding provides empirical evidence for what has been mostly anecdotal support that firms with the adequate IT competence to complement investments in digital technologies are more likely to gain a high level of IT innovation.

Finally, the moderating role of organizational agility on the relationship between digital investment and IT innovation offers interesting cues. Although it has been noted that IT competence enables the adoption of innovative and new technological ideas [4,73], this study contends that IT innovation cannot always be explained by existing IT competence. Furthermore, the insignificant relationship in the link between IT competence and IT innovation speaks to the diminishing role of IT competence as an innovation driver in a fast-paced digital climate. One reason for this diminished role is that today's tech-savvy workforce has transformed IT competence into a general skill and requirement for job seekers and employees rather than a capability that is firm-specific and developed within an organization. The lack of a significant result on the relationship between IT competence and IT innovation should alert managers of the growing role of digital investments. Moreover, our results indicate that organizational agility provides an added boost and moderates the relationship between digital investment and IT innovation. Directly to this point, our study highlights the need for organizations to be agile and able to identify opportunities for innovation and follow through on those opportunities by investing in digital technologies to fully attain a high level of IT innovation.

6.2. Implications for Practice

This study has several implications for managers and practitioners alike. The study will be of practical importance to IT managers and CIOs who are grappling with ways to strategically deploy emerging digital technologies to gain competitive advantage in a digital economy. Our research provides a blueprint for understanding the requirements for digital transformation and strategic investments in emerging digital technologies. The insight emerging from this study can help managers make informed decisions and avoid pitfalls that may undermine digital transformation efforts and innovation.

For companies investing in digital technologies, our results reinforce the importance of digital investment in a firm's innovation stance. Thus, as companies engage in digital investment initiatives, infusing a digital mindset in the workforce may not be enough. Companies may need to make innovation the focus of training and hiring programs as they adopt and invest in these digital technologies. Although IT innovation is typically entrenched in startups and new companies, traditional industry players need to find way to embed it into their core businesses. Managers and firm executives should foster an

environment that encourages new business models and a culture that make innovation the focus of their business strategy, which in turn requires investment in digital technologies.

Our results reveal that organizational agility is an important enabler of digital investment. Prior research has consistently viewed technology as a key enabler to organizational agility [64,78,79]. However, our findings indicate that the relationship is reversed when dealing with investments in digital technologies that represent add-on investments that complement existing IT capabilities. The study demonstrates the important role of organizational agility in discerning digital opportunities in a competitive and rapidly evolving digital landscape. Clearly, companies should seek to build organizational agility capabilities to detect the appropriate digital investment opportunities. In particular, business managers should strive to first develop the necessary agility needed to recognize digital solutions and technologies that are suited to meet their firm's strategic needs. Thus, as investments in digital technologies continue to generate mixed results, new entrepreneurs, startups, and nascent businesses that typically face tough competition and entry barriers with traditional mainstream industry players will welcome the news that being nimble and agile can foster digital investment and inspire IT innovation.

An additional insight emerging from this study is the diminished positive relationship between IT competence and IT innovation. This surprising finding reinforces the understanding that in a digital business climate with rapidly changing technologies, competence can be very fleeting. As a result, prior IT adoption competence does not necessarily imply the ability to obtain IT innovation from digital technologies [18]. In a digital economy, agile firms are better positioned to bypass the hurdles of existing technologies and tailored to invest in cutting-edge digital technologies. As the positive mediating relationship suggests, having technological competence alone does not necessarily guarantee IT innovation rather firms need to build competence that fosters digital investment to drive IT innovation. The result nevertheless echoes the findings of the Forbes insight [6] study of C-level executives, showing that technology is a double-edged sword when it comes to digital transformation and IT innovation. On the one hand, firm executives identify technology as a top contributor to a successful digital transformation and IT innovation. On the other hand, they note that existing technologies can undermine digital transformation initiatives and IT innovation.

Moreover, the findings reveal that successful investments and use of digital technologies are more than the technology infrastructure and competence. Managers and IT executives need to understand the roles that organizational and competitive factors play in implementing and fostering digital investment. More interestingly, firms lacking the necessary antecedents of digital investment may not lay claim to a superior level of IT innovation. While the direct impact of IT competence may be diminishing, the mechanism through which digital investment may contribute indirectly by leveraging other resources to drive IT innovation within organizations remains of important interest to managers.

Finally, this study reveals that investment in digital transformation can provide the mechanisms through which IT competence can influence IT innovation. As such, it is important that managers and IT executives strategically align digital transformation initiatives with existing IT competence within the firm. Therefore, the result should encourage managers of firms that are seeking to gain competitive advantage through digital transformation.

6.3. Limitations and Future Research

The findings of our study must be judged in the context of its limitations. First, for parsimony, the study emphasized a limited number of variables that may affect digital investment and IT innovation. Although IT competence, organizational agility, and competitive pressure play important roles in influencing digital investment, these factors are by no means exhaustive. Other factors, such as financial resources, may affect how such firms pursue digital transformation. Future studies that consider a comprehensive taxonomy of digital transformation and IT innovation may be more insightful. Furthermore, it is important not to restrict digital transformation and investments to technology, organizational, and environmental contexts while ignoring other contexts that may be inherent in such a transformation.

Second, the study examined the variables at the firm level. This study recognizes that some activities associated with digital investment will certainly occur at the individual level. Similarly, while this study followed the recommended statistical tests to address potential biases, the interpretation of our results must take into account that we collected data on each firm through a single respondent. However, the sample of respondents were drawn from top management executives, suggesting that our result capture true positions about digital transformation in these organizations. Furthermore, our sample selection of CIOs affords us the ability and privilege of using strategic constructs that a C-level executive is likely to have not only comprehended but also applied.

Third, this study adopts a cross-sectional view in measuring some constructs. Therefore, such a design may not sufficiently capture the interactions and relationships among the constructs and cannot establish causality. Future research might benefit from a longitudinal study from the firm's initial deployment of digital technologies to the time of organizational IT innovation. Such an inquiry may enrich the findings of our results.

Finally, the generalizability of our study is limited as some of the empirical data were collected from one key respondent in each firm and from a single country. This could potentially lead to the percept-percept inflation problem, which refers to artificial inflation of estimates of co-variance [113]. However, this concern was partly alleviated in our context for several reasons including the depth of involvement of these respondents in the management responsibilities for and the operations of their respective firms, as well as the combination of observed secondary data. In addition, the results from Harman's single-factor test suggest that common method bias did not influence our results.

6.4. Conclusions

As organizations embark on digital transformation by investing in such emerging digital technologies as big data, analytics, social media, the cloud, mobile, embedded systems, their strategic investment choices are shaped by IT competence, competitive pressure, and organizational agility. Drawing on the TOE framework, we developed and tested a theoretical model that links technological, organizational, and environmental factors to digital investment and IT innovation. Our results reveal how IT competence, competitive pressure, and organizational agility act as useful triggers for subsequent digital investment. Our results also offer support for a positive relationship between digital investment and IT innovation. Surprisingly, we did not find support for a relationship between IT competence and IT innovation, which may point to a lack of a strategic alignment between existing IT resources and innovation in a rapidly changing business landscape. Yet, the mediating role of digital investment in the relationship between IT competence and IT innovation demonstrates how digital investment acts as a catalyst for IT innovation. In the era of digital technologies, managers need to understand that simply having IT competence within the organization is not enough to drive IT innovation. Rather, organizations with IT competence can generate a greater impact from digital investment, which in turn results in IT innovation. We believe that our model has important implications for both researchers and practitioners because it identifies key factors that foster digital investment. Furthermore, our findings bring to the surface the role of organizational agility as a moderator and antecedent of digital investment. Organizations need to be agile to identify opportunities for innovation and follow through on those opportunities by investing in digital technologies. Therefore, understanding the relationship between digital investment and IT innovation, as well as the interplay with organizational agility may prove vital for new startups and entrepreneurs grappling with how to gain market share in a competitive business environment.

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Appendix A

Constructs, Instructions, and Measurement Items	Supporting Research
IT Competence	
Relative to other firms in your industry, please indicate how would you rate your organization in the following (1 = “strongly disagree”, 7 = “strongly agree”)	
ITC1: Performance in providing IT support to facilitate digital technologies. ITC2: Experience in supporting digital technologies.	[33,72]
ITC3: Expertise in supporting digital technologies.	
ITC4: The number of IT-knowledgeable employees available to facilitate digital technology usage.	
Competitive pressure	
Relative to other firms in your industry, please indicate your level of agreement with each statement (1 = “strongly disagree”, 7 = “strongly agree”)	
CP1: Our organization is under pressure to invest in digital technologies to meet business partners’ requirements.	[31,33]
CP2: Our organization is under pressure from industry to embrace digital technologies as standard practice.	
CP3: Our organization fears that competitive edge will be lost due to lack of investment in digital technologies.	
CP4: Our organization fears that the majority of our competitors are investing in digital technologies or soon will be using digital technologies.	
Organizational Agility	
Relative to other firms in your industry, please indicate your level of agreement with each statement (1 = “strongly disagree”, 7 = “strongly agree”)	
OA1: Our organizational strategy emphasizes building capabilities to foresee a wide range of scenarios.	
OA2: Our organization believes in rapidly taking advantage of opportunities.	[8,64]
OA3: Our strategic assets can easily be converted to alternative forms.	
OA4: Our organization has the ability to absorb environmental shocks.	
OA5: We react immediately to incorporate changes into our business processes and systems.	
OA6: We have the appropriate technology and capabilities to quickly respond to changes in customer demands.	
Digital Investment	
Relative to other firms in your industry, please indicate your level of agreement with each statement (1 = “strongly disagree”; 7 = “strongly agree”).	
DI1: Our company invests in digital technologies (e.g., analytics, big data, cloud, social media, mobile, artificial intelligence) in our business transactions.	
DI2: We strategically invest in digital technologies (e.g., analytics, big data, cloud, social media, mobile, artificial intelligence) in our firm’s operations.	[4]
DI3: Our business invests in new digital opportunities and technologies (e.g., analytics, big data, cloud, social media, mobile, artificial intelligence).	
DI4: We are constantly investing in digital technology-enabled initiatives (e.g., analytics, big data, cloud, social media, mobile, artificial intelligence) in our internal operations	
IT Innovation	
Relative to other firms in your industry, please indicate your level of agreement with each statement (1 = “strongly disagree”; 7 = “strongly agree”).	
ITI1: Our organization is a leading IT innovator in our industry.	[7,93]
ITI2: Our organization believes in being first in the industry in developing new IT initiatives even if not all of these efforts prove to be highly profitable.	
ITI3: Our organization responds rapidly to early signals concerning areas of opportunity for IT.	
ITI4: Our organization’s IT initiatives are often emulated by competitors in our industry	

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