

IT Capability and Digital Transformation: A Firm Performance Perspective

Completed Research Paper

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Abstract

As emerging digital technologies and capabilities continue to dominate our economic landscape, organizations are facing increased scrutiny on how digital transformation can provide the mechanism for innovation and firm performance. Using resource-based view (RBV) framework, this research examines the mediating effects of digital transformation in the relationship between IT capability and firm performance. Empirical data collected from CIOs from US firms reveal that although IT capability positively influences firm performance, it is mediated by digital transformation. Furthermore, our findings show that digital transformation positively influences innovation and firm performance while innovation is reaffirmed as having a positive implication on firm performance.

Keywords: Digital Transformation, IT capability, innovation, firm performance

Introduction

Improving business performance is regarded as one of the most crucial objectives for organizations. One area that continues to generate great scrutiny is the impact of information technology (IT) on a firm's performance. On the one hand, there is a rich body of literature on IT value and its direct impact on firm performance (Bharadwaj 2000; Chan 2000; Dehning and Richardson 2002; Mahmood and Mann 2000; Wade and Hulland 2004). On the other hand, some scholars continue to question the direct effect of IT on firm performance and the suggestion that superior IT capability can generate significant competitive advantage for organizations (Carr 2003; Clemons and Row, 1991; Chae et al., 2014). Arguably, the standardized and ubiquitous nature of today's information systems has led to diminished strategic importance (Carr 2003), while the ease with which companies can imitate or even better the IT capabilities of their competitors continues to cast doubt on the impact and superiority of IT capabilities (Masli et al., 2011; Chae et al., 2014). Furthermore, the underlying apparatus through which IT capability impacts firm performance remains blurred (Liu et al., 2013; Yan & Sengupta, 2011). The lack of agreement within the information systems (IS) literature on how IT capability influences organizational performance (Chen et al., 2014; Melville et al., 2004; Kohli & Grover, 2008) has led to calls for more empirical studies that seek to identify the mechanisms through which firms can use IT capability to achieve superior organizational performance (Chen et al., 2014).

Although there is no debate that IT capabilities are core to performance, the link between IT capabilities and firm performance remains inconclusive (Stoel and Muhanna 2009). Thus this paper represents an

attempt to advance our understanding of the relationship between IT capabilities and firm performance by underscoring “how” digital transformation influences the hitherto inconclusive relationship.

Digital transformation is characterized by changes and transformation which are driven and built on a foundation of technologies. Within an enterprise, digital transformation is defined as an organizational shift to big data, analytics, cloud, mobile and social media platforms. The current business environment is witnessing a radical altering of the business landscape fueled by the emergence of digital innovations and opportunities. Firms are increasingly adopting various opportunities such as analytics, big data, cloud, social media and mobile platforms in a bid to build competitive digital business strategies. There has been an increased focus on digital business opportunities and strategies with practitioners and scholars alike aiming to understand how firms can take advantage of digital opportunities and drive innovation and enterprise-wide transformation (Markus & Loebbecke 2013; Westerman et al., 2014; Pagani, 2013). Digital technologies are not only affecting the way businesses are conducted, but are disrupting existing business models in many industries. A recent Forbes Insights report (2016), found that 42 percent of chief information officers (CIOs) and chief executive officers (CEOs) predicted that in five years, their jobs will involve mostly digital business strategies and transformation, while 31 percent believed that digital transformation will expand considerably across their organizational value chain. Thus, organizations have to choose whether to digitally transform their existing businesses and gain from these technologies or yield to the disruptions of their organizational processes and traditional business models.

While disruptions caused by digital technologies have led to positive business changes and new opportunities, major issues have emerged as firms struggle with how to ignite digital transformation within their organization (Abrell et al., 2016; Yoo et al., 2010). Prior literature on digital innovation suggests that some managerial challenges are linked to digital innovations and transformation. The introduction of digital technologies can bring business processes restructuring, changes in system architectures, problem framing issues, and interaction among value chain partners (Abrell et al., 2016). Challenges may also arise due to the complexity associated with the convergence of digital business models with traditional business models as well as embedding digital technologies into non-digital products and services (Nylen & Holmstrom 2015; Henfridsson et al., 2014). Adopting digital technologies can engender new products and novel business processes that require major organizational transformation. However, little is known about the enablers of digital transformation (Yoo et al., 2010). There is still a lack of a theory driven antecedents of digital transformation. Thus, the objective of this research is to fill this gap, in both IS and management literature, by identifying and empirically testing the antecedents of digital transformation.

One of the key driving forces of digital business is the IT capability within the organization. Recognizing the role of technology in attaining the appropriate digital transformation and motivated by the call to link IT capability to competitive advantage (Chen et al., 2014; Sambamurthy et al., 2003), the current study explores the mediating effects of digital transformation in the relationship between IT capability and firm performance. Given that appropriate digital business strategy cannot be established without digital transformation, understanding key factors that can influence the digital transformation is very important. Although prior research has advocated the need to develop appropriate digital business strategies and the need to evolve towards greater digitization (for example, Mithas et al., 2013, Bharadwaj et al., 2013), theoretical frameworks are yet to identify antecedent and consequence of digital transformation. As a result, there is still a lack of empirical evidence on the role of digital transformation. Thus, the objective of this study is to fill this important gap in both IS and management literature by investigating the mediating roles of digital transformation in the relationship between IT capability and firm performance. More specifically, this study, drawing from resource-based view (RBV) theory, investigates a fundamental research question: To what extent does the strategic integration of digital transformation influence the relationship between IT capabilities and organizational performance?

Our study attempts to answer the research question by conceptually and empirically testing a research model through a survey data collected from chief information officers (CIO) across United States-based firms. While studies within the IS literature have shown the importance of emerging digital technologies and the need to develop a digital business strategy (Bharadwaj et al., 2013; Mithas et al., 2013), the current study furthers our understanding on how IT capability affect digital transformation, a pre-condition to attaining digital business strategy. Similarly, by investigating IT capability as an antecedent

of digital transformation, this study has the potential to offer managers and top management practical insights on how to establish successful digital footprint in an increasingly digital economy.

Theoretical background

Resource-based view theory

The resource-based view has been extensively used within the IS literature to explain how firms are able to gain competitive advantage and superior performance. At the core of the theory is that superior firm performance is attributable to resources and skills that are firm-specific, rare, and difficult to imitate by rival firms (Barney, 1986; Bharadwaj, 2000). As a result, firms can achieve competitive advantage by acquiring or developing organizational capabilities that are rare, non-substitutable, and not subject to imitation (Barney, 1991; Amit & Schoemaker, 1993). Furthermore, the theory assumes that skills, capabilities and other resources that organizations possess differ among organizations and such resources are the primary determinants of firm performance. Thus, firms that are able to identify the characteristics of resources or capabilities that are not subject to imitation by competitor will attain sustainable competitive advantage (Barney, 1991; Daft 1983). Indeed, scholars have noted the importance of IT capability as a key organizational capability and consistent with the view of RBV, found that an IT capability that shares the characteristics of rarity, non-substitutability and non-replicability can foster superior firm performance (Wade & Hulland, 2004; Chen et al., 2014). Nevertheless, in investigating how IT capability leads to superior performance, evidence suggest that outcome variations in firms' performance may be explained by how IT capability leverages the value of other resources and capabilities within the organization (Ravichandran et al., 2005; Radhakrishnan et al., 2008). The perspective taken in this study is that IT capabilities are valuable resources however, these IT resources may contribute indirectly by influencing other resources or capabilities within the firm (Kohli & Grover, 2008).

IT Capability

IT capability describes a firm's ability to assemble and deploy IT-based resources in combination with other firms' resources (Bharadwaj, 2000). Some scholars have argued that IT capability is more than just an ability that a firm possesses, but rather a complex package of IT-related resources, skills and knowledge that enable firms to coordinate activities and other resources to produce desired results (Stoel & Muhanna, 2009). Firms with the ability to plan and integrate their IT resources are more positioned to capture information about customers, share knowledge and improve business processes (Karimi et al., 2001; Mithas et al., 2011). To attain superior performance from IT resources, the resource-based view of IT advocates that firms need to create a firm-wide IT capability by combining IT infrastructure, human IT skills, and IT-enabled intangibles with other firm-specific resources (Bharadwaj, 2000; Wade & Hulland, 2004). Directly to this point, the impact of IT capability on firm performance has received a lot of positive attention with studies suggesting that firms with superior IT capability tend to outperform their competitors (Bharadwaj, 2000; Mithas et al., 2011). Consistent with resource-based view, for an organizational capability to be a source of competitive advantage, it has to be considered relative to other rival firms. However, the era of homogeneity and ubiquitous best practice solutions, such as enterprise systems, has led IS scholars to question the ability of IT capability to directly impact firm performance. In an attempt to reconcile the evolving status of IT as a capability and its impact, some studies have argued that competitive advantage from IT capability is a function of whether or not firms take full advantage of their existing IT capability (Bhatt & Grover, 2005; Rai & Tang 2010; Chen et al., 2014). Similarly, some scholars have observed that firm capability or resource are not valuable in isolation, rather they are valuable when used to exploit opportunities (Barney, 1991; Stoel & Muhanna 2009). In an increasingly digital business environment, IT capability has re-emerged as an important mechanism through which firms can create pervasive digital connections among activities and entities within the value chain. Thus, an organization's IT capability enables firms to take advantage of emerging digital technologies and respond to the changing market demands.

Both strategic management and IS literature identify IT capability as a multi-dimensional latent variable with various dimensions contributing to its makeup (Chen et al., 2014; Lu & Ramamurthy, 2011). Consistent with prior literature, this model conceptualizes IT capability as a latent construct with three dimensions namely: "IT infrastructure capability", "IT business spanning capability", and "IT proactive

stance” (Lu & Ramamurthy, 2011). IT infrastructure capability refers to a firm’s architecture, data management services, application platforms. This capability enables a firm to build a robust communication and integration system within and across organizational boundaries. IT business spanning capability is a measure of a firm’s ability to envisage and apply IT resources to support business goals and objectives. IT proactive stance refers to the ability of a firm to actively and constantly search for innovative ways of using IT resources to identify and create new opportunities and ideas (Fichman, 2004). The perspective taken in this study is that a firm with a high IT capability is expected to demonstrate greater capability in each of the three aforementioned dimensions.

Digital Transformation

Digital technologies such as analytics, big data, cloud, social media, mobile platforms and intelligent solutions are driving innovations reshaping business models and reinvesting the way organizations are running business operations (Markus & Loebbecke 2013; Westerman et al., 2014; Pagani, 2013). Digital transformation refers to changes and transformations that are driven and built on a foundation of digital technologies. Within an enterprise, digital transformation is defined as an organizational shift to big data, analytics, cloud, mobile and social media platform. Whereas organizations are constantly transforming and evolving in response to changing business landscape, digital transformation are the changes built on the foundation of digital technologies, ushering unique changes in business operations, business processes and value creation (Libert et al., 2016). For instance, Libert et al. (2016) distinguished between digital upgrade, which is the use of digital technologies to increase efficiency and effectiveness in a firm’s business processes, and digital transformation, which occurs when digital technologies are used to radically change the overall business operations, value creation and in some case new digital product offerings. Through digital transformation, organizations are able to integrate digital technologies in many facets of their operations and are also able to engage customers with emerging digital innovations (Aral & Weill, 2007). Possessing traditional IT capability does imply the ability to transition to emerging digital transformation (Anand et al., 2010). Anecdotal evidence suggests that firms that have successfully applied digital transformation are superior at generating revenue using their existing resources (Westerman et al., 2014). Hence, firms that have embraced digital transformation are able to effectively utilize the pervasive digital connections and communications among principal partners within the value chain.

Innovation

Innovation has long been a central theme in the business strategy literature. Innovation can be defined as the creation and discovery of new ideas, practice, process, product or services (Daft, 1978, Thompson, 1965, p.36). Innovations are non-routine, significant and involve the altering of existing organizational competencies (Mezias & Glynn 1993). In an increasingly competitive business landscape, innovation is recognized as a key enabler for firms seeking to create value and sustainable competitive advantage (Wang & Wang 2012). Innovation can be delineated into two levels namely: improvements and new directions (Verganti 2016). While improvements are novel solutions aimed at optimally satisfying existing definition of value or problems that are well established (Verganti 2016), new direction innovations are more radical creating a new set of value proposition and a new path. The emphasis on innovation has led to significant investigations by practitioners and researchers alike seeking to understand the role of innovation in firm performance (Datta & Roumani 2015). Not surprisingly, firms with greater innovativeness have demonstrated greater abilities to develop new capabilities and respond to evolving business climate leading to better performance (Calatone et al., 2002).

Firm performance

Firm performance is a measure of how well a firm is able to meet its goals and objectives compared with its primary competitors (Cao & Zhang 2011). In general, superior firm performance is typically characterized with profitability, growth and market value (Cho & Pucik, 2005). As expected, much scholarly attention has been directed toward understanding the causal structure of firm performance and explaining the variations in performance among competing businesses (March & Sutton, 1997).

Research Model and Hypotheses

Building on the background literature discussed above, Figure 1 provides a research model underlying our study. The study proposes that IT capability has an indirect effect on firm performance and that digital transformation mediates this relationship. The specific hypotheses are discussed below.

The Effect of IT Capability on Digital Transformation

Anecdotal evidence suggests that a firm's digital posture is a function of its organizational IT capabilities (Aral & Weill, 2007), thus IT capabilities is required to pursue an effective digital business strategy (Mithas et al., 2013; Aral & Weill, 2007). For example, organizations such as Amazon, Unilever and P&G have, over the years, built IT capabilities that enable high digital transformation in product offerings, services and other activities in their respective value chains (Galante et al., 2013). Consistent with RBV, for IT capability to be a source of firm performance, the capability will have to be evaluated relative to other competing firms. In the face of digital transformation, firms with IT-based resources, knowledge and skills are more likely to evolve from pure information systems applications and utilization to specific digital technologies such as social media, mobile and big data analytic. Firms with superior IT capabilities are able to create digital transformation by redesigning and rethinking existing business processes and by transforming traditional product, service and customer offerings to digital offerings. Given that firms need to leverage IT capability in order to achieve digital transformation, this study argues that possession of IT capabilities will likely yield greater digital transformation as firms attempt to take advantage of prevalent digital marketplace. Thus, this leads to the first hypothesis:

H1: There is a positive relationship between IT capability and digital transformation.

The Effect of IT Capability on Firm Performance

Positive performance implications arising from IT Capability has been attested in empirical studies such as Hitt & Brynjolfsson (1996), Bharadwaj (2000) and Santhanam & Hartono (2003). IT Capability allows firms to improve business processes, operations and efficiency of business performance (Melville et al., 2004; Stoel & Muhanna, 2009; Chen et al., 2014). Nonetheless, emerging IS literature continues to question the direct implication of IT capability on firm performance (Carr, 2003; Chen et al., 2014). For instance, Mithas et al. (2011) found that IT capability contributed to firm performance by enabling other firm capabilities such customer management capability, process management capability and performance management capability. There is a lack of agreement in the IS literature about how IT capability enables firm performance (Melville et al., 2004; Kohli & Grover, 2008) with some studies suggesting that linkage between IT capability and firm performance should be re-examined (Chen et al., 2014). Yet scholars argue that IT capability continues to play an important role in firm's performance. Indeed, IT capability enables firms to create market niche and differentiate their product offerings in an increasingly competitive business landscape (Tan & Teo, 2000). Similarly, Bharadwaj (2000) analyzed firms' performance using profit and cost-based performance matrix and found that firms with higher IT capability tend to outperform their rivals. Thus, firms with higher IT capability are more able to mobilize, deploy and leverage IT resources with other existing resources to achieve better performance. This leads to the second hypothesis:

H2: There is a positive relationship between IT Capability and firm performance.

The Effect of Digital Transformation on Innovation.

Naturally, digital transformation enables organizations to take advantage of the pervasive digital connection of people, data, information and knowledge. Anecdotal evidence suggests that digital transformation nurtures digital business strategy leading to process improvement and modularization (Bharadwaj et al., 2013). Organizations that have embraced digital transformation are able to introduce new practices and innovative initiatives within their business operations (Diaz-Chao et al., 2015). As a result, digital transformation enables 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 (Bharadwaj et al., 2013; Westerman et al., 2014). Therefore, we would expect the following relationship to hold true:

H3: There is a positive relationship between digital transformation and innovation.

The Effect of Digital Transformation on Firm Performance.

As digital transformation increases, firms are able to achieve improved customer offering through greater customization, increased customer satisfaction and reduced cost of selling (Mithas et al., 2005; Brynjolfsson & Hitt, 2000). Prior studies on the implications of digital technologies suggest that digitalization can positively influence firm performance. Firms using more digitally embedded business processes obtain higher performance benefits from their IT capabilities (Brynjolfsson & Yang, 1997). Digital integration among suppliers and value chain partners are capable of reducing coordination cost (Malone, 1987) transaction cost (Williamson, 1975) and agent cost through increased communication, transparency and monitoring (Aral & Weill 2007). Companies such as Best Buy and Starbucks are leveraging on digital technologies as they attempt to improve performance through the transformation of customer-side business operations and the synchronization data, information and ideas (Kovac et al., 2009; Setia et al., 2013). Hence, we hypothesize the following:

H4: There is a positive relationship between digital transformation and firm performance.

The Effect of Innovation on Firm Performance.

The impact of innovation on firm performance has been noted in prior literature (Hsu & Sabherwal 2012; Wang & Wang 2012). In an increasingly competitive and uncertain business environment, innovation has emerged as an important means of survival and growth for businesses (Gronhaug & Kaufmann 1988). Innovation improves organizational efficiency, adds potential value and brings intangible resources to the firm (Wang & Wang 2012). Firms with greater innovativeness are more responsive to customers' needs and are able to develop more capabilities leading to better performance (Calantone et al., 2002). Over a cross-section of industries, innovative firms are able to increase their market shares and develop unique market niches that may not be readily available to their competitors (Liao et al., 2010; Robinson 1990). Thus, innovation has been emphasized as a means of gaining and sustaining superior profit margin (Brown & Eisenhardt 1997). Therefore, we would expect the following relationship to hold true:

H5: There is a positive relationship between innovation and firm performance

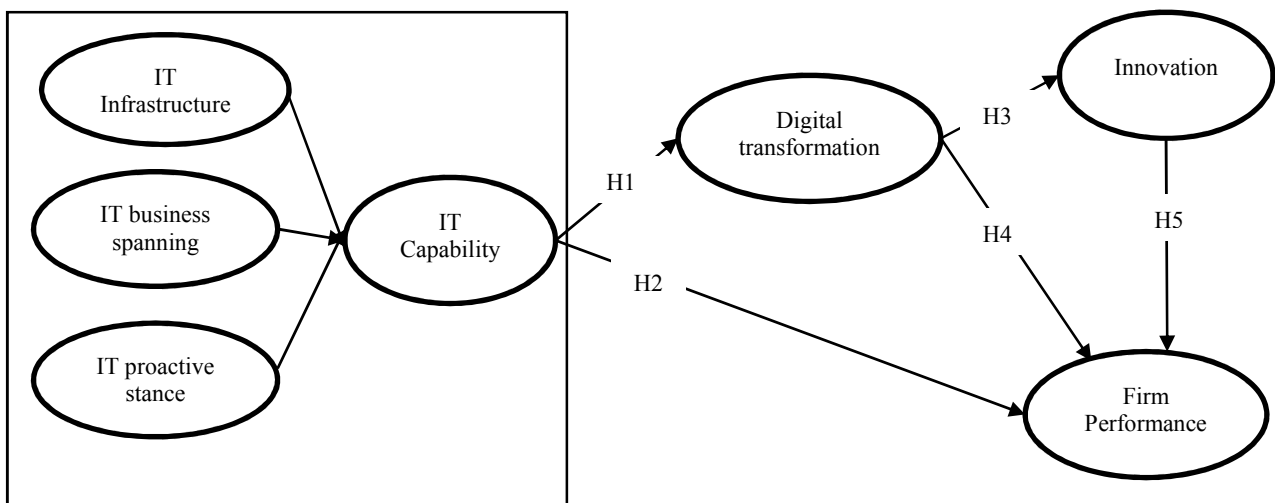


Figure 1: Conceptual model

Control variables

This study included firm size and the type of industry as control variables in an attempt to minimize the confounding effect of spurious correlation. Our choice to include firm size as a control variable is based on prior studies which found that firm size affects firm's performance and innovativeness (Kim & Lee, 2010) and that firm performance differences attributable to interindustry variances (Hendricks & Singhal 2001).

Research Methodology

Participants and Procedures

In order to validate the research model, we collected data in early 2015, through a mail based survey and used secondary data. The subjects were chief information officers (CIO), vice presidents of IT operations, and IT executives of US firms. Following a comprehensive investigation of existing literature, interviews, and reviews from individuals with extensive knowledge of digital businesses and IT innovations, we designed our survey instrument. Our preliminary survey was reviewed by IT professionals and doctoral students of a large public university in the United States with knowledge of the area. Reviewers were invited to match the survey question to the appropriate constructs in order to determine whether the items represented the constructs of our model. This helped us to establish face and content validity. Furthermore, changes were applied to existing constructs in order to remove any ambiguities. When developing the scale, we followed Churchill (1979) procedure and we used previously validated scales to fit the dimensions and constructs of our research model. After incorporating suggested modifications, the modified questionnaire was pilot-tested by IT executives and went through two iterations before being used in the survey. Using perceptual measures and a single informant requires obtaining the response from the experienced and knowledgeable (Huber & Power, 1985). Prior literature suggests using CIO as respondents for questions on the use of IT within the organization (DeLone & McLean, 1992). Single source respondent can lead to common source bias; thus respondents were advised that results would be completely anonymous. Furthermore, we applied Nunnally and Bernstein (1994) recommended questionnaire design strategies to minimize common source bias. First, in the framing of the responses, we avoided implying that one response is more acceptable than the other. Second, we made all the responses of equal effort. Third, we paid attention to item wording. Finally, we tried to avoid socially desirable responses.

Table 1 Sample Characteristics

Classification	(%) Respondents
1. Industry	
Arts Entertainment & Recreation (NAICS 71)	15
Construction (NAICS 23)	14
Finance and Insurance (NAICS 52)	16
Information (NAICS 51)	18
Manufacturing (NAICS 31-33)	14
Retail Trade (NAICS 42)	20
Other	3
2. Firm's size - Number of employees	
Less than 500	24
500 -999	35
1,000 - 4,999	25
above 5,000	16

3. Respondent's job title	
Chief Information Officer	64
Chief Technology Officer	17
IT Director	10
Vice President of IT	9

The finalized sample was administrated to a stratified random sample of 1000 CIOs in firms across the United States. When using perceptual measures and single respondents, it is necessary to solicit data from the most qualified and well-informed individuals (Huber & Power, 1985). This argument shaped our choice of CIOs and IT executives as the key informants. Multiple phone calls to non-respondents and two waves of mailing yield 167 usable responses, for a response rate of 16.7%. Table 1 provides sample characteristics information.

Constructs and Measures

Appendix 1 contains the final set of measurement items used to measure each construct and the original source of these measurement items. Whenever possible, this study used previously validated measures and adapted them in the context of this study. These constructs were measured with multiple indicators coded on a seven-point Likert scale. As there was no existing measure for digital transformation, this study developed new a measure to capture the construct. The theoretical domain for digital transformation scale items was drawn from IS literature (e.g., Bharadwaj et al., 2013; Aral & Weill, 2007; Westerman et al., 2014).

Analysis and Results

The analysis and empirical validation of the research model was done using Partial Least Square (PLS) analysis. The choice of PLS was informed by the robustness of PLS in cases of small samples (e.g., Fornell and Bookstein, 1982) and because of its ability to specify and test path models with latent constructs. The sample size of 167, although considered acceptable in IS research, is still small. Furthermore, PLS does not necessitate any assumptions of multivariate normality (Chin et al., 2001; Hair et al., 1998) and is suited for complex models with latent variables. More specifically, this study used SmartPLS 2.0 (Ringle et al., 2005) for the analysis. A bootstrap procedure was used to assess the statistical significance of the loadings and of the path coefficients (Ringle et al., 2005). Bootstrapping is a non-parametric approach for estimation by re-sampling the original data with replacement to get an estimate for each parameter in the PLS model (Chin, 2001). The hypotheses were supported if the measurement model reported acceptable levels of reliability, convergent and discriminant validity, and if the parameter estimates of the structural path were statistically significant.

Assessment of Potential Response Bias and Common Method Bias

This study ensured that the responses in the sample were free from the threats of non-response bias and common method bias. First, the sample was split into two groups based on the time each response was returned. Then, the sample was tested to determine statistically whether later respondents were significantly different from earlier respondents. The results revealed no significant differences between the two groups thus, indicating that non-response bias was not a significant concern that could confound this study's findings. Second, this study followed Liang et al. (2007) procedure to test for common method bias in PLS. This procedure involves including a new factor "method" in the research model and comparing this method factor with each indicator's variances. The results showed method loadings were not significant and that indicators substantive variances were substantially larger than their method variances. Third, this study conducted Harman's one-factor test on each of the constructs (Podsakoff et al., 2003). Common method bias is present when one single factor accounts for the majority of the covariance among the variables. The results revealed that the most covariance explained by one factor was 23.67 percent, which suggest that common method bias was not present in the study. Therefore, the study concluded that common method bias was not a serious concern.

Measurement Model and Construct Validity

We conducted various tests to assess and examine the psychometric properties of the measurement model. Confirmatory factor analysis (CFA) was conducted for all the latent variables used in the model. The results revealed that all the indicators loadings were greater than .70, as recommended by Hair et al. (1998), an indication that the items are representative of their respective constructs. Furthermore, the items loadings were found to be much higher than all cross-loadings. See Table 2.

Table 2: PLS confirmatory factor analysis and cross loadings

	FP	IN	DT	ITI	ITB	ITP
FP1	0.892	0.432	0.322	0.233	0.202	0.279
FP2	0.871	0.331	0.233	-0.12	0.141	0.313
FP3	0.901	0.298	0.366	-0.34	0.341	0.274
FP4	0.851	0.312	0.234	0.345	0.111	0.299
IN1	0.374	0.873	0.312	0.238	0.318	0.319
IN2	0.391	0.841	0.367	0.321	0.279	0.289
DT1	0.344	0.234	0.899	0.256	0.364	0.391
DT2	0.317	0.311	0.874	0.311	0.297	0.287
DT3	0.319	0.319	0.892	0.349	0.277	0.259
ITI1	0.231	0.411	0.291	0.872	0.255	0.228
ITI2	0.274	0.336	0.289	0.899	0.281	0.231
ITI3	0.302	0.327	0.307	0.869	0.216	0.317
ITI4	0.317	0.315	0.313	0.891	0.189	0.123
ITB1	0.295	0.218	0.301	0.311	0.892	0.267
ITB2	0.241	0.255	0.294	0.219	0.881	0.197
ITB3	0.271	0.296	0.297	0.287	0.908	0.201
ITB4	0.253	0.217	0.341	0.187	0.899	0.232
ITP1	0.261	0.167	0.305	0.263	0.322	0.892
ITP2	0.317	0.229	0.297	0.234	0.287	0.871
ITP3	0.309	0.218	0.318	0.228	0.239	0.864
ITP4	0.299	0.299	0.277	0.233	0.225	0.898

Convergent validity was assessed by examining the significant factor loading on each construct. Convergent validity is present when scores of items used to measure a construct load significantly on their designated latent variables (Anderson & Gerbing 1988). Discriminant validity was tested by examining factor correlations (Kling, 2001; Chin 2001) and whether the square root of the average variance extracted (AVE) for each construct was greater than its correlation with the other factors (Gefen et al., 2000). Table 3 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. Thus, Table 3 presents sufficient evidence of discriminant validity of the constructs.

Table 3: Correlations

Variables	Mean	SD	ITC	DT	IN	FP
IT Capability	5.13	1.37	0.90			
Digital Transformation	4.61	1.25	0.21	0.87		
Innovation	5.11	1.29	0.43	0.31	0.89	
Firm Performance	4.91	1.17	0.37	0.28	0.21	0.91

Notes: Diagonal elements are the square roots of AVE extracted

Structural Model Testing

In PLS analysis, examining the structural paths and the R-square scores of the endogenous variables, assess the explanatory power of the structural model. A bootstrapping procedure with 167 cases and 10,000 resamples was used to test the significance of all paths in the research model (Hair et al., 2011). The results of the structural model are shown in Figure 2. The results suggest that the model is capable of explaining 41% of the variance of firm performance. Overall, all hypotheses were supported. In support of hypothesis 1, IT Capability has a significant positive impact on digital transformation ($\beta = 0.34$, $p < 0.001$). Similarly, in support of hypothesis 2, IT Capability has a significant positive relationship with firm performance ($\beta = 0.19$, $p < 0.01$). Hypothesis 3 states that digital transformation is positively related to innovation. This hypothesis was supported ($\beta = 0.28$, $p < 0.001$). The results provide strong support for the significant positive relationship between digital transformation and firm performance ($\beta = 0.31$, $p < 0.001$), thus providing support for hypothesis 4. Finally, in support of hypothesis 5, the results reaffirm the positive role of innovation on firm performance ($\beta = 0.34$, $p < 0.001$).

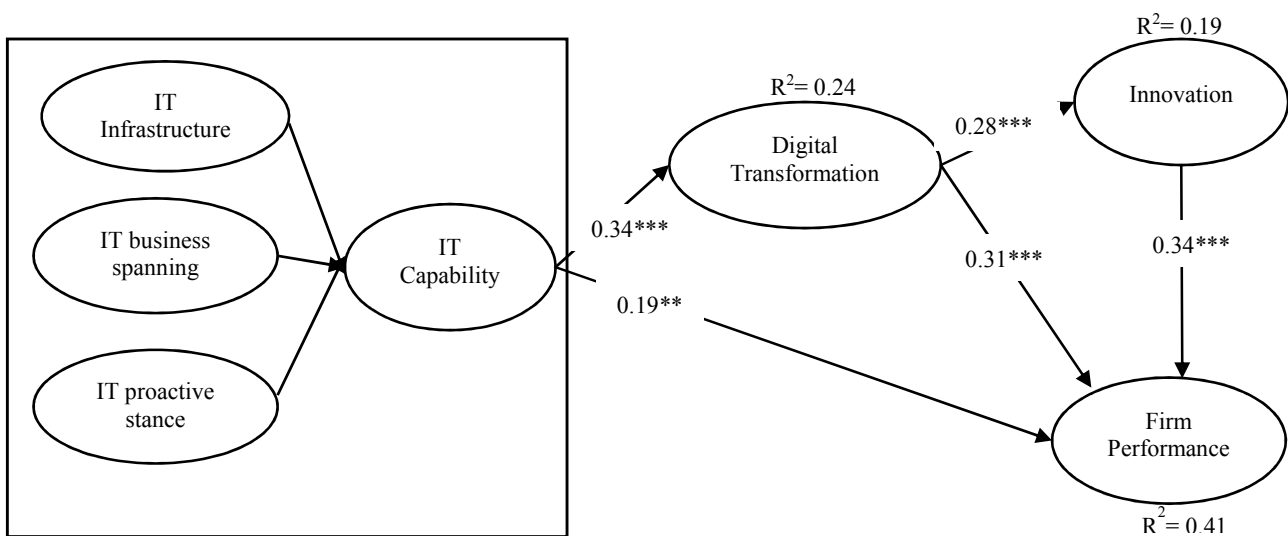


Figure 2: Research model with results (***) significant at $p < 0.001$, (**) significant at $p < 0.01$)

Mediation Effects of Digital Transformation

In order to examine this mediating effect, we used Sobel test procedure and two regression models. The Sobel test was significant ($z = 4.49$, $p < 0.001$), implying that there is an indirect effect within the research model. The regression models tested if the relationship between IT capability and firm performance was significantly reduced or completely diminished when digital transformation is introduced into the model. Our results reveal that IT capability had a positive significant effect on the mediator digital transformation ($\beta = 0.22$, $p < 0.001$) as well as a positive effect on firm performance ($\beta = 0.26$, $p < 0.001$). As seen in Figure 2, when digital transformation is integrated in the relationship between IT capability and firm performance, the significant effect of IT capability and firm performance ($\beta = 0.19$, $p < 0.01$) decreased while the influence of digital transformation on firm performance increased ($\beta = 0.31$, $p < 0.001$). This implies that digital transformation partially mediates the influence of IT capability on firm performance.

Discussion and Conclusions

This study examined the mediating role of digital transformation in the relationship between IT capability and firm performance. Using RBV theory, a theoretical framework explaining the effect of digital

transformation was tested using a survey of 167 CIOs from firms across the United States. Consistent with our proposed model, this research finds that IT capability positively influences digital transformation. This research study finds empirical support for mostly anecdotal evidence regarding the impact of digital transformation on firm performance. Surrounded by the emergence of so many digital technologies from social media to mobile platforms to big data, organizations can drive performance by using digital technologies to drive unprecedented convergence of people, business and things.

Also, this study reveals that digital transformation plays a more nuanced role by mediating the influence of IT capability and firm performance. Firms must recognize the importance of digital transformation and how to leverage the effect of IT capability in creating and fostering firm performance. This finding is particularly interesting because it underscores the importance of digital transformation in supporting and fostering firm performance. Firms investing in digital transformation are able to align digital insights about customers with innovative processes and investments leading to improved customer experience and performance.

Implications for theory

This study offers several theoretical implications. First, the findings suggest that the effect of IT capability on firm performance may be mediated by digital transformation. To our knowledge, this is one of the first research studies that offer an empirical evidence for the association between IT capability and digital transformation. The theoretical model identifies IT capability as a key antecedent of digital transformation, thus advancing our knowledge on how firms can use IT capability and achieve performance. Therefore, this study extends prior work in IS research that seeks to reconcile the underlying apparatus through with IT capabilities impacts firm performance (Chae et al., 2014; Kohli & Grover, 2008). Secondly, although prior studies have shown the influence of IT capability and firm performance (Bharadwaj, 2000; Wade & Hulland, 2004), less is known about the relationship with digital technologies. The empirical validation of the proposed model adds to the theoretical development of digital business strategic stream thus, separating this study from existing research that largely offer anecdotal evidence on digital business technologies.

Implications for practice

Our research has implications for managers and organizations. Specifically, the study will be of practical importance to managers and executives who struggle to develop and integrate digital technologies with their business processes. This study reveals that IT capability is a driving force behind establishing digital transformation. However, while the direct impact of IT capability on firm performance may be decreasing, further exploration is needed to examine how IT capability may contribute indirectly by influencing other resources, capabilities, and core competencies within organizations. This study fills the void and reveals that creating digital transformation through existing capabilities can drive performance. Furthermore, this study underscores the need to be aware of the digital footprint of a firm's industry. The ability to develop and nurture IT capability to achieve firm performance may be enabled by the digital transformation established within the organization.

Limitations and future research

Although this study makes a number of contributions, like all other research studies, it has some limitations. First, the study used a small number of variables that may affect digital transformation. While IT capability plays a critical role in influencing digital transformation, other factors, such as financial resources, may affect how such firms use and apply digital technologies. Future studies that consider a comprehensive taxonomy may be needed. Therefore, it is important not to delimit digital transformation to organizational context while ignoring the social context in which the system is used. Second, IT capability was examined at the firm level. However, this study recognizes that some initiatives associated with IT capability will inevitably occur at the individual level. Nevertheless, sample of respondents were obtained from top management, indicating that our results capture true positions about IT use in these firms. Finally, although the study hypothesized causal relationships between many of the key constructs, it is important to emphasize that the cross-sectional data-collection approach does not define an optimal lag between IT capability, digital transformation, and firm performance. This issue is prevalent in most

extant research, given the complexities and noise involved in gauging an exact temporal lag between the cause and the outcome. Therefore, future studies can dig deeper with an in-depth process model to examine the longitudinal path of digital transformation.

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Appendix 1

Construct	Measurement item	Loading
IT Infrastructure (Bharadwaj et al. 1998 Ross et al. 1996 Weill et al. 2002) CR = 0.92	Relative to other firms in your industry, please evaluate your firm's IT infrastructure capability in the following area on a scale of 1 - 7 (1 = poorer than most; 7 = superior to most). ITI1: Data management services & architectures (e.g., databases, data warehousing, data availability, storage, accessibility, sharing etc.) ITI2: Network communication services (e.g., connectivity, reliability, availability, LAN, WAN, etc.) ITI3: Application portfolio & services (e.g., ERP, ASP, reusable software modules/components, emerging technologies, etc.) ITI4: IT facilities' operations/services (e.g., servers, large-scale processors, performance monitors, etc.)	87 90 87 89
IT business spanning (Bharadwaj et al. 1998 Mata et al. 1995) CR = 0.92	Relative to other firms in your industry, please evaluate your organization's IT management capability in responding to the following on a 1 to 7 scale (1 = poorer than most, 7 = superior to most). ITB1: Developing a clear vision regarding how IT contributes to business value ITB2: Integrating business strategic planning and IT planning ITB3: Enabling functional area and general management's ability to understand value of IT investments ITB4: Establishing an effective and flexible IT planning process and developing a robust IT plan	89 88 91 90
IT Proactive stance (Lu & Ramamurthy 2011; Weill et al. 2002) CR = 0.90	Relative to other firms in your industry, please evaluate your capability in acquiring, assimilating, transforming, and exploiting IT knowledge in the following areas on a 1 to 7 scale (1 = strongly disagree, 7 = strongly agree). ITP1: We constantly keep current with new information technology innovations ITP2: We are capable of and continue to experiment with new IT as necessary ITP3: We have a climate that is supportive of trying out new ways of using IT ITP4: We constantly seek new ways to enhance the effectiveness of IT use	89 87 86 90

<p>Digital Transformation Aral & Weill 2007 CR = 0.89</p>	<p>Relative to other firms in your industry, please identify the degree to which your company uses digital technologies on a 1 to 7 scale (1 = strongly disagree, 7 = strongly agree).</p> <p>DT1: Our firm is driving new business processes built on technologies such as big data, analytics, cloud, mobile and social media platform. DT2: Our firm is integrating digital technologies such as social media, big data, analytics, cloud and mobile technologies to drive change. DT3: Our business operations is shifting toward making use of digital technologies such as big data, analytics, cloud, mobile and social media platform.</p>	<p>90 89 87</p>
<p>Innovation Hsu & Sabherwal 2012 CR = 0.88</p>	<p>Please identify the degree to you agree with the statement on a scale of 1 to 7 (1 = strongly disagree, 7 = strongly agree).</p> <p>IN1: Our firm develops and produces new products or services continually. IN2: Our firm gives priority to making efforts to increase the quality of products or services.</p>	<p>87 84</p>
<p>Firm Performance Tippins & Sohi 2003 CR = 0.89</p>	<p>Relative to other direct competitors, indicate how well your firm performed during the last 3 years</p> <p>FP1: Profitability FP2: Customer retention FP3: Return on Investment FP4: Sales growth</p>	<p>89 87 90 85</p>