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Impact of IT governance mechanisms on IT-enabled dynamic capabilities to achieve firm performance: role of moderators

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Aboobucker Ilmudeen
Department of Management and IT, Faculty of Management and Commerce, South Eastern University of Sri Lanka, Oluvil, Sri Lanka, and
Alaa A. Qaffas
Department of Management Information Systems, College of Business, University of Jeddah, Jeddah, Saudi Arabia

Abstract

Purpose – Although information technology (IT) governance and IT capability have been extensively examined, the impact of IT governance mechanisms on IT-enabled dynamic capability (ITDC) with moderators has received less attention. This study investigates how the impact of IT governance mechanisms on firm performance is achieved through an ITDC through the moderating role of IT governance decentralization and a turbulent environment.

Design/methodology/approach – This study extends from the traditional view of IT capabilities and integrates dynamic capability theory to propose that IT governance is vital for the ITDC. Path analysis, hierarchical regression analysis and moderation analysis were performed using partial least squares (Smart PLS 3.0) as the data analysis methods. This study empirically tests the proposed mediated moderation model by using data collected from 254 firms in China to test the hypotheses.

Findings – Significant and impactful relationships are found in the model that includes turbulent environment moderating effects. Contrary to expectations, IT governance decentralization is also significant but not very strong.

Research limitations/implications – This study's findings have implications for investigating IT governance, IT-enabled capabilities and moderators. Accordingly, this study has implications for board and executive management to capitalize on dynamic IT capability, to keep pace with the challenges and turbulent conditions associated with business needs and for the productivity paradox in the context of Chinese firms.

Originality/value – This country-specific research study theoretically contributes to the IT governance, dynamic capabilities and turbulent environment in the information systems literature and proposes many practical guides to the board and executive management of companies in the Chinese context.

Keywords IT governance mechanisms, IT-enabled dynamic capability, Moderators, Firm performance

Paper type Research paper

1. Introduction

It is almost a truism that IT governance leads to a growing clock speed of enterprises that necessitates firms to govern IT investment (Turel *et al.*, 2017). Scholars have started to identify the importance of governance mechanisms that enable effective IT governance (Ali and Green, 2012; Héroux and Fortin, 2014; Prasad *et al.*, 2012). Despite the few studies examining the relationship between IT governance and firm performance, there is limited agreement on how IT governance drives firm performance (e.g. Wu *et al.*, 2015). Similarly, the traditional view of IT governance may not adequately address today's strategic, managerial and technological complexities (Dong, 2012). Furthermore, this situation no longer resembles what is happening in the real world, where firms are implementing a portfolio of IT

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governance mechanisms (Boh and Yellin, 2006). In prior studies, different perspectives on the effect of IT governance on firm performance have been reported. For instance, effective IT governance enables the generation of IT capability, which in turn results in superior firm performance (Zhang *et al.*, 2016). IT governance capabilities lead to IT-based synergies through IT-relatedness and business process-relatedness (Kude *et al.*, 2017). Prasad *et al.* (2012) found that a positive relationship exists between IT governance structures and IT-related capabilities that improve firm performance [1].

Many of the extant scholarly works broadly examined the relationship between IT capability and firm performance (e.g. Aral and Weill, 2007; Bharadwaj, 2000; Bhatt and Grover, 2005; Chen *et al.*, 2014; Ilmudeen and Yukun, 2018; Nevo and Wade, 2011; Tallon, 2008; Zhang *et al.*, 2016). The key conclusion of these scholarly works was that firms with superior IT capability generally attain greater firm performance. In addition, several researchers have argued that superior IT-enabled performance can be generated by unique and valuable IT resources (e.g. Nevo and Wade, 2011; Ravichandran *et al.*, 2005). Accordingly, it allows the reconfiguration and integration of IT and non-IT resources (Ilmudeen and Yukun, 2018; Mikalef and Pateli, 2017; Wang *et al.*, 2015) and the ability of IT-enabled firms to react to dynamic environments (Kim *et al.*, 2011; Pavlou and El Sawy, 2010). Today, firms are seeking to segregate themselves in the market by positioning IT to develop dynamic IT capabilities; as a result, they react to competitors' actions to replicate or improve these capabilities (Pavlou and El Sawy, 2010). Furthermore, the growing pervasiveness of IT-enabled dynamic capability (ITDC) in modern organizations has heightened the significance of adopting IT governance mechanisms.

Scholars have suggested that ITDC is required to achieve firm performance, particularly in turbulent environments (Mikalef and Pateli, 2017; Mikalef *et al.*, 2016). Specifically, China has transformed its economy to a larger market orientation. Thus, IT has been identified as a critical driver of business and economic success (Davison *et al.*, 2008; Dologite *et al.*, 1998). Similarly, Chinese firms have heavily invested in IT infrastructure and various information systems in recent years (Peng *et al.*, 2016; Shao *et al.*, 2016). Although IT deployment has increased vastly in China, empirical studies on the governance and management of IT-related issues in China are limited (Chen, 2010; Wang *et al.*, 2015; Zhong *et al.*, 2012). Similarly, IT investment and firm performance issues have been the focus of scholars and practitioners, but empirical examination in China is relatively scarce, and the results of a few existing studies are erratic (Peng *et al.*, 2016). However, prior research warrants further studies to shed additional light on the effects of IT governance on other aspects, such as structures and processes (Ali and Green, 2012), sustainable IT-related capabilities (Lockamy, 2011; Prasad *et al.*, 2012), IT-enabled capabilities [2] (Boh and Yellin, 2006) and the multifaceted nature of environmental dynamics (Dohale *et al.*, 2020; Xue *et al.*, 2011), including a call for a special issue in IS journals (Tiwana *et al.*, 2013). However, the extant literature does not address IT governance mechanisms in enabling ITDCs, which represents a significant research gap and thus far appears inconclusive. Hence, this study is motivated on the above basis and inspired by this research gap.

In an open system, environmental changes can affect a firm's resources. However, little is known about how environmental factors influence a firm's IT assets and IT management (Wang *et al.*, 2015). Furthermore, scholars have encouraged the study of firms' ability and early reactions to dynamic and turbulent market situations (e.g. Hashem and Aboelmaged, 2023; Pedroso *et al.*, 2020). In more turbulent environments, firms tend to decentralize IT governance. Thus, it offers greater autonomy over IT decisions (Xue *et al.*, 2011). Furthermore, by decentralizing IT governance, business units can configure existing applications or deploy new ones to address emerging opportunities in turbulent environments. In the past, studies on IT governance/IT management (e.g. Tallon, 2008; Xue *et al.*, 2011) fairly kept silent to uncover substantial evidence that the turbulent

environment is connected with the IT governance mechanism. Moreover, whether and how some moderating (e.g. IT governance decentralization) or contextual factors affect IT governance mechanisms have not been explored in depth. Understanding such effects not only advances theory but also helps firms acquire possible interventions that may help them grasp more business value or strategic decision-making. Hence, it is unclear how the impact of IT governance mechanisms can enable ITDCs to achieve firm performance in turbulent environments. Against these backdrops and motive considerations, this study tries to address the following questions.

(1) How does the impact of IT governance mechanisms drive ITDCs to achieve firm performance?

(2) How do IT governance decentralization and a turbulent environment amplify or attenuate the impact of the IT governance mechanism—the ITDC—and the ITDC–firm performance relationship?

This study aims to contribute to multiple streams of IS literature and has implications for research and practice. First, this study reveals how firms can drive ITDC and performance outcomes through IT governance mechanisms, thereby lengthening prior studies on IT governance and IT capability. Hence, this paper presents both the theoretical rationale and empirical evidence for the above performance outcomes in an emerging economy such as the Chinese context. As this is a country-specific research study, its findings extend to the information systems literature and propose many practical guides to the board and executive management of companies in the Chinese context. Second, the conceptualization of ITDCs in turbulent environments is a great move, thus inspiring an opening for future research on ITDCs. Third, the findings offer a more refined understanding of the relationship between IT governance mechanisms and ITDC in turbulent environments and increasingly competitive business landscapes. Hence, this study provides valuable guidance to industry leaders who are looking for strategies to formulate the IT governance mechanisms required to achieve ITDC. Furthermore, the moderating role of a turbulent environment and IT governance decentralization also add value to this study. Hence, the study's findings and implications bring many merits and novelty to this paper.

The remainder of the paper proceeds as follows. Section 2 discusses the theoretical background with a literature review, followed by the research model with hypothesis development (Section 3), the analyses (Section 4), the discussion of the results (Section 5) and the implications and conclusions (Section 6).

2. Theoretical foundation and hypothesis development

2.1 IT governance and IT capability

IT governance covers a set of mechanisms for ensuring the realization of IT capabilities (Zhang *et al.*, 2016). It contains structures, processes and relational mechanisms that work together as a whole to improve firm performance (Ali and Green, 2012; Héroux and Fortin, 2014; Wu *et al.*, 2015). IT governance requires a set of IT governance mechanisms to be implemented more effectively to inspire an analogy with the corporate mission, strategy, culture, values, norms and business processes (Ali and Green, 2012; Dong, 2012; Van Grembergen and De Haes, 2009; Wu *et al.*, 2015). The definition of IT capability varies in the literature; for instance, Lu and Ramamurthy (2011) defined IT capability as a firm's ability to acquire, deploy, combine and reconfigure IT resources in support and enrichment of business strategies and work processes. Conversely, Zhang *et al.* (2016, p. 362) defined IT capability as "the firm's ability to innovatively implement and deploy IT resources to obtain IT/business alignment and create competitive advantage." The notion of IT capabilities mainly builds on

the firm's resource-based view (RBV). However, the manner in which to theorize and measure the conception of how IT investments are leveraged to add value is limited (Mikalef and Pateli, 2016). IT capability is a set of IT resources and IT competencies that are necessary to aptly deliver IT solutions (Mikalef and Pateli, 2016). The IT function has its own rules, policies, business relationships and other compliance requirements essential for designing, deploying and managing IT infrastructure and supporting business needs (Kim *et al.*, 2011).

2.2 Resource-based view (RBV) and dynamic capability view (DCV)

Although the RBV helps explain how firms achieve competitive advantage, it does not sufficiently detail how firms achieve competitive advantage in rapidly changing dynamic environments (Almazmomi *et al.*, 2022; Zhou and Li, 2010). Because resources are circumstance-based, their values rest on the characteristics of the given environment; resources are also comparatively stickier than their environment, and their variations and adaptations often lag behind environmental changes (Teece *et al.*, 1997). The RBV provides a set of required conditions for realizing competitive advantage, but it does not indicate how competitive advantage is realized (Mikalef and Pateli, 2017). The RBV covers the notion of dynamic capabilities as a means to elucidate how firms respond to rapid changes in customer needs and business environments (Turel *et al.*, 2017). Researchers have stated that the dynamic capabilities view appears from the RBV of the firm (Yeow *et al.*, 2017) or that the extension of the RBV is the dynamic capability view (Kazmi and Ahmed, 2022). The RBV highlights resource selection (choosing resource combinations), whereas dynamic capabilities emphasize resource renewal (reconfiguring resources into new mixtures of operational capabilities) (Pavlou and El Sawy, 2011).

Dynamic capabilities are defined as "the firm's ability to integrate, build, and reconfigure internal and external competencies to address rapidly changing environments" (Teece *et al.*, 1997, p. 516). It enables firms to sense, seize opportunities, integrate, build and reconfigure resources and increase their competencies to cope with threats in the face of changing conditions to cope with threats and increase their competitiveness (Mikalef and Pateli, 2016; Zhang *et al.*, 2016). Due to environmental turbulence, a firm emphasizes the ITDC, which has noteworthy implications for how the IT function needs to be managed (El Sawy and Pavlou, 2008). Furthermore, IT is a tool that can be used during turbulent conditions where a more turbulent environment leads to greater need and more noticeable IT leveraging capabilities for organizations (Ilmudeen, 2022). To summarize, the traditional RBV underemphasizes the role of the turbulent environment, and dynamic capabilities overcome this limitation as more viable for responding to environmental turbulence (Nevo and Wade, 2011; Pavlou and El Sawy, 2011; Teece *et al.*, 1997). Dynamic capabilities are enabled to react to turbulent conditions by extending, modifying and reconfiguring current operational capabilities into new capabilities that fit the environment well (Ilmudeen, 2022). Scholars suggest that the dynamic view of firm performance offers substitute insight into the positive link between market share and productivity (Dawkins *et al.*, 2007). Hence, the dynamic capabilities view of the firm is a suitable theoretical background for elucidating how firms differentiate and compete, wherein firms advance and reconfigure their operations to stay competitive (Mikalef and Pateli, 2016).

2.3 IT-enabled dynamic capabilities (ITDC)

In the literature, dynamic capabilities have been characterized into different types. For example, Mikalef and Pateli (2017) categorized social media into five capabilities: sensing, coordinating, learning, integrating and reconfiguring. *Sensing* is the ability to identify, interpret and pursue opportunities in the environment (Mikalef and Pateli, 2017). Sheng (2017) claimed that firm sense-making is positioned as a dynamic capability that stresses the

internal processes of restoring capabilities to react to environmental changes and captures the generation, dissemination and responsiveness to market intelligence (Pavlou and El Sawy, 2011). Second, *coordinating* is the ability to orchestrate and deploy tasks and resources and synchronize activities with involved stakeholders (Mikalef and Pateli, 2017); thus, coordinating captures resource allocation, task assignment and synchronization (Pavlou and El Sawy, 2011). Third, *learning* refers to the capacity to acquire, assimilate and exploit new knowledge that enables informed decision-making (Mikalef and Pateli, 2017); thus, it captures the acquisition, assimilation, transformation and exploitation of knowledge (Pavlou and El Sawy, 2011). Fourth, *integrating* capability denotes the evaluation of firm and partner resources and capabilities and the capacity to embed and exploit them in new or restored operational capabilities (Mikalef and Pateli, 2017). It captures the contribution, representation and interrelation of individual inputs to the entire business unit (Pavlou and El Sawy, 2011). Fifth, *reconfiguration* is the capacity of firms to effectuate strategic moves and thus cope with the shifting business environment (Mikalef and Pateli, 2017).

2.3.1 IT governance mechanism and IT-enabled dynamic capability. Firms deploy a holistic mixture of various structures (connections), processes (coordination) and relational mechanisms (collaboration) that define a layered system of sequentially higher levels of capabilities (De Haes and Van Grembergen, 2013; Peterson, 2004). Firms with superior IT capabilities are better able to make meaningful decisions affecting IT investment and IT development (Zhang *et al.*, 2016). Hence, more developed IT governance mechanisms enable interactions between IT and businesspeople (Héroux and Fortin, 2018; Wu *et al.*, 2015), which, in turn, creates synergy for business-IT alignment, resulting in greater capability. IT governance denotes the strategic importance of IT; thus, a firm can enhance its IT resources, sustain its operations and extend its businesses, thus enriching its ability to leverage IT resources with other corporate resources (Zhang *et al.*, 2016). Effective IT governance does not occur by accident (Weill and Ross, 2005). For effective IT governance, horizontal integration capabilities—the ability to coordinate and integrate the formal and informal IT decision-making required for sustaining business value from IT in a complex and dynamic environment—should be the focus of research (Peterson, 2004). Prior studies argue that there is a positive link between IT governance and the possibility that a firm will cultivate greater IT capability (Zhang *et al.*, 2016). Hence, the first hypothesis is stated as follows:

H1. IT governance mechanisms have a positive impact on firm ITDC.

2.3.2 ITDC and firm performance. The IT capability literature shows that the ability to assemble and deploy IT-based resources is the basis of competitive advantage and determines firm performance (Barney, 1991). A firm can react amply and timely to external changes, which puts forth the notion of an ITDC (Mikalef and Pateli, 2016). Given the dynamic landscape of IT and a hypercompetitive environment (Bhatt and Grover, 2005), an ITDC must advance to stay competitive under increasingly unstable and dynamic market conditions (Pavlou and El Sawy, 2011; Teece *et al.*, 1997). An effective firm employs its technology base and human IT skills to develop IT-enabled intangibles such as synergy, customer orientation and superior firm knowledge (Bharadwaj, 2000). For example, the Walmart case is a well-publicized case for IT-enabled competency that streamlined its purchasing procedure, increased its operational efficiency, reduced its merchandise inventory and stock cost, supported its low-cost strategy and enhanced its operation and market performance (Wang *et al.*, 2012). Tan *et al.* (2019) suggested that IT-enabled operational agility can be nurtured through the development of resource-independent capabilities to provide effective sensing and response mechanisms for dynamic marketplace conditions. Dynamic IT capabilities are durably heterogeneous; hence, firms with robust dynamic capabilities can leverage feedback cycles of experience to build stronger or reconfigured IT capabilities (Lim *et al.*, 2011). Furthermore, Queiroz *et al.* (2017) suggested that a firm's IT application orchestration

capability allows it to continually refresh its IT application portfolio to reduce IT-based rigidities and accelerate reactions to market change, thus enabling improved agility, which in turn affects firm performance.

H2. ITDC has a positive impact on firm performance.

2.3.3 Moderating effect of IT governance decentralization. Decentralized IT governance offers greater autonomy over IT decisions; this autonomy decodes into improved ITDC only when it works with the modular design of IT. A decentralized decision-making structure is possible when decision authority resides mainly within business units (Boh and Yellin, 2006). IT governance decentralization allows changes to existing applications or the deployment of new applications to address evolving opportunities (Tiwana and Konsynski, 2010). Similarly, independent business units require decentralized IT governance to exploit business synergies, as they usually follow their own objectives (Tanriverdi, 2006). When environmental uncertainty increases from low to high, firms tend to first decentralize their IT infrastructure decisions to business units to improve their responsiveness. Then, their IT infrastructure decisions are centralized in headquarters as uncertainty increases further to achieve the benefits of coordination and to mitigate potential agency problems in uncertain environments (Xue *et al.*, 2011). Decentralization offers departmental control and possession of resources and superior responsiveness to business units' requirements (Boh and Yellin, 2006). For example, firms may collaborate with new suppliers to introduce their new products to the market. This initiative requires efficient coordination mechanisms, IT applications that help individuals collaborate with new suppliers and the integration of repositories and structures for storing and distributing newly acquired or codeveloped knowledge (Mikalef and Pateli, 2016). Decentralization cannot be used as an independent variable; rather, it can moderate the relationship between IT and firm performance (Mohamad *et al.*, 2017). In a similar vein, Tiwana and Konsynski (2010) posited that IT governance decentralization positively moderates the effect of IT architecture modularity on IT agility, which, in turn, drives IT alignment. Hence, we posit that IT governance decentralization will positively moderate the effect of the IT governance mechanism on ITDC and, in turn, achieve firm performance. The third hypothesis is stated as follows:

H3. IT governance decentralization positively moderates the effect of IT governance mechanisms on ITDC.

2.3.4 Moderating role of a turbulent environment. A turbulent environment can perhaps moderate the impacts of IT resources on competitive strategies so that IT resources are less powerful in dynamic environments (Wang *et al.*, 2012). Scholars have agreed that dynamic capability, or the ability to integrate, build and reconfigure resources, is crucial for competitive advantage under turbulent business environments (Teece *et al.*, 1997; Wu, 2010). Similarly, IT capability and IT-enabled resources become more valuable because they enable firms to effectively mobilize various types of IT assets and resources under dynamic environmental conditions (Chen *et al.*, 2014; Nevo and Wade, 2011). However, dynamic environments create uncertainty in market demand, unstable business opportunities and difficulty in predicting rival actions (Wang *et al.*, 2012). When an industry becomes more dynamic or fast-growing, a firm must react to a more diverse set of competitors, customers and suppliers in a timely manner. Hence, firms need to constantly integrate, build and reconfigure internal and external resources to address dynamic environmental changes (Wang *et al.*, 2012). In highly turbulent environments, it may be difficult to create and sustain a competitive advantage due to many concurrent changes and the speed of these changes may reduce any benefits generated (Chen *et al.*, 2014). As a result, fast-growing companies focus on innovation and time to market to maximize responsiveness to customer needs and minimize constraints on creativity in turbulent environments (Weill and Ross, 2005). As a

result, innovation gives the firm a workable competitive advantage that is authoritative in today's turbulent environment (Lee and Jungbae Roh, 2012). The more turbulent the environment is, the greater the ability of IT to support efficient market operations (Chen *et al.*, 2014). According to El Sawy and Pavlou (2008), the greater the turbulence of the business environment is, the more serious the enterprise's dynamic and improvisational capabilities become. Therefore, the following hypothesis is proposed:

H4a. A turbulent environment negatively impacts and decreases the influence of an ITDC on firm performance.

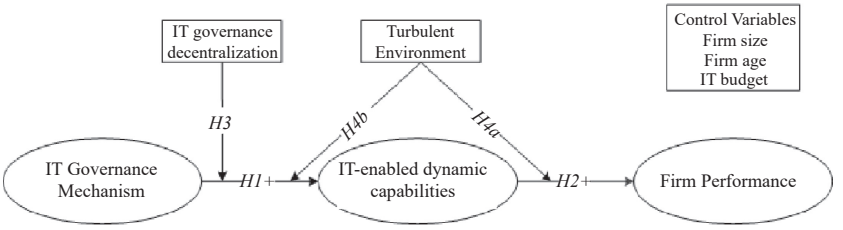
Environmental uncertainty and IT governance are multidimensional constructs; hence, mixed results have been obtained (Xue *et al.*, 2011). In turbulent environments, the effective management of IT infrastructure requires concurrent loose or tight control and modifications in response to changes in business requirements. Thus, mutual understanding is involved across business units, IT departments and IT vendors (El Sawy and Pavlou, 2008). In dynamic environments, IT management has the power to mobilize and continually reconfigure various IT assets and firms may need to leverage their IT assets to improve operational efficiency and cost control (Wang *et al.*, 2015). Environmental dynamism positively moderates the link between managerial IT capabilities and agility, signifying that IT governance is important for firms whose markets are in a constant state of instability (Tallon, 2008). In dynamic environments, IT management can help firms achieve greater performance by involving activities such as planning for security control, standard compliance and disaster recovery with agility (Wang *et al.*, 2015). In more turbulent environments, firms are involved in more alignment-facilitating actions, such as sanctioning IS managers in business planning and drawing the attention of top management in IS strategy, which leads to superior firm performance. Xue *et al.* (2011) proposed that "business unrelatedness between business units and their headquarters moderates the curvilinear relationship between environmental uncertainty and IT infrastructure governance." Therefore, we formulate the following hypothesis for empirical testing.

H4b. The effect of the IT governance mechanism on the ITDC is improved by a turbulent environment.

3. Research methodology and data analysis

3.1 Measurement development

All the constructs in the research model (see Figure 1) were extracted from existing studies. The IT governance mechanism consists of three first-order formative constructs, namely, *decision-making* structure—the extent to which a firm has established organizational units and the roles responsible for making IT decisions (De Haes and Van Grembergen, 2009; Wu *et al.*, 2015). *Formal process*—the extent to which the firm has established formal processes to monitor and ensure that IT policies are consistent with business needs (De Haes and Van



Source(s): Authors' own work

Figure 1.
Research model

Grembergen, 2009; Weill and Ross, 2005; Wu *et al.*, 2015). *The communication approach* is the extent to which the firm has established channels to ensure proper communication and disseminate IT governance principles (Weill and Ross, 2005; Wu *et al.*, 2015). The five first-order reflections, namely, sensing, coordinating, organizing, integrating and reconfiguring (Mikalef *et al.*, 2016; Mikalef and Pateli, 2016; Protogerou *et al.*, 2012), create ITDC as a second-order formative construct. The items for IT governance decentralization (Boh and Yellin, 2006; Mikalef and Pateli, 2016) and a turbulent environment (Chung *et al.*, 2015) are also adopted. Firm performance consists of three first-order formative constructs: financial return (Prasad *et al.*, 2010; Wu *et al.*, 2006, 2015), operational excellence (Ravichandran *et al.*, 2005; Wu *et al.*, 2015) and marketing performance (Wu *et al.*, 2006), to best measure a firm's total performance relative to its competition (Wu *et al.*, 2015). The first-order reflective and formative constructs are based on the criteria suggested by Diamantopoulos (2011). Firm performance is multidimensional in nature and accounting measures may be misleading because of "their (1) inadequate handling of intangibles and (2) improper valuation of sources of competitive advantage" (Bharadwaj *et al.*, 1993; Morgan and Strong, 2003). Furthermore, in China, obtaining financial data seems fairly difficult, and firms may be unable to provide their actual financial data (Li and Liu, 2014). This study used objective measures for firm performance. For all the items, a five-point Likert scale ranging from 1 = "strongly disagree" to 5 = "strongly agree" was used. This study included firm size, firm age and the IT budget as control variables. The reason for including control variables is the potential effects they have. For example, large firms with plentiful IT resources and capabilities can have the ability to significantly impact their current performance (Wang *et al.*, 2012). Firm age is assumed to mean that older firms might enjoy experience-based progress that empowers them to tolerate growth better than younger firms (Chen *et al.*, 2014).

3.2 Sample and data collection procedure

For the data collection, the key informant approach, which is a common method in IS research, was used (Ilmudeen and Yukun, 2018; Nevo and Wade, 2011; Wu *et al.*, 2015). The data collection started in July and went through the last week of October 2017. This study's sampling frame included senior-level IT and business managers from Chinese firms. These working professionals graduated from the School of Management, Huazhong University of Science and Technology, which conducts postgraduate programs in the major metropolitan cities of China (Wuhan, Shenzhen, Suzhou, Guangzhou, Jinan and Nanjing). The Center for Modern Information Management belongs to this School and maintains a database for all the alumni working professionals. The researcher obtained the target respondent's e-mail addresses from this accreditation center. The electronic version of the questionnaire in the Chinese language was developed on a paid Chinese electronic platform (www.sojump.com). Researchers ensured that one respondent was from each organization, and they were allowed to answer only one questionnaire to avoid multiple responses from a single respondent. Selecting a single respondent may not be ideal for firm-level studies; however, this method was acceptable in recent studies (e.g. Ilmudeen and Yukun, 2018; Mao *et al.*, 2016). The opening paragraph of the electronic questionnaire highlighted the survey objectives, target respondents and roles of the respondents. These respondents are likely to be involved in IT governance activities and IT and business operations in their firms. The questionnaire link was then sent to 100 selected working professionals for each city, both in 2015 and 2016; these professionals were batch alumni IT and business professionals and included 600 respondents. After three weeks of follow-up, in the first wave (n = 112) and in the second wave (n = 167), a total of 279 initial responses yielded an overall response rate of 23.25%. Twenty-five records were eliminated because they had the same answer for all questions or incomplete or missing responses. Finally, a useable sample of 254 valid records was obtained,

accounting for 91.04% of the valid response rate in this study. This study sample was an exact representation of the population of interest; 43.3% of the respondents were IT professionals (IT Controller and Head of IT/MIS), and 44.1% of the respondents were business professionals (department manager and marketing manager). Other respondents were senior executives, such as CEOs, CIOs and MDs. In terms of experience, 63.1% of the respondents had more than six years of working experience. Overall, 23.3% of the respondents had more than 12 years of experience. The sample includes a wide range of industry sectors, such as manufacturing (37.8%), IT and technology (28.3%), construction (8.7%), transport/logistics (8.3%), banking/finance/insurance (6.3%), trade and business (5.5%) and others (5.1%). Table 1 shows the demographic profile of the sample.

3.3 Data validation

3.3.1 Nonresponse bias. For external validity, we tested through *t*-tests to check for the presence of nonresponse bias. Based on the assumption that the last group of respondents is most similar to non-respondents, a comparison of the first and last quartile of respondents shows a test of nonresponse bias in our sample (Armstrong and Overton, 1977). Accordingly, the first and last quartiles were compared, and no significant difference was found between the early and late respondents. *T*-tests were performed on the means of the independent variables, such as ITGM ($p = 0.063$), ITDC ($p = 0.149$), ITGDE ($p = 0.097$) and TE ($p = 0.029$). This finding provides evidence that there is no significant threat of nonresponse bias in this study sample.

3.3.2 Common method bias (CMB). The common method bias (CMB) was addressed by using several methods. First, following the suggestion recommended by Podsakoff *et al.* (2003), Harman's single-factor test was conducted by including all the independent and dependent variables in an exploratory factor analysis. The first factor explained 35.2% out of

Position	*N*	%	Total sales in last year	*N*	%
CEO and CIO	14	5.5	<100 million $	96	37.8
Managing director	18	7.1	100–499 million $	40	15.7
IT controller	46	18.1	500–999 million $	35	13.8
Head of IT/MIS	64	25.2	1,000–1,499 million $	15	5.9
Depart. manager	57	22.4	1,500–1999 million $	17	6.7
Market. manager	55	21.7	>2,000 million $	51	20.1
Experience					
<3 years	27	10.6	*Employees*		
3.1–6 years	66	25.9	Less than 100	21	8.2
6.1–9 years	87	34.3	100–500	61	24
9.1–12 years	15	5.9	500–1,000	54	21.3
12.1–15 years	34	13.4	1,000–1,500	15	5.9
15.1–18 years	4	1.6	1,500–2000	20	7.9
18.1–20 years	20	7.9	More than 2000	83	32.7
>20 years	1	0.4			
IT budget in annual sales			*Org_Age*		
<1%	81	31.9	<4.9 years	21	8.3
1.1–2%	45	17.7	5–9.9 years	26	10.2
2.1–3%	33	13	10–14.9 years	51	20.1
3.1–4%	28	11	15–19.9 years	80	31.5
4.1–5%	32	12.6	>20 years	76	29.9
>5%	35	13.8			

Source(s): Authors' own work

Table 1. Demographic profile of the sample

75.2% of the total variance, which is less than the cut-off value of 50% for Harman's single-factor test (Podsakoff *et al.*, 2003). Due to the growing limitations of Harman's single-factor test, we reconfirmed CMB using two other methods. First, any high correlation ($r > 0.90$) is also an indication of CMB (Gaskin, 2011; Lowry and Gaskin, 2014). This study confirmed that Pearson's correlation coefficient (r value) was less than this threshold value (Table 2: $r < 0.9$). Second, according to Kock (2015), if all the VIFs generated from a full collinearity test are equal to or less than 3.3, the model is free from CMB. In this study, the VIFs are less than 3.3 except for the first-order construct OE (VIF = 3.493; see Appendix 1).

4. Results and findings

4.1 Measurement model

For data analysis, the partial least squares (smart PLS 3.0) were used for the following reasons (Talapatra *et al.*, 2019). First, it handles a large number of variables at a time (Gupta *et al.*, 2019; Hair *et al.*, 2014). Second, this technique helps to discover and confirm the associations among the constructs in a complex model (Dubey *et al.*, 2019; Hair *et al.*, 2014). Third, it can effectively handle datasets that are not normally distributed and missing data (Gupta *et al.*, 2019; Hair *et al.*, 2014).

The measurement model includes a two-step analysis. First, it measured psychometric properties for the proper measurement model. Second, the structural model is measured (Ilmudeen and Yukun, 2018). Reliability, convergent validity and discriminant validity are assessed to confirm the quality of the measurement items (Hair *et al.*, 2016). All cross-loadings are greater than 0.7 except TE2 = 0.693 and exceed the loadings between other constructs and items. The difference between the loadings of the item with its primary construct and those of the item to other constructs is greater than 0.1 (Gefen and Straub, 2005). Thus, it demonstrates the variance shared between the primary construct and each item exceeded the error variance (Chin *et al.*, 2003; Hair *et al.*, 2016) (see Appendix 2: PLS item to construct loading). The Cronbach's alpha and AVE values above 0.7 and 0.5, respectively, signify composite reliability (Fornell and Larcker, 1981) (see Table 3). For the discriminant validity, the values of the square roots of AVE should be greater than all other cross-correlations (see Table 2 diagonal values). All these measures confirm sufficient discriminant validity and convergent validity of this study. As a rule of thumb, a factor loading of 0.66 or above is recommended as ideal. It indicates that at least 50% of the variance in the manifest variable is accounted for in the construct (Hair *et al.*, 2010). Except for the dropped two items (TE3 $\alpha = 0.637$ and TE4 $\alpha = 0.639$) in a turbulent environment, all other items have factor loading above 0.66, signifying good indicator reliability, and t values show that all the loadings are significant ($p < 0.001$). The cross-loadings shown in Appendix 2 indicate that the manifest variables load only in the desired latent variable, and cross-loadings of items are not an issue.

Regarding the formative constructs, we measured item weights, multicollinearity between items and discriminant validity (Hair *et al.*, 2016). As shown in Appendix 1, the items on the IT governance mechanism, firm performance and the ITDC have satisfactory weights. The collinearity diagnostic checks for multicollinearity issues using the variance inflation factor (VIF) for formative constructs (see Appendix 1), ranging from 2.151 to 3.493 (<5), indicating a noncritical level of multicollinearity (Hair *et al.*, 2016). For formative construct discriminant validity, the intraconstruct item correlations should be greater than the interconstruct item correlations (Wang *et al.*, 2017). We used PLS item weights for individual indicators, and we calculated composite construct scores for measuring item-to-item and item-to-construct correlations. The correlations between the constructs and items were greater than the correlations between the constructs and items, and individual items were more strongly correlated with their composite scores than with other constructs. To confirm whether interpretational confounding occurred, we followed the approach suggested by Kim *et al.*

Table 2. Descriptive statistics, correlations and reliability

	Mean	SD	DMS	FPR	CA	SNS	CRD	LRN	INT	RCF	ITGDE	TE	FR	OE	MP	Age	Size	ITbudget
DMS	3.43	1.20	–															
FPR	3.54	1.09	0.736	–														
CA	3.53	1.10	0.649	0.706	–													
SNS	3.91	0.87	0.342	0.389	0.406	*0.914*												
CRD	3.94	0.79	0.3	0.306	0.363	0.688	*0.902*											
LRN	3.98	0.80	0.275	0.316	0.345	0.684	0.567	*0.919*										
INT	3.90	0.80	0.265	0.269	0.361	0.629	0.736	0.709	*0.877*									
RCF	3.84	0.83	0.293	0.319	0.352	0.653	0.727	0.711	0.508	*0.88*								
ITGDE	3.38	1.17	0.529	0.498	0.691	0.367	0.303	0.3	0.273	0.33	*0.892*							
TE	3.65	0.87	0.146	0.164	0.235	0.274	0.236	0.293	0.279	0.318	0.178	*0.755*						
FR	3.52	0.86	0.292	0.383	0.375	0.194	0.255	0.246	0.229	0.261	0.349	0.275	–					
OE	3.61	0.86	0.27	0.314	0.273	0.251	0.334	0.328	0.305	0.344	0.297	0.226	0.467	–				
MP	3.57	0.95	0.205	0.253	0.209	0.268	0.31	0.326	0.318	0.276	0.227	0.269	0.668	0.677	–			
Age			0.012	0.109	0.095	0.139	0.068	0.079	0.047	0.03	0.072	−0.006	0.061	0.033	0.052	1		
Size			0.203	0.269	0.114	0.123	0.054	0.031	0.035	0.033	0.245	0.092	0.045	0.016	0.114	0.257	1	
ITbudget			0.139	0.222	0.149	0.189	0.127	0.114	0.014	0.065	0.158	0.047	0.167	0.147	0.183	0.071	0.118	1

Note(s): Diagonal italic values are the square root of the AVE for first-order reflective constructs; off-diagonal elements are correlations. For discriminant validity, diagonal elements should be greater than off-diagonal elements; all of the correlations are significant at the $p < 0.01$ level

Source(s): Authors' own work

Constructs and measurement items	Weight	Loading	STDEV	*t* statistics
Decision-making structure				
DMS1 Our company has a steering committee at the executive or senior management level responsible for determining IT development prioritization	0.329	0.914	0.064	14.221
DMS2 Our company has a steering committee consisting of IT and business people on prioritizing and managing IT projects	0.444	0.906	0.057	15.961
DMS3 CIO has a direct reporting line to the CEO and/or COO	0.357	0.833	0.057	14.565
Formal process				
FP1 Our company has established a formal prioritization process for IT investments and projects in which business and IT are involved	0.446	0.947	0.025	38.038
FP2 Our company has established formal processes to define and update IT strategies	0.429	0.956	0.026	36.69
FP3 Our company has established formal processes to govern and manage IT projects	0.183	0.917	0.035	26.333
Communication approach				
CA1 CIO is a full member of the executive committee	0.320	0.786	0.058	13.612
CA2 Our company has a committee at level of broad of directors to ensure IT is a regular agenda item and reporting issue for the board of directors	0.375	0.890	0.074	11.95
CA3 The CIO or similar role in our company is able to clearly articulate a vision for IT's role in the company	0.711	0.972	0.023	43.18
Sensing (SNS) CA = 0.935; rho _A = 0.937; CR = 0.953; AVE = 0.836				
SNS1 Scanning the environment and identifying new business opportunities	0.254	0.892	0.019	47.948
SNS2 Reviewing our product development efforts to ensure they are in line with what the customers want	0.265	0.935	0.01	93.733
SNS3 Implementing ideas for new products and improving existing products or services	0.286	0.931	0.012	78.596
SNS4 Anticipating discontinuities arising in our business domain by developing greater reactive and proactive strength	0.288	0.899	0.014	64.724
Coordinating (CRD) CA = 0.923; rho _A = 0.924; CR = 0.946; AVE = 0.813				
CRD1 Providing more effective coordination among different functional activities	0.284	0.902	0.016	55.541
CRD2 Providing more effective coordination with customers, business partners and distributors	0.267	0.901	0.018	49.404
CRD3 Ensuring that the output of work is synchronized with the work of other functional units or business partners	0.284	0.914	0.018	50.585
CRD4 Reducing redundant tasks or overlapping activities performed by different operational units	0.275	0.890	0.019	47.98
Learning CA = 0.939; rho _A = 0.939; CR = 0.956; AVE = 0.845				
LRN1 Identify, evaluate and import new information and knowledge	0.273	0.929	0.015	59.986
LRN2 Transform existing information into new knowledge	0.263	0.911	0.017	54.44
LRN3 Assimilate new information and knowledge	0.281	0.931	0.015	62.052
LRN4 Use accumulated information and knowledge to assist decision-making	0.270	0.907	0.019	47.322

Table 3.
Constructs and measurement items

(*continued*)

Constructs and measurement items	Weight	Loading	STDEV	*t* statistics
Integrating (INT) CA = 0.9; rho _A = 0.901; CR = 0.93; AVE = 0.769				
INT1 Easily accessing data and other valuable resources in real-time from business partners	0.281	0.866	0.019	45.511
INT2 Aggregating relevant information from business partners, suppliers and customers. (e.g. operating information, business customer performance)	0.289	0.891	0.017	53.012
INT3 Collaborating in demand forecasting and planning between our firm and our business partners	0.293	0.909	0.016	57.365
INT4 Streamlining business processes with suppliers, distributors and customers	0.277	0.841	0.029	29.412
Reconfiguring (RCF) CA = 0.903; rho _A = 0.906; CR = 0.932; AVE = 0.775				
RCF1 Adjusting for and responding to unexpected changes easily	0.290	0.894	0.016	55.584
RCF2 Easily adding an eligible new partner that you want to do business with or removing ones that you have terminated your partnership	0.259	0.847	0.028	30.657
RCF3 Adjusting our business processes in response to shifts in our business priorities	0.297	0.893	0.016	56.954
RCF4 Reconfiguring our business processes in order to come up with new productive assets	0.290	0.886	0.022	41.172
IT Governance decentralization (ITGDE) CA = 0.873; rho _A = 0.888; CR = 0.921; AVE = 0.795				
ITGDE1 Infrastructure planning and management	0.323	0.900	0.020	44.097
ITGDE2 Application development, project prioritization and approval	0.364	0.891	0.019	46.237
ITGDE3 IT development and implementation	0.436	0.883	0.018	49.863
Turbulent environment CA = 0.872; rho _A = 0.888; CR = 0.902; AVE = 0.57				
TE1 Our customer product preferences change quickly	0.198	0.717	0.069	10.359
TE2 Our customers looking for new products/services all the time	0.150	0.693	0.075	9.228
TE5 The technology in our industry is changing rapidly	0.209	0.846	0.041	20.746
TE6 Technological changes provide big opportunities in our industry	0.203	0.819	0.053	15.53
TE7 A large number of new product ideas have been made possible through technological innovations in our industry	0.253	0.834	0.042	20.012
TE8 It is very difficult to forecast where the technology in our industry will be in the next 2–3 years	0.124	0.746	0.059	12.578
Financial returns (FR)				
FR1 Our company's return on investment (ROI) is better compared to other companies in the same industry	0.435	0.958	0.018	52.205
FR2 Our company's return on equity (ROE) is better compared to other companies in the same industry	0.093	0.907	0.027	33.396
FR3 Our company's return on asset (ROA) is better compared to other companies in the same industry	0.514	0.970	0.016	59.664
Operational excellence (OE)				
OE1 Our company has better productivity improvements compared to other companies in the same industry	0.348	0.934	0.02	46.993
OE2 Our company has a better timeline of customer service compared to other companies in the same industry	0.390	0.940	0.019	50.166
OE3 Our company has better production cycle time compared to other companies in the same industry	0.332	0.928	0.023	40.935

(*continued*)

Table 3.

Constructs and measurement items	Weight	Loading	STDEV	*t* statistics
Marketing performance (MP)				
MP1 Our company performs much better than our competitors in sales growth	0.506	0.945	0.02	47.175
MP2 Our company performs much better than our competitors in market share	0.085	0.858	0.05	17.088
MP3 Our company performs much better than our competitors in product development and market development	0.478	0.940	0.023	41.005

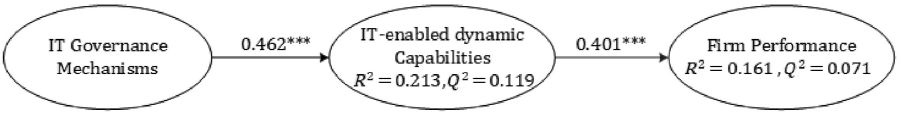
Note(s): Both standard errors and *t* values are for loadings, not weight
Source(s): Authors' own work

Table 3.

(2010) to assess the formative constructs of this study. Accordingly, we ran two models, one with an ITDC and another with firm performance as the sole dependent variable. The weights of all the indicators in the formative constructs remain consistent for the two models, indicating that interpretational confounding is not a concern in this study. In total, all of these measures confirm that the formative constructs of this study have satisfactory measurement properties.

4.2 Structural model

The direct model indicates satisfactory path coefficients that are significant at the 0.001 level and that have explained the variance (R^2); for example, ITDC = 21% and firm performance = 16% (Figure 2). In addition to R^2, we assessed the predictive relevance of the Q^2 values for the constructs to confirm that the structural model has satisfactory predictive relevance. Conversely, Q^2 values > 0 indicate predictive relevance, whereas Q^2 values of 0 or less indicate a lack of predictive relevance (Hair *et al.*, 2016). The results of the blindfolding procedure show that ITDC Q^2 = 0.119 and that firm performance Q^2 = 0.071 demonstrates acceptable predictive relevance. In addition to the direct model, we tested the models with moderating variables separately (Figures 3 and 4), which demonstrated that each model satisfactorily explained the variance.



Source(s): Authors' own work

Figure 2.
Direct model

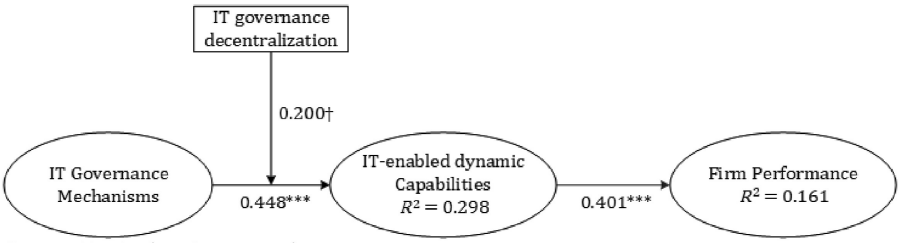


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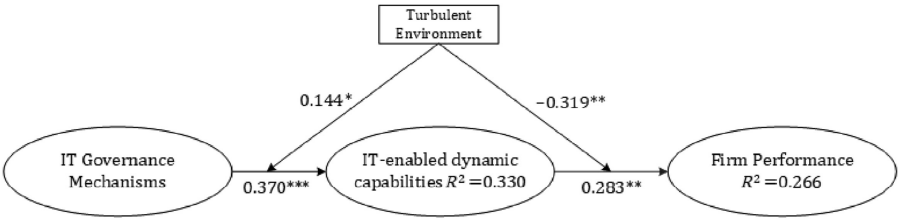
Figure 3.
Indirect mediation, ITGDE moderation model

4.3 Hypothesis testing

The hierarchical regression analysis presented in this study was based on prior studies (Chen *et al.*, 2014; Wang *et al.*, 2015, 2017). This analysis systematically introduces predictors to calculate the explained variance in the dependent variables. Therefore, we developed several models (M), starting from the control variables to the primary and moderating variables in PLS. M1 measures the impact of the control variables on the ITDC. M2 tests the ITGM; thus, H1 is tested. M3 tests the effect of ITGDE on the ITDC, thus assessing H3. M4 tests the ITGM, with the moderating effect of TE on ITDC, thus assessing H4a. M5 measures the impact of the control variables on firm performance. M6 tests the impact of the ITDC on firm performance, validating H2. M7 tests the effect of ITDC on the moderating effect of TE on firm performance. Hence, H4b is tested. Table 4 presents the hierarchical regression results with standardized path coefficients, variances explained by the independent variables (R^2), incremental changes in R^2 (ΔR^2), effect sizes (f^2) and F hierarchical.

The hypotheses are tested by examining the size and significance of the paths in the models via hierarchical regression analysis. In M1, among the control variables, only the IT



Source(s): Authors' own work

Figure 4.
Indirect mediation and TE moderation model

	IT-enabled dynamic capability				Firm performance		
	M1	M2	M3	M4	M5	M6	M7
Control variables							
AGE	0.088	0.054	0.043	0.055	0.060	0.029	0.063
SIZE	0.044	−0.031	−0.017	−0.016	0.212	0.099	0.067
IT-BUDGET	0.153*	0.039	0.032	−0.004	0.128	0.107	0.109*
Direct effect							
ITGM		0.459***	0.440***	0.371***			
ITGDE			0.146*				
ITDC						0.376***	0.305***
TE				0.332***			0.171*
Interaction							
ITGM * ITGDE			0.199†				
ITGM * TE				0.142*			
ITDC * TE							−0.319**
R^2	0.038	0.221	0.302	0.335	0.079	0.183	0.256
ΔR^2		0.183	0.081	0.033		0.104	0.073
f^2		0.235	0.116	0.171		0.127	0.238
F		3.848**	2.665*	3.453**		3.580**	4.072***

Note(s): That ITGM: IT governance mechanism; ITGDE: IT governance decentralization; ITDC: IT-enabled dynamic capability; and TE: turbulent environment
*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$; †$p < 0.10$
Source(s): Authors' own work

Table 4.
Hierarchical regression results

budget has a positive and significant effect on the ITDC (β = 0.153, $p < 0.05$). In M2, the independence variable ITGM has a positive and significant effect on the ITDC (β = 0.459, $p < 0.001$), but none of the control variables is significant. Therefore, H1 is strongly supported, as ITGM has a positive impact on firm ITDC. In M3, the ITGDE is positive and significant (β = 0.146, $p < 0.05$). The moderating effect of ITGDE is also significant, but contrary to expectations, it is not very strong (β = 0.199 †, $t = 1.796$, $p < 0.10$). Hence, H3 is modestly supported, as ITGDE moderates the effect of ITGM on the ITDC. In Models M4 and M7, the moderating effect of the turbulent environment is positive and significant for the ITGM-ITDC relationship (β = 0.142, $p < 0.05$) and negative and significant for the ITDC-firm performance relationship (β = -0.319, $p < 0.05$). Therefore, H4a is supported, as a turbulent environment will lower the impact of an ITDC on firm performance. H4b is supported by the fact that the impact of the ITGM on the ITDC is improved by the turbulent environment. In M6, the impact of the ITDC on FP is significant and positive (β = 0.376, $p < 0.001$). Hence, H2 is strongly supported by the fact that the presence of an ITDC has a positive impact on firm performance.

In addition, we plotted the interaction effect of ITGDE on the relationship between ITGM and the ITDC. Accordingly, ITGM has a weaker positive relationship with ITDC when the ITGDE is high rather than low. In other words, the moderating effect of ITGDE is high when the ITGM is superior, but this relationship is not strong (Figure 5). Consistent with H4a, an ITDC has a weaker positive relationship with firm performance when the turbulent environment is high rather than low (Figure 6). In addition, the interaction term (Figure 7)

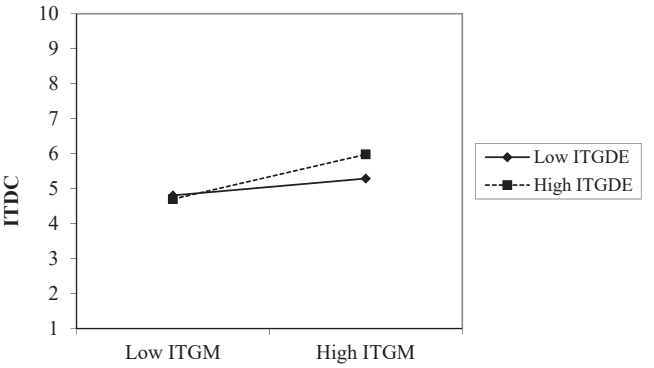


Figure 5.
ITGDE moderates the ITGM–ITDC relationship

Source(s): Authors' own work

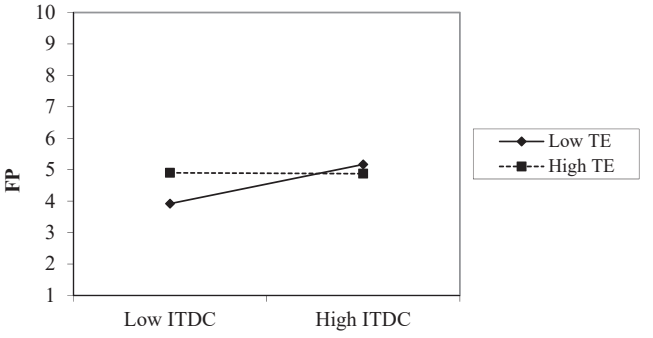
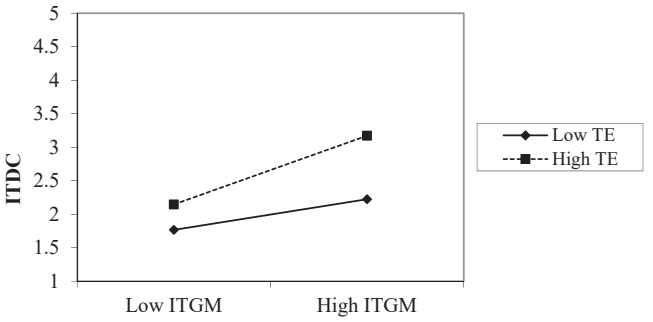


Figure 6.
Moderating effect of TEs on the ITDC–FP relationship

Source(s): Authors' own work



Source(s): Authors' own work

Figure 7.
Moderating effect of TEs on the ITGM-ITDC relationship

between the turbulent environment and the IT governance mechanism is positive and significant ($\beta = 0.142$, $p < 0.05$), which supports H4b; specifying the turbulent environment amplifies the impact of the ITGM on the ITDC and is consistent with the findings of prior studies (Wang *et al.*, 2015).

4.4 Robustness check

This study's model shows that ITDC mediates the effects of ITGM on firm performance. To check whether the effect of ITGM on firm performance is better explained through a mediator, we used the following approaches. First, a bootstrapping approach and a nonparametric resampling procedure that does not impose the assumption of normality of the sampling distribution (Preacher and Hayes, 2008) were used. The direct model without the mediator ran with 5,000 resamples; thus, ITGM has a significant direct effect on firm performance ($c = 0.473$ $t = 3.466$ $p < 0.001$). When the mediator is added (Figure 2), the direct effect of ITGM on firm performance decreases ($c' = 0.374$, $t = 2.242$; $p < 0.05$). Moreover, the results of the Sobol test conducted for mediation analysis (Sobol test statistic: 4.528, $p < 0.001$) signify that the ITDC mediates the relationship between ITGM and firm performance. Furthermore, we calculated the variance accounted for (VAF), which defines the size of the indirect effect in relation to the total effect. ITDC has a VAF value of 28%, which resides between the 20 and 80% range and demonstrates a partial mediating effect (Hair *et al.*, 2016).

To assess the overall effect size [3] of the model, the R^2 values of the two models were also compared. When IT governance decentralization moderates, the variance explained by ITDC increases from the base model, $R^2 = 21.3\%$ (Figure 2), to the moderated model, $R^2 = 29.8\%$ (Figure 3) and is produced nearest to a medium [4] Effect size of 0.121. When the turbulent environment is introduced in the ITGM-ITDC relationship, the variance explained in the ITDC increases from the base model ($R^2 = 21.3\%$ (Figure 2)) to the moderated model ($R2 = 33\%$ (Figure 4)) and yields 0.175, which is a medium effect size. Similarly, when the turbulent environment moderates the ITDC-firm performance relationship, the variance explained in firm performance increases from the base model ($R^2 = 16.1\%$ (Figure 2)) to the moderated model ($R^2 = 26.6\%$ (Figure 4)) and yields 0.143, which is nearest to the medium effect size. According to Chin *et al.* (2003), small effect sizes are common, and the significance of the path coefficient of the moderating variable interaction term should be considered when measuring the model. In this study, the interaction terms for the moderating variables demonstrate and signify that IT governance decentralization has significant moderating effects but is not very strong and that a turbulent environment has significant moderating effects (see Table 4). Overall, the robustness check of this study proves the evidence and

strength of the proposed model in which the effect of ITGM is mediated by the ITDC on firm performance, and the moderators also have impactful moderating effects.

5. Discussion and implications

5.1 Discussion

Building on the drawbacks of the extant literature and integrating dynamic capabilities theory, this study aims to examine how IT governance mechanisms enable the establishment of an ITDC and its subsequent effect on firm performance. In today's dynamic business conditions, firms are increasingly confronting hyper-competition. In their quest for competitive dominance, firms are pursuing a broad range of dynamic capabilities to stay competitive and respond swiftly to market changes. Firms rely on IT more than ever, and their ability to effectively integrate IT resources with other firm-level and managerial processes is critical to realizing competitive advantage (Zhang *et al.*, 2016). IT governance is multifaceted and dynamic in nature (Ali and Green, 2012); hence, the existence of its mechanism does not guarantee that effective IT governance can be achieved within the firm. As a result, the IT governance decision allocation to the IT department allows firms to adopt risky IT to support their interfirm business operations in the modular design of IT systems (Xue *et al.*, 2013). IT governance mechanisms and ITDC are essential for IT-related capabilities of top management commitment toward IT initiatives, shared firm knowledge between IT and non-IT managers and flexible IT infrastructure (Prasad *et al.*, 2012).

Prior scholarly works on the nature of ITDCs have mostly drawn on the RBV of firms (Kude *et al.*, 2017), leading to the key conclusion that firms are collections of assets and capabilities that offer value when strategies are implemented, which in turn improves effectiveness or efficiency. Furthermore, in a turbulent business environment, the lowest expenditure of energy, time or resources advances firm competencies (HassabElnaby *et al.*, 2012). According to Bhatt and Grover (2005), three types of capabilities—value, competitiveness and dynamism—enhance the competitive advantage of a firm. In addition, past studies warrant additional rigorous empirical investigations to strengthen our understanding by incorporating other IT governance structures, sustainable IT-related capabilities and contingent factors that support effective IT governance mechanisms (e.g. Ali and Green, 2012; Prasad *et al.*, 2012). Motivated by this debate, this study draws upon and integrates three streams of literature to develop a research model: (1) studies on the impact of IT governance on firm performance (e.g. Ali and Green, 2012; Tiwana and Konsynski, 2010; Wu *et al.*, 2015; Zhang *et al.*, 2016); (2) studies that investigate the impact of IT-enabled capabilities on firm performance (e.g. Kim *et al.*, 2011; Kude *et al.*, 2017; Mikalef *et al.*, 2016; Mohamad *et al.*, 2017); and (3) studies that examine the moderating effect of IT governance decentralization (e.g. Boh and Yellin, 2006; Mikalef *et al.*, 2016; Xue *et al.*, 2011) and a turbulent environment (e.g. El Sawy and Pavlou, 2008; Pavlou and El Sawy, 2010; Tallon, 2008; Wang *et al.*, 2015).

5.2 Implications for IS research

This study has several noteworthy contributions to IS research. First, it conceptualizes, operationalizes and validates IT capabilities through a systematic approach defined in dynamic capabilities theory as a higher-order construct, whereas prior studies mainly conceptualized IT capabilities on the basis of the RBV of the firm (Kude *et al.*, 2017; Mikalef and Pateli, 2017). The conceptualization of the ITDC construct is well-matched to explain how IT rooted in firm processes can help to achieve and sustain a competitive advantage (Mikalef and Pateli, 2017). Second, IT can create business value and improve firm performance when firms invest and govern their IT resources and practices (Turel *et al.*, 2017). Hence,

the realization of superior business value from increasingly complex investments in IT is a concern for many businesses (De Haes and Van Grembergen, 2013). Recent IT governance-related studies have identified various factors that can decode the impact of IT governance on firm performance, such as strategic alignment and an authoritarian governance style (Turel *et al.*, 2017). This study is among the first to treat ITDC as an endogenous construct and explicitly assimilate these capabilities into the IT governance domain.

Third, the results of our mediation analysis suggest that ITDC plays a significant role in how ITGM fosters firm performance. According to the Mikalef and Pateli (2016) study, ITDC can act as a mediator, signifying the extent to which specific sets of IT resources and IT competencies can work toward their development. Similarly, Kim *et al.* (2011) suggested that IT management capabilities act as a potential mediator between IT expertise and IT infrastructure flexibility. Furthermore, their findings indicate that sufficient IT governance is an antecedent to flexibility in IT infrastructure. Fourth, researchers have argued that dynamic capabilities are difficult for competitors to imitate because they are built on the idiosyncratic characteristics of innovation. Similarly, strong dynamic capabilities can be a solid source of sustainable competitive advantage (Teece, 2017). From our theorizing, this study's findings propose that firms with superior ITGM can enable ITDC, which, in turn, achieves firm performance.

5.3 Theoretical implications

This study has the following theoretical implications. First, the conceptualization and consideration of ITDC fills the research gap and advances the body of knowledge in the IS literature. Hence, this study provides an encouraging opportunity for empirical research to address IT-enabled dynamic capabilities. Second, past studies focused on Western developed markets that failed to explore the business consequences of dynamic capability and its relationship with firm performance for an economy such as China. China has a diverse culture from Western countries, such as power distance, uncertainty avoidance, individualism/collectivism, masculinity/femininity, business practices, guanxi, Confucianism and localization, which may have unique business implications and insights (Lai *et al.*, 2016; Zhong *et al.*, 2012). Furthermore, scholars believe that there is a noteworthy gap in the literature (Li and Liu, 2014). Hence, this study uses China as a testing ground for Western-made theories and fills the gaps in the Chinese IS literature. Third, prior studies highlighted that Western-made theories may not be completely applicable to societies with noticeably different sociocultural and socioeconomic traditions (Li and Liu, 2014; Lin and Germain, 2003). Hence, this study's empirical investigation, which draws on the multi-theoretic lens in the context of China, is a significant contribution to the literature. Fourth, past studies necessitate further investigation of the consequences of IT governance and environmental dynamics (Tiwana *et al.*, 2013) and the potential benefits of the IT governance–IT capability relationship in turbulent environments (Kude *et al.*, 2017; Tallon, 2008; Turel *et al.*, 2017). Nevertheless, studies validating these claims are rare. Hence, this study addresses these gaps by examining how the IT governance mechanism drives IT-enabled capabilities to achieve firm performance through the use of moderator variables.

5.4 Practical implications

This study has several practical implications for business practitioners and industry leaders. First, it offers a practical guide to the board, executive management and corporate leaders to identify ways to build a firm-wide dynamic IT capability. In doing so, executives should do much more than simply invest in IT by systematically analyzing (e.g. self-assessment, comparison with competitors and benchmarking possible ways to build strong IT capability) business goals and environmental turbulence. Second, IT governance mechanisms are a

strategic concern for board members, heads of IT and internal auditors who oversee IT strategy, IT risk management, IT decision-making and the control of IT systems (Héroux and Fortin, 2014). Corporate leaders and practitioners recognize that IT investment decisions should be headed not only by IT executives but also by other stakeholders. Managers confidently invest in building IT dynamic capabilities to overcome turbulent environments, eliminating central rigidities and capability traps. As a result, the results of this study help to draw managers' attention to the fact that ITDCs must keep pace with turbulent conditions and business needs. Third, for organizations that struggle with productivity and cost leadership, IT governance mechanisms should be geared toward decentralization. Decentralizing decision rights to business units enables firms to be more liable for increasing firm capabilities. As a result, they sanction their business operations even in turbulent environments. In this respect, the findings of this study have wider implications for managers who face the challenge that IT is sometimes realized as a cost driver and, other times, is seen to deliver additional value. Fourth, managers must understand that merely investing in IT is not sufficient to achieve firm performance, and if they see only the financial profits in figures, they could easily be misguided from reality. Hence, organizations should improve complementary and balanced IT capabilities by thoroughly scrutinizing the links between IT assets and other firm-level resources, business objectives and environmental conditions. Finally, this study tested the proposed model by collecting responses from senior IT and business professionals from Chinese firms. The majority of prior studies in IT governance and IT capability research have been based on surveys of firms in Western countries (i.e. North America, Europe and Australia). Dissimilarities exist between diverse countries owing to the cultural and regional variations that may bring noteworthy insights (Wang *et al.*, 2015). Hence, the empirical findings based on the Chinese context have remarkable implications for firms operating in similar contexts in other regions.

6. Conclusion and limitations

6.1 Research limitations

Given the aforesaid contributions, the limitations below also merit consideration. First, this study measures IT governance decentralization using three items (Infrastructure planning, application development and IT development), which were deemed not comprehensive enough to fully cover this variable. Second, the research model was validated using primary data collected from Chinese firms. Considering the emerging notion of IT governance and dynamic IT capabilities in recent years, this study is limited in its capacity to uncover the comprehensive contribution of IT governance—the relationship between dynamic IT capabilities and firm performance—using secondary data. Third, this study can be extended to generalize its findings to other areas in the IT governance domain.

6.2 Future study

First, future studies can consider the following as a research avenue. Accordingly, other aspects of IT governance may be considered for IT governance decentralization. Hence, upcoming studies can focus on establishing more proper measures for this variable by considering its wide spectrum of industry usage and requirements. Second, future studies can be designed and conducted more rigorously across multiple countries. By testing longitudinal data obtained from industries for cross-industry comparisons or from selected enterprises, archival data may provide richer and better insights into this research context. Third, future studies can consider other aspects of IT decision-making, such as IT architecture, IT orchestration, IT conversion and strategic IT planning and implementation, instead of conceptualizing IT governance; hence, they may provide valuable insights.

6.3 Conclusion

In closing, by developing and testing a multi-theoretic lens, this study focused on how IT governance mechanisms allow ITDCs to achieve firm performance. This study contributes more granularity to our understanding of IT governance–ITDC relationship research. IT governance mechanisms with better decision-making structures, formal processes and communication approaches enable firms to adopt dynamic IT capabilities in turbulent settings, thereby increasing firm performance. The findings of this study suggest that IT governance mechanisms and ITDC collectively drive firm performance, which is of ever-increasing significance in the rapidly changing business environment. The theoretical and practical implications of this study can contribute to multiple streams of literature and provide practical guidance on IT governance mechanisms and ITDCs for achieving firm performance.

Notes

1. For ease of expression, we refer to IT-enabled dynamic capabilities as ITDC, IT governance mechanism as ITGM and IT governance decentralization as ITGDE.
2. Several IT-enabled capabilities have been studied by IS scholars, such as IT-based synergies (Kude *et al.*, 2017), IT-leveraging capability (Pavlou and El Sawy, 2010), IT-enabled business capabilities (El Sawy and Pavlou, 2008), IT-enabled interfirm collaboration (Wang *et al.*, 2017), IT-related capabilities (Prasad *et al.*, 2012), IT-enabled knowledge management capability (Mao *et al.*, 2016), IT-enabled capabilities (Tan *et al.*, 2019).
3. Effect size $f^2 = (R^2$ moderated model $- R^2$ direct model)/(1- R^2 moderated model)
4. Effect sizes are small if 0.02, medium if 0.15 and large if 0.35 (Cohen, 1988).

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Appendix 1

IT governance mechanisms	Second-order construct Weight	STDEV	*t*-statistics	VIF	First-order construct Item	Weight	Loading
DMS	0.147	0.239	3.636	2.352	DMS1	0.329	0.914
					DMS2	0.444	0.906
					DMS3	0.357	0.833
FPR	0.245	0.258	0.617	2.716	FPR1	0.446	0.947
					FPR2	0.429	0.956
					FPR3	0.183	0.917
CA	0.697	0.192	0.951	2.151	CA1	0.320	0.786
					CA2	0.375	0.89
					CA3	0.711	0.972
Firm performance							
FR	0.376	0.010	37.420	2.566	FR1	0.435	0.958
					FR2	0.093	0.907
					FR3	0.514	0.97
OE	0.353	0.012	29.008	3.493	OE1	0.348	0.934
					OE2	0.39	0.940
					OE3	0.332	0.928
MP	0.374	0.010	38.506	2.649	MP1	0.506	0.945
					MP2	0.085	0.858
					MP3	0.478	0.940
ITDC							
SNS	0.221	0.009	24.472	2.374			
CRD	0.236	0.008	30.835	3.265			
LRN	0.243	0.008	29.281	3.02			
INT	0.219	0.007	30.034	3.443			
RCF	0.222	0.009	24.475	3.46			

Note(s): FR: Financial return; OE: Operational excellence; MP: Marketing performance; DMS: Decision making structure; FPR: Formal Process; CA: Communication approach; SNS: Sensing; CRD: Coordinating; LRN: Learning; INT: Integrating; RCF: Reconfiguring, All weights are significant at $\alpha = 0.01$

Source(s): Authors' own work

Table A1. Multicollinearity diagnostics and path weights of first-order constructs on the second-order construct

Table A2.
PLS item to construct loading

	DMS	FPR	CA	SNS	CRD	LRN	INT	RCF	ITGDE	TE	FR	OE	MP
DMS1	0.914	0.706	0.604	0.267	0.233	0.226	0.196	0.266	0.713	0.155	0.274	0.214	0.179
DMS2	0.906	0.696	0.577	0.305	0.270	0.247	0.249	0.272	0.805	0.184	0.274	0.263	0.186
DMS3	0.833	0.546	0.544	0.333	0.288	0.256	0.251	0.238	0.561	0.038	0.225	0.233	0.178
FP1	0.690	0.947	0.657	0.390	0.297	0.315	0.273	0.332	0.963	0.140	0.368	0.303	0.232
FP2	0.701	0.956	0.690	0.346	0.280	0.286	0.245	0.278	0.845	0.203	0.366	0.288	0.231
FP3	0.699	0.917	0.643	0.366	0.292	0.289	0.231	0.285	0.823	0.082	0.337	0.302	0.274
CA1	0.524	0.552	0.786	0.265	0.293	0.265	0.304	0.294	0.520	0.263	0.321	0.205	0.142
CA2	0.619	0.668	0.890	0.320	0.318	0.289	0.268	0.271	0.639	0.239	0.291	0.192	0.138
CA3	0.610	0.666	0.972	0.415	0.355	0.344	0.380	0.365	0.636	0.216	0.388	0.292	0.228
SNS1	0.349	0.383	0.408	0.892	0.570	0.589	0.512	0.537	0.380	0.230	0.196	0.258	0.274
SNS2	0.293	0.338	0.361	0.935	0.591	0.592	0.541	0.575	0.351	0.246	0.147	0.205	0.216
SNS3	0.301	0.352	0.346	0.931	0.650	0.655	0.616	0.632	0.372	0.258	0.140	0.186	0.204
SNS4	0.311	0.352	0.374	0.899	0.695	0.660	0.623	0.636	0.358	0.265	0.225	0.269	0.287
CRD1	0.269	0.264	0.311	0.636	0.902	0.740	0.671	0.665	0.279	0.188	0.209	0.291	0.275
CRD2	0.282	0.275	0.352	0.598	0.901	0.654	0.629	0.610	0.298	0.205	0.264	0.300	0.283
CRD3	0.318	0.316	0.376	0.642	0.914	0.680	0.680	0.698	0.321	0.270	0.254	0.326	0.308
CRD4	0.211	0.247	0.268	0.603	0.890	0.685	0.674	0.647	0.241	0.186	0.194	0.285	0.249
LRN1	0.246	0.312	0.344	0.633	0.701	0.929	0.652	0.654	0.307	0.260	0.253	0.334	0.300
LRN2	0.264	0.302	0.333	0.587	0.690	0.911	0.639	0.606	0.300	0.311	0.208	0.289	0.311
LRN3	0.241	0.289	0.280	0.655	0.737	0.931	0.669	0.690	0.311	0.267	0.232	0.278	0.278
LRN4	0.263	0.259	0.312	0.638	0.685	0.907	0.646	0.663	0.263	0.241	0.210	0.304	0.310
INT1	0.263	0.256	0.367	0.531	0.650	0.642	0.866	0.665	0.263	0.259	0.172	0.224	0.236
INT2	0.216	0.217	0.309	0.584	0.639	0.642	0.891	0.690	0.258	0.217	0.178	0.252	0.283
INT3	0.212	0.233	0.313	0.561	0.660	0.613	0.909	0.752	0.247	0.248	0.233	0.279	0.315
INT4	0.238	0.239	0.278	0.530	0.634	0.589	0.841	0.717	0.261	0.257	0.218	0.317	0.280
RCF1	0.200	0.236	0.270	0.609	0.618	0.652	0.720	0.894	0.245	0.301	0.223	0.312	0.289
RCF2	0.227	0.308	0.307	0.496	0.578	0.554	0.650	0.847	0.303	0.268	0.233	0.277	0.176
RCF3	0.304	0.300	0.332	0.575	0.710	0.643	0.757	0.893	0.319	0.271	0.252	0.316	0.239
RCF4	0.297	0.283	0.331	0.614	0.647	0.649	0.703	0.886	0.328	0.280	0.210	0.304	0.261
ITGDE1	0.419	0.706	0.604	0.267	0.233	0.226	0.196	0.266	0.9	0.155	0.274	0.214	0.179
ITGDE2	0.609	0.696	0.577	0.305	0.27	0.247	0.249	0.272	0.891	0.184	0.274	0.263	0.186
ITGDE3	0.69	0.479	0.657	0.39	0.297	0.315	0.273	0.332	0.883	0.14	0.368	0.303	0.232

(*continued*)

Table A2.

	DMS	FPR	CA	SNS	CRD	LRN	INT	RCF	ITGDE	TE	FR	OE	MP
MT1	0.095	0.101	0.134	0.035	0.066	0.151	0.135	0.132	0.087	0.717	0.212	0.151	0.226
MT2	0.065	0.063	0.126	0.117	0.152	0.148	0.224	0.207	0.075	0.693	0.164	0.126	0.156
TT1	0.182	0.180	0.241	0.248	0.153	0.211	0.192	0.239	0.185	0.846	0.220	0.186	0.216
TT2	0.138	0.204	0.231	0.318	0.237	0.297	0.240	0.310	0.188	0.819	0.220	0.155	0.229
TT3	0.181	0.196	0.275	0.248	0.246	0.260	0.237	0.280	0.178	0.834	0.294	0.225	0.235
TT4	0.117	0.125	0.110	0.234	0.166	0.218	0.145	0.241	0.129	0.746	0.153	0.108	0.108
FR1	0.297	0.371	0.376	0.207	0.261	0.246	0.251	0.268	0.351	0.250	0.958	0.737	0.635
FR2	0.249	0.340	0.376	0.201	0.235	0.269	0.234	0.224	0.338	0.282	0.907	0.672	0.626
FR3	0.272	0.369	0.343	0.165	0.233	0.222	0.190	0.240	0.358	0.273	0.970	0.742	0.648
OE1	0.283	0.297	0.275	0.226	0.311	0.281	0.276	0.321	0.316	0.204	0.739	0.934	0.692
OE2	0.236	0.288	0.267	0.263	0.338	0.354	0.327	0.341	0.281	0.230	0.705	0.940	0.734
OE3	0.240	0.295	0.219	0.209	0.282	0.277	0.246	0.298	0.303	0.196	0.700	0.928	0.721
MP1	0.180	0.211	0.171	0.274	0.318	0.293	0.299	0.235	0.201	0.250	0.642	0.713	0.945
MP2	0.192	0.258	0.214	0.232	0.266	0.288	0.299	0.279	0.228	0.214	0.569	0.662	0.858
MP3	0.204	0.259	0.218	0.230	0.264	0.320	0.296	0.279	0.243	0.261	0.617	0.732	0.940

Source(s): Authors' own work

About the authors

Dr Aboobucker Ilmudeen is working as a Lecturer in management and IT at the South Eastern University of Sri Lanka. He obtained his Ph.D. at the Huazhong University of Science and Technology in Wuhan, China in 2018. His research interests are IT governance, business analytics, business-IT alignment, big data, social media and IT-enabled capabilities and innovation. He has published many research articles in peer-reviewed academic journals and participated in local and international research conferences. Some of his journal articles are published in indexed journals such as *Industrial Management and Data Systems*, *Journal of Enterprise Information Management* and *Journal of High Technology Management Research*. Aboobucker Ilmudeen is the corresponding author and can be contacted at: ilmudeena@seu.ac.lk

Dr Alaa A. Qaffas is an Associate Professor and the Head of the Management Information System Department, at the College of Business, University of Jeddah, Kingdom of Saudi Arabia.