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Does Governance in Information Technology Matter When It Comes to Organizational Performance in Pakistani Public Sector Organizations? Mediating Effect of Innovation

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Abstract

Information technology governance (ITG) is recognized as a vital organizational ability to exploit opportunities for innovation and enhance organizational performance. However, the potential of ITG for public sector innovation and performance has not been fully grasped in Pakistani public sector organizations (PakPSOs). This study has presented an explanatory model to investigate the mediating effect of innovation in the relationship between ITG and organizational performance in PakPSOs. Partial least squares structural equation modeling (PLS-SEM)–based hierarchical component modeling approach has applied to analyze the model by taking sample data from 97 PakPSOs. The results revealed that ITG positively affected innovation and organizational performance. Innovation positively affected organizational performance. Innovation partially mediated the relationship between ITG and organizational performance. The study corroborates the strategic use of information technology (IT) to enhance innovation and organizational performance in this context. The study contributes to the existing knowledge base through a new theoretical model and promotes academic rigor. The results are also significant for the practice as they can help to achieve organizational performance in terms of operational efficiency, transparency in costs and results, planning and decision making, performance monitoring and control, and collaboration and synergy. The other countries operating in a similar environment can also take the benefit of this study.

Keywords

information technology governance, innovation in public sector, organizational performance, hierarchical component modeling, Pakistani public sector organizations

Introduction

Public sector organizations (PSOs) are crucial for socioeconomic development of a country and the prosperity of its people. Therefore, an improved and sustained public service delivery is indispensable for these organizations. The use of information technology (IT) has become imperative for efficient, quality, and innovative public services (Al-Qatamin & Al-Omari, 2020; Attour & Chaupain-Guillot, 2020). Consequently, contemporary PSOs are highly relying on IT to enhance their innovation capability and performance (Benbunan-Fich et al., 2020; Pang et al., 2014).

In Pakistan, various policy adjustments have been introduced over the last two decades to plan and prioritize the IT investments, enhance innovation capability, and improve performance in the public sector. Some of these adjustments include "National IT Policy and Action Plan, 2001"; "E-Governance Strategy and Five-Year Plan for Federal Government, 2005"; and "Digital Pakistan Policy, 2018." Many endeavors have been taken to uplift IT in Pakistani

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public sector organizations (PakPSOs). For example, information technology boards (IT boards) in provinces and IT directorates in districts have been institutionalized to diffuse IT in government departments. Several public datacenters, national database and registration, e-filing, e-tax, e-billing, driving licensing and vehicle registration, land record management, hospital management, disaster management, and so on are functional in various PakPSOs. Other initiatives are under implementation. However, IT potential and its contribution have not yet been fully grasped in PakPSOs (Arif, 2018).

Information technology governance (ITG) is recognized as a vital organizational ability to exploit opportunities for innovation and enhance organizational performance (De Haes & Van Grembergen, 2013). ITGI (2007, p.5) states,

> IT governance is the responsibility of the board of directors and executive management. It is an integral part of enterprise governance and consists of the leadership and organizational structures and processes that ensure that the organization's IT sustains and extends the organization's strategies and objectives.

Weill and Ross (2004, p.8) define ITG as "specifying the decision rights and accountability framework to encourage desirable behavior in the use of IT." At its most basic level, ITG is implemented through decision-making structures, processes, and relational mechanisms (Peterson, 2004). The role of IT in PSOs has become more imperative as governments are among the major investors, strategists, and users of IT (Pang et al., 2014). However, despite sufficient IT investments and serious endeavors to modernize the public sector, the effect of ITG on innovation capability and organizational performance has not been fully comprehended in PSOs (Magnusson et al., 2020; Tonelli et al., 2017).

Although some studies have examined the impact of ITG mechanisms on ITG effectiveness and performance and also on organizational performance in PSOs of various countries, the majority of these studies have investigated the effect of individual mechanisms on ITG effectiveness (Ali & Green, 2007), the effect of critical success factors (CSFs) on ITG performance (Nfuka & Rusu, 2011), and effect of ITG mechanisms on IT and organizational performance (Tonelli et al., 2017). Moreover, some studies have explored the link between IT-enabled investments and innovation in public sector, but these studies have mainly focused on IT as a driver of innovation for promoting creativity, constancy, connectivity, and courage for long-term progress (Nemeslaki, 2014); the effect of Information Communication Technology (ICT) on process innovation (Lohmeier, 2013); and the effect of ambidextrous ITG, in terms of exploration and exploitation, on innovation and efficiency (Magnusson et al., 2020). Furthermore, some researchers have analyzed the influence of innovation on organizational performance in public sector, but these have emphasized on the influence of organizational innovation on organizational performance (Damanpour et al., 1989), the impact of service and process innovation on operational performance (Moreira et al., 2017), and the performance management as a mediator in the association between innovation and organizational performance (Walker et al., 2010). However, innovation as a mediator in the relationship between ITG and organizational performance has not been investigated in the previous studies in public sector. This study fills this gap by developing and testing a conceptual model to understand the association between ITG and organizational performance, ITG and innovation, and also innovation and organizational performance.

The following research questions are investigated in this study:

> **Research Question 1:** What is the impact of ITG on organizational performance?
> **Research Question 2:** What impact ITG has on innovation?
> **Research Question 3:** Up to what extent innovation impacts organizational performance?
> **Research Question 4:** How much innovation mediates the relationship between ITG and organizational performance?

This is achieved through a partial least squares structural equation modeling (PLS-SEM)–based hierarchical component modeling approach by conceptualizing ITG and innovation as higher order (second-order) constructs and testing the model taking sample data from PakPSOs.

This introductory section is followed by the "Theoretical Background and Hypotheses." "Conceptual Model," "Method," "Results," "Discussion," and "Conclusion" sections.

Theoretical Background and Hypotheses

Prior studies in the private sector indicate that IT investments are positively associated with firm performance in terms of market value, profitability, and productivity (e.g., Anderson et al., 2006; Bharadwaj et al., 1999). These studies have mainly used the resource-based view and production function model to assess firm performance. However, these studies do not cover the distinctive characteristics of the public sector (Pang et al., 2014), including political and bureaucratic nature (Yildiz, 2007), non-profit-seeking and non-competitive nature (Cordella & Bonina, 2012), and diversity in the public sector stakeholders (Newcomer & Caudle, 1991). The public sector has different demands in terms of organizational outcomes (Moore, 1994). In the context of public sector, many researchers have applied public value management theory to answer the question of how superior public value can be created through the use of IT resources (e.g., Cordella & Bonina, 2012; Panagiotopoulos et al., 2019;

Pang et al., 2014). The theory essentially asserts that managers in public organizations should make active endeavors on behalf of public to create increased public value like managers in private organizations strive to gain superior private value (Moore, 1995). Public value not only covers tangible benefits from the public services such as public welfare and education of individual clients but also covers broader tangible values such as fairness, trust in governments, and national pride (Alford & O'Flynn, 2009; Moore, 1995). Moore (1994) asserted that organizational performance in PSOs can be evaluated in terms of organizational capability to exploit resources more effectively to achieve goals and missions and benefits to citizens (public value management). However, there is immense criticism on the public value management due to the vagueness in the meaning of public value, confusion about the empirical testability of the theory, and inappropriate focus on political roles of public managers (Alford & O'Flynn, 2009; Rhodes & Wanna, 2007). On the contrary, some researchers have applied other simple criteria to measure performance in PSOs. For example, Tonelli et al. (2017) contended that operational efficiency in public service delivery, quality of public services, transparency in costs and results, and performance measurements are the fundamental concerns in the PSOs. Therefore, they used operational efficiency, innovation in actions, transparency in costs and results, and improvement in public services measures to evaluate the organizational performance. Weill and Ross (2004) in their study of 256 organizations specifically evaluated PSOs in a separate chapter based on operational efficiency and increased transparency in costs and results. Andersen et al. (2010) suggested that better planning and decision making, effective monitoring and control, and increased interactions in and across organizations are the essential performance outcomes of IT in the PSOs. Thus, operational efficiency, transparency in disclosure of costs and results, planning and decision making, monitoring and control, and collaboration and synergy are the important measures to assess organizational performance in the PSOs.

Many prior studies on strategic IT management and IT value have revealed an indirect relationship between the effective use of IT resources and organizational performance via organizational capabilities. These studies have found that the effective use of IT resources facilitates many organizational capabilities like IT capability, innovation capability, IT relatedness, knowledge management, and supply chain management. Subsequently, these capabilities enhance organizational performance and become a source of competitive advantage. For example, Tanriverdi (2005) found that IT relatedness in terms of IT process management and standardized and shared IT infrastructure enhances organizational performance by enhancing cross-unit knowledge management capability. Rai et al. (2006) found that IT infrastructure integration with customers and suppliers enhances supply chain integration which subsequently enhances organizational performance. Zhang et al. (2014) found that ITG improves firm performance through the mediator of IT capability. Lee et al. (2016) found that technology orientation improves firm performance through the mediator of innovation. Lang et al. (2012) found that investment capability improves firm performance through the mediators of technology innovation capabilities.

Nevertheless, IT also has a vital impact on organizational capabilities in public sector (Andersen et al., 2010). Like their private counterparts, innovation capability is one of the important organizational capabilities, among others, in the public sector (Pang et al., 2014). Innovation essentially deals with the development (creation) or utilization (adoption) of new thoughts, substances, or practices (O'Toole, 1997). Boer and During (2001) proposed, analyzed, and compared three types of innovation: service, process, and organizational innovation. Dunleavy et al. (2006) emphasized that public sector needs to be more agile and flexible to deal with the emerging challenges in innovative ways. Many studies have revealed that innovation in public sector leads toward performance (e.g., De Vries et al., 2016; Gieske et al., 2018; Moreira et al., 2017). Thus, effective use of IT facilitates innovation capability, which subsequently leads toward organizational performance in public sector. Adopting an interdisciplinary approach that combines ITG, innovation, and public sector administration and performance literature, we theorize that the relationship between ITG and organizational performance in the PSOs is mediated by the innovation capability of these organizations.

ITG and Organizational Performance

Organizations with mature ITG mechanisms (decision-making structure, processes, and relational mechanisms) make the right IT investment decisions and more likely to achieve ITG and/or organizational performance. Ali and Green (2007) found a positive effect of IT strategic committee (decision-making structure) and organizational communication system (a relational mechanism) on the overall effectiveness of ITG in Australian PSOs. Maidin and Arshad (2010) revealed a positive relationship between steering committee (decision-making structure), organizational communication system, and performance measurement system (processes) and ITG performance in Malaysian PSOs. Nfuka and Rusu (2011) demonstrated a positive effect of consolidated IT structures (decision-making structures), consolidated performance measures (processes), and other CSFs, including IT leadership (relational mechanisms) on ITG performance in Tanzanian PSOs. Adopting a consolidated approach, Tonelli et al. (2017) tested the effect of maturity of ITG mechanisms on IT performance and organizational performance using sample data from 146 Brazilian PSOs. The results revealed that relational mechanisms positively influenced IT performance, which further influenced organizational performance. Hence, we posit the following hypothesis:

Hypothesis 1 (H1): The maturity of ITG is positively associated with organizational performance in PakPSOs.

ITG and Innovation

Due to technological advancements and dramatic changes and expectations in public demands, PSOs must ensure continuous improvement in their business models, operating systems, and value proposition. Mature ITG mechanisms improve the quality of public services and products, quality and efficiency of internal and external processes, and changes in organizational systems and working procedures and routines. De Haes and Van Grembergen (2013) concluded that improving ITG can enable organizations to augment their capacity for innovation. Fernández-Mesa et al. (2014) advocated that IT facilitates in developing knowledge-sharing portals and collaboration (ITG relational mechanisms) to encourage creative thinking and innovation processes. Arvanitis et al. (2013) revealed that IT training (ITG relational mechanism) has a positive impact on both product/service and process innovation. In the context of public sector, Magnusson et al. (2020) argued that ambidextrous ITG, in terms of exploration and exploitation, increases public sector innovation capability over time. Hence, we posit the following hypothesis:

Hypothesis 2 (H2): The maturity of ITG is positively associated with innovation in PakPSOs.

Innovation and Organizational Performance

Innovation helps in establishing conditions for implementing public policies and structural reforms and improves internal working processes, managerial systems, and public service delivery. Due to public sector innovation, citizens in many countries have begun to use more advanced public services. Moreira et al. (2017) found a positive association between service and process innovation and organizational innovation in a quantitative study of 34 Portuguese hospitals. The results also revealed that service and process innovations positively affect operational performance. Furthermore, the overall innovation process has a positive impact on financial performance. Damanpour et al. (1989) used organizational innovation to separate organizations based on their performance level. However, Walker et al. (2010) demonstrated that management innovation influences organizational performance indirectly through the performance management process as a mediator. They further revealed that performance management process positively affects organizational performance. Similarly, De Vries et al. (2016) revealed that innovation enhances efficiency and effectiveness and citizens' satisfaction in public sector. Hence, we posit the following hypothesis:

Hypothesis 3 (H3): Innovation is positively associated with organizational performance in PakPSOs.

ITG, Innovation, and Organizational Performance

Many organizations use IT in their day-to-day operations. However, IT by itself does not provide direct benefits rather it depends on how agile they are in using IT to create innovation at all organizational levels (Tiwana & Kim, 2015). Pang et al. (2014) proposed that IT resources in public sector enhance innovation capability, among others, which subsequently improves organizational performance in terms of public value. Brynjolfsson and Saunders (2010) argued that IT investment by itself cannot contribute to sufficient performance improvement unless organizational resources and work processes are improved or changed. ITG provides necessary conditions for innovation to happen (Borja et al., 2018), which further leads toward organizational performance (Moreira et al., 2017). IT contributes to organizational performance through its innovation capability (Cofriyanti & Hidayanto, 2013). Brynjolfsson (1993) found that IT enhances organizational performance through its innovative use and application. Lee et al. (2016) revealed that innovation mediates the relationship between technology orientation and firm performance. Lang et al. (2012) found that technology innovation capabilities mediate the association between investment capability and firm performance. Putting all together, we posit the following hypothesis:

Hypothesis 4 (H4): Innovation mediates the relation between the maturity of ITG and organizational performance in PakPSOs.

Conceptual Model

A conceptual model was developed based on the theoretical background and hypthoses as shown in Figure 1. We formulated the conceptual model as a hierarchical component model (second-order model) that included the second-order and first-order constructs. Hierarchical component models or higher order models deal with the testing of more general constructs at a higher level of abstraction and usually involve the testing of second-order constructs (Hair et al., 2017). These models are useful to reduce model complexity, to make the model more parsimonious, to minimize the bias due to collinearity, and to address the possible discriminant validity problems (Hair et al., 2017).

Due to the generic and complex nature of ITG and innovation (INNOV) concepts, these two constructs were modeled as second-order constructs. It is important to mention that higher (second) order constructs are generic concepts that do not exist without their underlying lower (first) order constructs and represented (reflective) or constituted (formative) from their underlying lower (first) order constructs

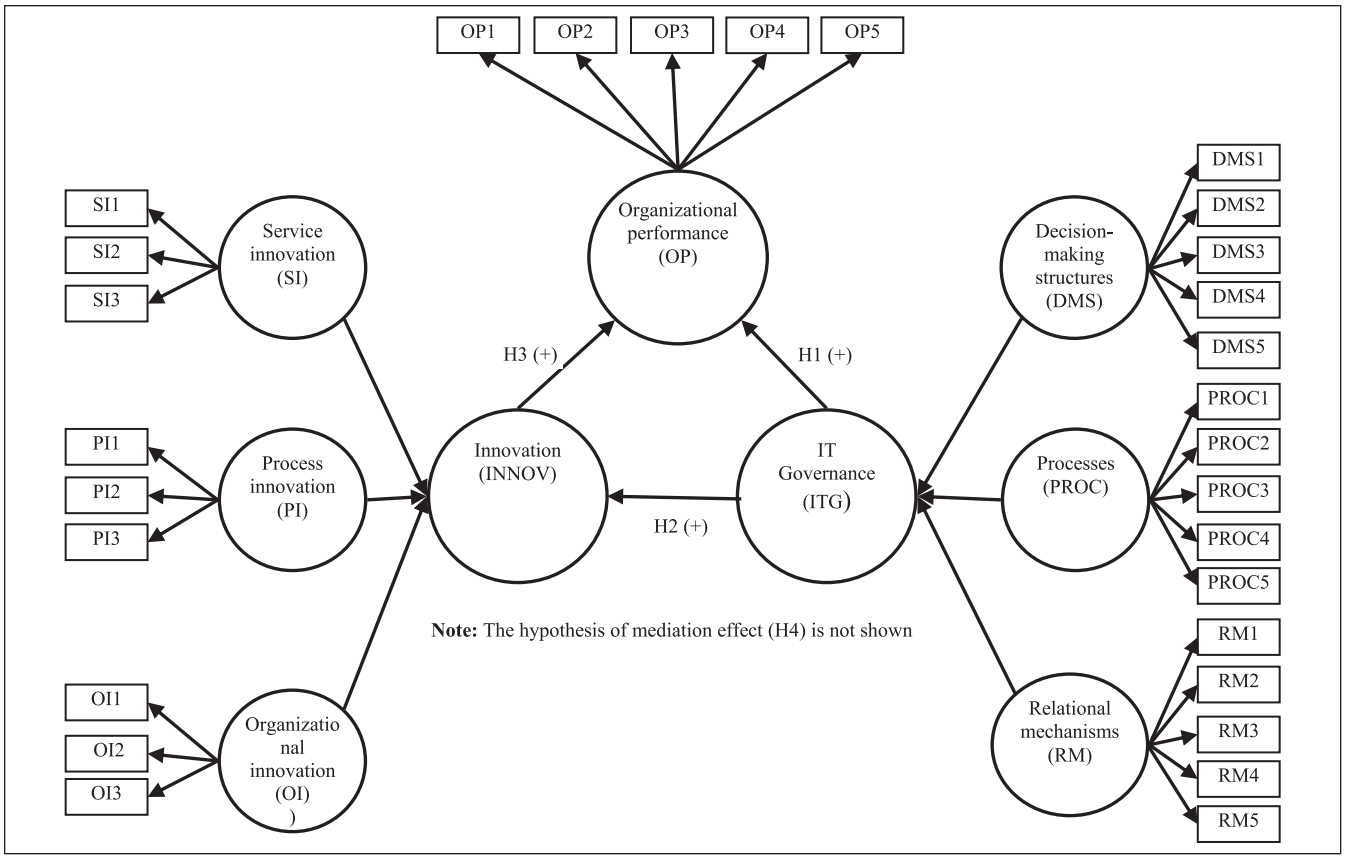

Figure 1. Conceptual model.

(Becker et al., 2012; Tehseen et al., 2020). Thus, ITG was constituted from its three underlying first-order constructs, that is, decision-making structures (DMS), processes (PROC), and relational mechanisms (RM). Similarly, INNOV was constituted from its three underlying first-order constructs, that is, service innovation (SI), process innovation (PI), and organizational innovation (OI). However, the first-order constructs of both ITG and INNOV were represented from their underlying indicators. In other words, ITG and INNOV were treated as formative constructs, whereas DMS, PROC, RM, SI, PI, and OI were treated as reflective constructs. It is worthy to note that the relationship between higher (second) and lower (first) order constructs is not a representation of causality rather a representation of the nature of the constructs (Becker et al., 2012).

Method

Operational Measures

We applied a multidimensional approach to measure the constructs of the conceptual model in Figure 1. The items to measure the constructs were adapted from prior studies. A questionnaire was developed based on the items. The items and their sources are given in the appendix. The endogenous construct organizational performance (OP) is composed of five items and measured on a 5-point Likert-type scale (1 = *strongly disagree* to 5 = *strongly agree*). The first-order constructs DMS, PROC, and RM consisted of five items each and measured on "six levels of the generic maturity model proposed by ITGI, Governance Institute (2007) (0 = Nonexistent, 1 = Ad hoc, 2 = Intuitive and repeatable, 3 = Implemented and documented, 4 = Measured with indicators, and 5 = Optimized with improvements)." Similarly, the first-order constructs SI, PI, and OI are composed of three items each and measured on a 5-point Likert-type scale (1 = *strongly disagree* to 5 = *strongly agree*). However, both second-order constructs (ITG and INNOV) were estimated from their respective first-order constructs.

Data Collection

The study population consisted of PakPSOs (ministries, divisions, and their attached departments) at federal and provincial levels which are providing e-services to public, businesses, and themselves. Other types of PakPSOs such as planning, regulatory, and manufacturing organizations were not part of this study. The selection criteria consisted of the existence of formal IT function within the organization, that is, IT budget, IT-based working procedures (IT-based planning and decision making,

human resource management, communication, budgeting and control, etc.), and provision of at least three e-services to the public. Based on the selection criteria and consultation with their respective IT boards, 165 PakPSOs were finalized. The respondents were mainly heads of IT Chief Information Officers (CIOs) or personnel equivalent to this position) who involved in ITG initiatives in the selected PakPSOs. This conceptually resulted into expert sampling technique under non-probability purposive sampling in which respondents of high quality are selected to get meaningful data (Lavrakas, 2008). Structured survey questionnaire technique was applied for data collection due to its ability to reach a large number of respondents economically. We sent 165 questionnaires to the respondents through email, mail, and by hand. The data were collected from November 2019 to February 2020.

Data Analysis

We applied PLS-SEM to estimate the model. PLS-SEM has been applied in a variety of disciplines, including management information systems, strategic management, marketing, and operations management, due to its nonparametric nature and capability of estimating highly complex models with numerous variables without imposing distributional assumptions on the data (Hair et al., 2019). Specially, we used SmartPLS software version 3.2.7, which requires less technical knowledge and is quite user-friendly.

Results

We received 97 valid responses. This constituted a response rate of 58.79%. The sample characteristics are shown in Table 1. These characteristics show that they were at key positions in their respective organizations. Majority of the respondents hold a master's degree or bachelor's degree. Only eight (8.25%) of the respondents hold PhD degree. The average experience of the respondents was 12 years at similar positions at the time of data collection. Most of them were male respondents. Only 13 (13.40%) were female respondents who participated in this study.

Before performing actual PLS-SEM analysis, we first analyzed sample size, multivariate normality, non-response bias (NRB), and common method bias (CMB) (Tehseen et al., 2017). Peng and Lai (2012) recommended that the minimum sample size for PLS-SEM-based analysis should be at least 10 times as higher as the number of indicators of the latent construct with maximum number of indicators in the model. As our model contains latent constructs with maximum five indicators, the minimum required sample size is 50 (fairly below the actual sample size of 97). Hence, sample size is not an issue in this study. Multivariate normality was assessed as recommended by Hair et al. (2017). We assessed multivariate skewness and kurtosis of all the principal latent constructs. The results indicated that our data are not normal because Mardia's multivariate skewness ($\beta = 15.387$, $p < .001$) and Mardia's multivariate kurtosis ($\beta = 75.751$, $p < .001$). An important issue in survey research is that the quality of results is affected when the respondents significantly differ from the non-respondents resulting into NRB (Peytchev, 2013). We applied "Levene's Test for Equality of Variances" to analyze early and late responses. The results indicated p values greater than .05 for all principal latent constructs. This means the variances of both early and late responses can be treated as equal because no significant difference appeared. Therefore, it can be assumed that both early and late respondents are the part of same population and there is no issue of NRB. Another important issue in survey research is that the credibility of results is compromised if data for independent and dependent constructs are gathered from the same respondents resulting into CMB. We applied two statistical approaches to test CMB. First, we applied "Harman's single factor test" as suggested by Podsakoff et al. (2003). According to this test, principal components analysis of all indicators is performed with unrotated factor solution to determine whether a single factor is emerged or total variance of one common factor is greater than 50%. If a single factor is emerged or total variance of one common factor is greater than 50%, then CMB

Table 1. Sample Characteristics ($N = 97$).

Demographics	Frequency	%
Role in the organization		
Director General IT	04	04.12
Head of IT	22	22.68
Executive Director IT	07	07.22
Program Coordinators/Managers	14	14.43
Director/Deputy Director IT Planning	28	28.87
Director/Manager IT Operations	22	22.68
	Median	%
Experience		
Experience (in years)	12	
Qualification		
PhD	08	08.25
Master's degree	41	42.27
Bachelor's degree	48	49.48
Others	0	00.00
Age (in years)		
Below 25	0	00.00
25 to 30	02	02.06
31 to 40	38	39.17
41 to 50	45	46.39
Above 50	22	22.68
Gender		
Male	84	86.60
Female	13	13.40

Note. IT = information technology.

Table 2. Correlation Among Principal Latent Constructs.

Constructs	DMS	PROC	RM	SI	PI	OI	OP
DMS	1.000						
PROC	.425	1.000					
RM	.471	.671	1.000				
SI	.425	.370	.383	1.000			
PI	.594	.572	.531	.386	1.000		
OI	.208	.506	.409	.402	.598	1.00	
OP	.631	.583	.652	.607	.649	.602	1.000

Note. DMS = decision-making structures; PROC = processes; RM = relational mechanisms; SI = service innovation; PI = process innovation; OI = organizational innovation; OP = organizational performance.

exists. Our results indicated 29 unique factors explaining 76.518% of the total variance and the total variance explained by one common factor appeared 44.430%, which is below the threshold of 50%. Hence, CMB is not evident in our data. Second, we applied the correlation matrix procedure as suggested by Bagozzi et al. (1991). According to this procedure, if the correlation among the principal latent constructs is substantially higher, that is, $r > .9$, then CMB exists. The results are shown in Table 2. The results indicate that the correlation among the principal latent constructs is not substantially higher, that is, $r < .9$. Therefore, there is no issue of CMB. This shows our data are safe for further analysis.

Estimation of Hierarchical Component Models in PLS-SEM

Becker et al. (2012) specified four types of hierarchical component models, which are depicted in Figure 2. In reflective–reflective or Type I model, the first-order latent constructs are reflectively assessed. The correlation between these constructs is substantially high. However, these constructs can be differentiated from each other. In reflective–formative or Type II model, the first-order latent constructs are reflectively assessed. These constructs constitute a general concept that completely mediates the effect on second-order latent constructs but do not distribute a common cause. In formative–reflective or Type III model, the second-order latent constructs are a general concept of various formative first-order latent constructs. In formative–formative or Type IV model, the first-order latent constructs are formatively assessed and demonstrate a more abstract generic concept. As ITG and INNOV dimensions (first-order latent constructs) represent different concepts and these concepts cannot share a common cause or unite together conceptually, the overall model of this study is treated as reflective–formative or Type II second-order model.

PLS-SEM computes and uses construct scores of the latent constructs to estimate the path model. As indicators of higher order latent constructs do not exist, Becker et al. (2012) described three main approaches to model the higher order constructs, which are depicted in Figure 3. In repeated indicators approach, higher order latent constructs use all the indicators of their underlying lower order latent constructs. In a two-stage approach, latent variable scores of the lower order constructs are used as indicators of the higher order constructs. In hybrid approach, the one-half of the indicators of lower order latent constructs are used by lower order constructs themselves and remaining half is used by the higher order latent constructs. Each approach has advantages and disadvantages over each other (Sarstedt et al., 2019). However, this study applied a two-stage approach in line with Hair et al. (2017).

Assessment of the Measurement Model

As the first order, latent constructs of the model are reflective constructs; the outer loadings, Cronbach's alpha, composite reliability (CR), and average variance extracted (AVE) measures were used to assess these constructs as suggested by Hair et al. (2017). The results of PLS algorithm based on 5,000 maximum iterations are shown in Table 3. The results indicate that the outer loadings are above the minimum recommended value of 0.7 (Hair et al., 2017). The Cronbach's alpha, CR, and AVE are greater than the minimum threshold of .7, .7 and 0.5, respectively (Fornell & Larcker, 1981; Gefen & Straub, 2005). This provides strong evidence for the reliability, internal consistency reliability, and convergent validity.

To assess the discriminant validity, we applied new criteria of "Heterotrait–Monotrait ratio of correlations (HTMT)" to test the discriminant validity as proposed by Henseler et al. (2015). They recommended that to establish discriminant validity, all HTMT values should not be higher than .85 in case of the $HTMT_{.85}$ rule and the confidence interval (CI) should not involve the value of 1 in case of $HTMT_{inference}$ rule. The results are shown in Table 4. The results indicate that all HTMT values are less than .85. We also checked CI by performing bootstrapping and results indicated that CI did not involve a value of 1. This provides strong evidence for discriminant validity.

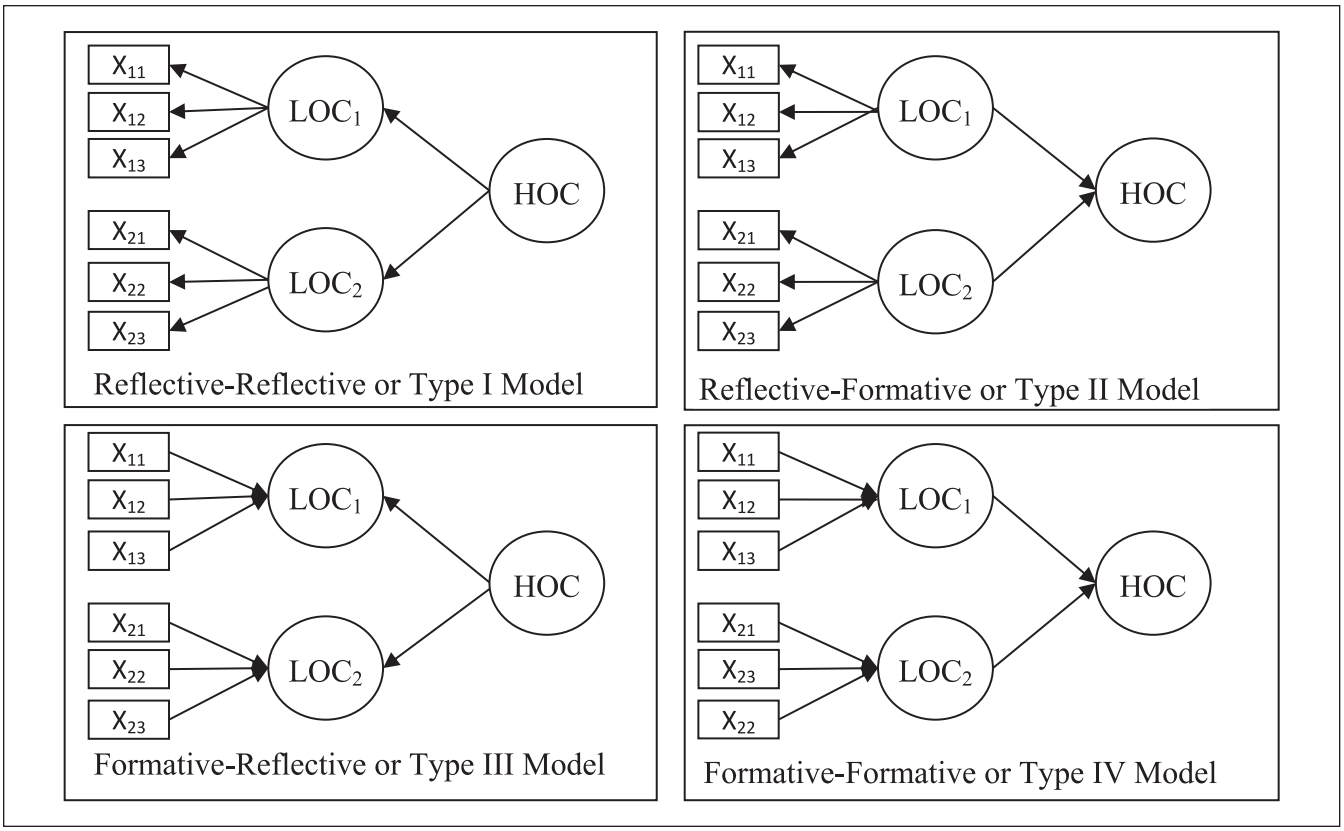

Figure 2. Types of hierarchical component models.
Note. LOC = lower order construct; HOC = higher order construct.

Assessment of the Measurement Model of Higher Order Formative Latent Constructs

As the second-order latent constructs ITG and INNOV are formative constructs and criterion to assess formative constructs is different to that of reflective constructs, we applied a two-stage approach suggested by Hair et al. (2017) to assess the measurement model validity of these second-order constructs. In this approach, the scores of the first-order constructs are used to measure the second-order constructs. In other words, the first-order constructs become the indicators of the second-order constructs. First, the collinearity between the predictors of the second-order formative constructs (first-order constructs) was evaluated using a variance inflation factor (VIF). Second, the outer weights and significance (*t*-value) were estimated through PLS bootstrapping based on 5,000 subsamples. The results are shown in Table 5. The results indicate that the VIF values of the predictors of ITG and INNOV are in a range from 1.236 to 1.992, which are within the limit of 0.2 to 5.0 as recommended by Ringle et al. (2012). It means there is no issue of collinearity. Furthermore, the results demonstrate that the outer weights are in a range from 0.383 to 0.475, which are significant, that is, $t > 2.576$ at .01% significant level. This provides strong support to conceptualize ITG and INNOV as formative constructs. Figure 4 depicts the conceptual model and PLS-SEM results.

Assessment of the Structural Model

Subsequently, we used the structural model to test the proposed hypotheses. The PLS bootstrapping has performed based on 5,000 subsamples. The results of the coefficient of determination (R^2) of endogenous latent constructs INNOV and OP are shown in Table 6, and path coefficient strength (β) and significance (*t*-value) of the relationships are shown in Table 7. The results in Table 6 indicate that 46.2% variance in INNOV can be explained by ITG and 69.7% variance in OP can be explained by ITG and INNOV, which are in line with the proposed threshold of Chin (1998).

The results in Table 7 indicate that ITG demonstrates positive effect on OP ($\beta = 0.422$, $t = 3.567$). Hence, H1 is supported. Moreover, ITG demonstrates positive effect on INNOV ($\beta = 0.680$, $t = 12.404$). Thus, H2 is supported. Furthermore, INNOV demonstrates positive effect on OP ($\beta = 0.488$, $t = 4.410$). Therefore, H3 is supported. The results also indicate that ITG demonstrates an indirect positive effect on OP through INNOV ($\beta = 0.332$, $t = 4.120$).

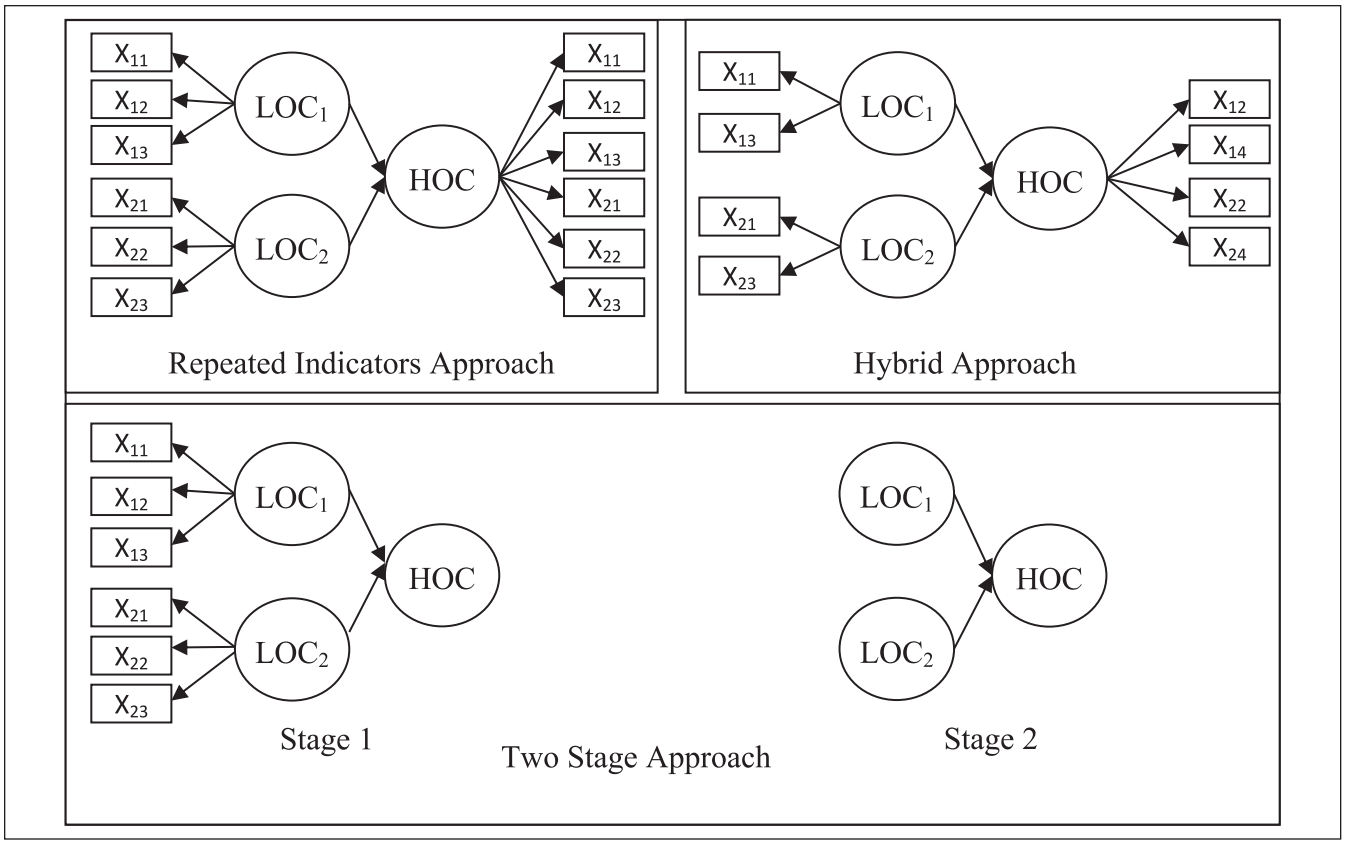

Figure 3. Main approaches to model the HOCs.
Note. LOC = lower order construct; HOC = higher order construct.

However, at this stage, we are not ascertained whether the H4 is supported or not. It requires some further analysis.

We tested the mediating effect of ITG on OP through INNOV in line with the updated procedure provided by Hair et al. (2017). First, we tested the effect of ITG on OP when INNOV is not present in the model. We found that ITG demonstrates positive effect on OP ($\beta = 0.756$, $t = 12.039$). Second, we tested the direct and indirect effects of ITG on OP when INNOV is present in the model. We found that ITG demonstrates direct positive effect on OP ($\beta = 0.422$, $t = 3.567$) and indirect positive effect on OP ($\beta = 0.332$, $t = 4.120$). Hair et al. (2017) recommended that if both effects (direct and indirect) are significant, then there are chances of partial mediation, but it depends on the value of variance accounted for (VAF). Therefore, assessing VAF is required to determine the magnitude of mediation. Hair et al. (2017) also described that if VAF is between 0 and 0.20, then no mediation takes place; if VAF is between 0.20 and 0.80, then partial mediation takes place; and if VAF is greater than 0.80, then full mediation takes place. The "VAF = Indirect effect/Total effect," where "Total effect = Direct effect + Indirect effect." Hence, VAF = 0.332 / (0.422 + 0.332) = 0.4403. It can be said that 44.03% of ITG's effect on OP can be explained via INNOV mediator. It means ITG transmits its 42.71% effect on OP through INNOV. As the VAF value is between 0.20 and 0.80, partial mediation has revealed in our model. Thus, we can say, H4 is also supported. In conclusion, the mediation effect of INNOV in the relationship between ITG and OP, although partially, has established in this study.

Discussion

Due to the increasing use of IT in PSOs and the great importance of ITG to provide conditions for innovation to occur and subsequent organizational performance in this context, this study investigated the mediating effect of innovation in the relationship between ITG and organizational performance in PakPSOs. The results revealed that ITG positively influenced innovation and organizational performance. Innovation positively influenced organizational performance. Innovation partially mediated the association between ITG and organizational performance. Therefore, special focus should be given to these areas while allocating scarce resources in this context.

The findings suggest that ITG in terms of decision-making structures, processes, and relational mechanisms has a huge potential to improve and sustain organizational performance in terms of operational efficiency in public service delivery, transparency in the costs and results, improved

Table 3. Construct Validity.

Latent construct	Indicators	Outer loading	Cronbach's α	CR	AVE
DMS (5 items)	DMS1	0.894	.940	.954	0.806
	DMS2	0.884			
	DMS3	0.897			
	DMS4	0.907			
	DMS5	0.906			
PROC (5 items)	PROC1	0.836	.906	.930	0.725
	PROC2	0.863			
	PROC3	0.857			
	PROC4	0.856			
	PROC5	0.845			
RM (5 items)	RM1	0.874	.927	.945	0.774
	RM2	0.911			
	RM3	0.882			
	RM4	0.864			
	RM5	0.867			
SI (3 items)	SI1	0.882	.824	.896	0.742
	SI2	0.911			
	SI3	0.787			
PI (3 items)	PI1	0.813	.825	.896	0.742
	PI2	0.910			
	PI3	0.858			
OI (3 items)	OI1	0.879	.894	.934	0.826
	OI2	0.943			
	OI3	0.902			
OP (5 items)	OP1	0.781	.872	.907	0.662
	OP2	0.840			
	OP3	0.814			
	OP4	0.805			
	OP5	0.827			

Note. CR = composite reliability; AVE = average variance extracted; DMS = decision-making structures; PROC = processes; RM = relational mechanisms; SI = service innovation; PI = process innovation; OI = organizational innovation; OP = organizational performance.

Table 4. HTMT Criterion.

Constructs	DMS	PROC	RM	SI	PI	OI	OP
DMS							
PROC	.458						
RM	.499	.728					
SI	.481	.429	.436				
PI	.655	.655	.603	.459			
OI	.224	.557	.447	.467	.695		
OP	.685	.646	.720	.714	.755	.679	

Note. HTMT = Heterotrait–Monotrait ratio of correlations; DMS = decision-making structures; PROC = processes; RM = relational mechanisms; SI = service innovation; PI = process innovation; OI = organizational innovation; OP = organizational performance.

planning and decision making, better monitoring and control, and enhanced collaboration and synergy. However, ITG does not contribute directly to organizational performance rather organizations have to strive for innovation capability in terms of service, process, and administrative tasks to achieve the desired results. Therefore, innovation should be the priority of the PSOs even when sufficient ITG mechanisms have implemented. Management of PSOs should not simply focus on increasing the maturity of ITG rather it is more important to strive for innovation capability. As ITG is a complex and broader concept and its purpose is well beyond the creation of innovation especially in PSOs which are more conservative regarding innovation than their private counterparts, ITG partially mediates the association between ITG and organizational performance through innovation instead of full mediation.

Implications for Theory

The study contributes to the existing knowledge base through a new theoretical model. It has investigated the mediating effect of innovation in the relationship between ITG and organizational performance, which lacks in previous studies.

Table 5. Measurement Model Validity of Second-Order Latent Constructs.

Second-order constructs	First-order constructs	Outer weights	VIF	*t*-value	Bias-corrected confidence interval
ITG	DMS	0.392	1.327	16.667***	[0.329, 0.459]
	PROC	0.405	1.895	12.428***	[0.326, 0.488]
	RM	0.411	1.992	14.894***	[0.353, 0.503]
INNOV	SI	0.389	1.236	9.569***	[0.277, 0.505]
	PI	0.475	1.605	9.916***	[0.381, 0.641]
	OI	0.383	1.635	8.463***	[0.258, 0.495]

Note. Bias-corrected and accelerated bootstrap based on 5,000 subsamples. VIF = variance inflation factor; ITG = information technology governance; DMS = decision-making structures; PROC = processes; RM = relational mechanisms; INNOV = innovation; SI = service innovation; PI = process innovation; OI = organizational innovation.
***$p < .001$ (two-tailed test).

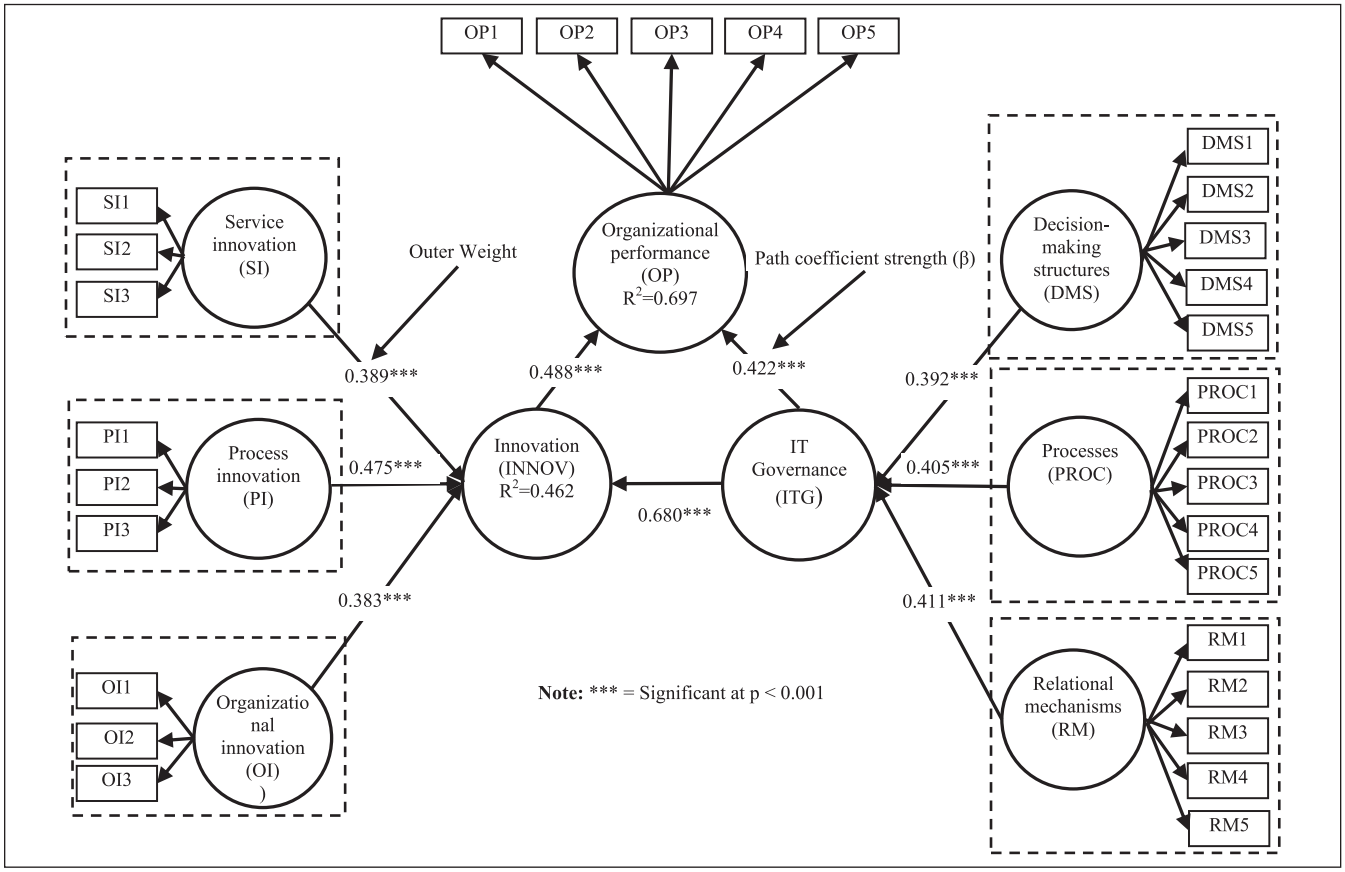

Figure 4. Conceptual model and PLS-SEM results.
Note. PLS-SEM = partial least squares structural equation modeling.

Table 6. Results of Coefficient of Determination (R^2).

Endogenous constructs	R^2
INNOV	.462
OP	.697

Note. INNOV = innovation; OP = organizational performance.

The study asserts that ITG mechanisms can be implemented to enhance innovation capability in PSOs as ITG facilitates innovation capability, which subsequently improves organizational performance. Moreover, the study provides empirical evidence to assist a new public management (NPM) strategy. Existing strategies and approaches in the ITG literature mainly focus on the direct link between ITG and organizational performance or implicitly cover innovation as an item of ITG or organizational performance measurement instrument. This study separates the concept of innovation from ITG or organizational performance. Therefore, the study complements the shortcomings of the previous studies and provides a theoretical foundation to improve the previous approaches and frameworks.

Table 7. Structural Model Path Coefficient Strength (β) and Significance (*t*-Value).

Path	Path coefficient strength (β)	Sample mean (*M*)	Standard deviation (|STDEV|)	*t*-value	Hypotheses
ITG → OP	0.422	0.434	0.118	3.567***	Supported
ITG → INNOV	0.680	0.692	0.055	12.404***	Supported
INNOV → OP	0.488	0.474	0.111	4.410***	Supported
ITG → OP (indirect effect)	0.332	0.413	0.096	4.120***	Supported

Note. Bias-corrected and accelerated bootstrap based on 5,000 subsamples. ITG = information technology governance; OP = organizational performance; INNOV = innovation.
***$p < .001$ (two-tailed test).

Implications for Practice

The study also provides managerial implications for public managers and decision makers in PakPSOs. The results are significant for practice as they point to the innovation and organizational performance in the public sector. Public managers in PakPSOs and other similar environments can better strive for ITG potential and its contribution to develop innovation capability and materialize the required public sector reforms. They can improve ITG through the implementation of appropriate mechanisms. Appropriate mechanisms lead toward innovation in the services, processes, and administration. Innovation in the services leads toward the fulfillment of citizens' needs and expectations from the government. Innovation in the processes leads toward better delivery of public services and innovation in the administration leads toward better management of the organization in terms of planning and decision making, better monitoring and control, and collaboration and synergy. However, the choice of ITG mechanisms and innovative services, processes, and administrative tasks may be different for different organizations and depends on the organizational strategies, structures, objectives, and types of the services they deliver to the public. The results are also useful to update existing IT management plans and related strategies.

Conclusion

The study investigated the mediating effect of innovation in the relationship between ITG and organizational performance in PakPSOs. This has achieved by developing and testing an explanatory model using sample data from 97 PakPSOs and applying PLS-SEM for data analysis. The study applied hierarchical component model (second-order model) of Type II (reflective–formative) using a two-stage approach due to the broader concept of ITG and innovation. The results revealed that ITG positively affected innovation and organizational performance. Innovation positively affected organizational performance. Moreover, innovation partially mediated the relationship between ITG and organizational performance. In this way, the study corroborates the strategic use of IT to enhance innovation and organizational performance in PakPSOs.

Although the study has carefully conducted to advance the knowledge and practice of ITG and innovation in this context, it comes up with few limitations which are important to take into account while interpreting the results. First, we applied the non-random sampling technique to select the organizations which belonged to only one country, that is, Pakistan, and one sector, that is, service sector organizations. Moreover, we used a single informant strategy to collect data from each organization. Although this limits the external validity of the results, it provides the gap for further research to analyze the model with other samples. Future researchers can involve other countries and/or other types of organizations such as planning, regulatory, and manufacturing sector organizations and use organization type as a control variable to extend the model of this study.

Appendix

Information Technology Governance (ITG)

Measured on six levels of the generic maturity model of Control Objectives for Information and Related Technologies (COBIT) by ITGI, Governance Institute (2007):

Level 0 (Nonexistent): The mechanism is not exercised in the organization at all.
Level 1 (Ad hoc): The mechanism is exercised but applied on case-to-case basis without any standardization.
Level 2 (Intuitive and repeatable): The mechanism is exercised intuitively by individuals.
Level 3 (Implemented and documented): The mechanism is exercised as per documented standards, which are communicated in the organization.
Level 4 (Measured with indicators): The mechanism is evaluated against pre-set performance indicators in line with documented standards.
Level 5 (Optimized with improvements): The mechanism is based on best practices and continuously improved after evaluation.

Construct	Items	Source(s)
DMS	DMS1: IT steering committee at executive level or senior management level to evaluate priorities in IT investments.	Wiedenhoft et al. (2017)
	DMS2: IT project steering committee composed of both management and IT personnel to focus on prioritizing and managing IT projects.	Tonelli et al. (2017)
	DMS3: IT security steering committee composed of both management and IT personnel to focus on IT-related risks and security issues.	Tonelli et al. (2017)
	DMS4: IT audit committee composed of independent members outside the organization to overview IT assurance activities and address IT-related risks.	Tonelli et al. (2017)
	DMS5: IT projects feasibility review committee composed of both management and IT personnel to provide guidelines on IT projects feasibility.	Tonelli et al. (2017)
PROC	PROC1: A formal strategic planning process to define and update IT strategy in line with organizational objectives and priorities.	Wiedenhoft et al. (2017)
	PROC2: A formal IT outsourcing management process for IT development projects, IT operations, or IT services.	Tonelli et al. (2017)
	PROC3: A formal IT project management methodology to manage IT projects in time, within budget, and according to specifications.	Tonelli et al. (2017)
	PROC4: A formal IT budget control and reporting process to control and report on IT activities/investments.	Tonelli et al. (2017)
	PROC5: A formal IT performance measurement process to measure performance in four perspectives, including organization contribution, user orientation, operational excellence, or future orientation.	Tonelli et al. (2017)
RM	RM1: Internal corporate communication to regularly address general IT issues.	Tonelli et al. (2017)
	RM2: A clear and top-level mandate of IT leadership to articulate a vision of IT and communicate it down into the organization.	Nfuka & Rusu (2011)
	RM3: Job rotation to train management personnel about IT and IT personnel about management.	Tonelli et al. (2017)
	RM 4: Senior management and IT personnel act as partners.	Nfuka et al. (2011)
	RM5: Campaigns to explain the need for IT governance.	Nfuka et al. (2011)

Note. DMS = decision-making structures; IT = information technology; PROC = processes; RM = relational mechanisms.

Innovation

Measured on a 6-point Likert-type scale (1 = *strongly disagree* to 6 = *strongly agree*).

Construct	Items	Source(s)
SI	SI1: New or significantly improved public services/products in terms of efficiency.	Windrum & Koch (2008)
	SI2: New or significantly improved public services/products in terms of cost-effectiveness.	
	SI3: New or significantly improved public services/products in terms of flexibility.	
PI	PI1: New or significantly improved methods of producing, developing, or designing public services/products.	Windrum & Koch (2008)
	PI2: New or significantly improved methods of delivering or distributing public services/products.	
	PI3: New or significantly improved methods for operations, maintenance, computing, accounting, and purchasing.	
OI	OI1: New management practices for organizing procedures (e.g., supply chain management, reengineering, knowledge management, production and quality management).	Windrum & Koch (2008)
	OI2: New methods of organizing work responsibilities and decision making (e.g., employee responsibilities, teamwork, decentralization, integration or de-integration of departments, and education/training systems).	
	OI3: New methods of organizing internal and external relations in and across organizations (e.g., collaboration, public–private partnerships, outsourcing, subcontracting).	

Note. SI = service innovation; PI = process innovation; OI = organizational innovation.

Organizational Performance

Measured on a 6-point Likert-type scale (1 = *strongly disagree* to 6 = *strongly agree*).

Construct	Items	Source(s)
OP	OP1: Operational efficiency	Weill & Ross (2004)
	OP2: Transparency in disclosing expenditures and results	Weill & Ross (2004)
	OP3: Planning and decision making	Andersen et al. (2010)
	OP4: Performance monitoring and control	Andersen et al. (2010)
	OP5: Collaboration and synergy	Andersen et al. (2010)

Note. OP = organizational performance.

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References

Alford, J., & O'Flynn, J. (2009). Making sense of public value: Concepts, critiques and emergent meanings. *International Journal of Public Administration*, *32*(3), 171–191.

Ali, S., & Green, P. (2007). IT governance mechanisms in public sector organizations: An Australian context. *Journal of Global Information Management*, *15*(4), 41–63.

Al-Qatamin, A. A., & Al-Omari, M. H. (2020). A study of the effect of information technology governance on quality of information technology services: The case of Jordan Customs Department. *Review of Integrative Business and Economics Research*, *9*, 41–55.

Andersen, K. N., Henriksen, H. Z., Medaglia, R., Danziger, J. N., Sannarnes, M. K., & Enemærke, M. (2010). Fads and facts of E-government: A review of impacts of E-Government (2003–2009). *International Journal of Public Administration*, *33*(11), 564–579.

Anderson, M. C., Banker, R. D., & Ravindran, S. (2006). Value implications of investments in information technology. *Management Science*, *52*(9), 1359–1376.

Arif, M. (2018). ICTs and development in Pakistan: A review. *Journal of Innovations and Sustainability*, *4*(3), 7–25.

Arvanitis, S., Loukis, E., & Diamantopoulou, V. (2013). The effect of soft ICT capital on innovation performance of Greek firms. *Journal of Enterprise Information Management*, *26*(6), 679–701.

Attour, A., & Chaupain-Guillot, S. (2020). Digital Innovations in public administrations: Technological or policy innovation diffusion? *Journal of Innovation Economics & Management*, *31*(1), 195–219.

Bagozzi, R. P., Yi, Y., & Phillips, L. W. (1991). Assessing construct validity in organizational research. *Administrative Science Quarterly*, *36*(3), 421–458.

Becker, J. M., Klein, K., & Wetzels, M. (2012). Hierarchical latent variable models in PLS-SEM: Guidelines for using reflective-formative type models. *Long Range Planning*, *45*(5–6), 359–394.

Benbunan-Fich, R., Desouza, K. C., & Andersen, K. N. (2020). IT-enabled innovation in the public sector: Introduction to the special issue. *European Journal of Information Systems*, *29*(4), 323–328.

Bharadwaj, A. S., Bharadwaj, S. G., & Konsynski, B. R. (1999). Information technology effects on firm performance as measured by Tobin's q. *Management Science*, *45*(7), 1008–1024.

Boer, H., & During, W. E. (2001). Innovation, what innovation? A comparison between product, process and organizational innovation. *International Journal of Technology Management*, *22*(1–3), 83–107.

Borja, S., Kim, K., Yoon, H., & Hwang, J. (2018). IT governance effectiveness and its influence on innovation product and process. *Journal of Strategic Innovation and Sustainability*, *13*(5), 43–57.

Brynjolfsson, E. (1993). The productivity paradox of information technology. *Communications of the ACM*, *36*(12), 66–77.

Brynjolfsson, E., & Saunders, A. (2010). *Wired for innovation: How information technology is reshaping the economy*. MIT Press.

Chin, W. (1998). Issues and opinion on structural equation modeling. *MIS Quarterly*, *22*(1), 7–16.

Cofriyanti, E., & Hidayanto, A. N. (2013). The relationship among organizations' factors, information technology, innovation and performance: An Indonesian SMEs study. *International Journal of Innovation and Learning*, *14*(3–4), 422–443.

Cordella, A., & Bonina, C. M. (2012). A public value perspective for ICT enabled public sector reforms: A theoretical reflection. *Government Information Quarterly*, *29*(4), 512–520.

Damanpour, F., Szabat, K. A., & Evan, W. M. (1989). The relationship between types of innovation and organizational performance. *Journal of Management Studies*, *26*(6), 587–602.

De Haes, S., & Van Grembergen, W. (2013). Improving enterprise governance of IT in a major airline: A teaching case. *Journal of Information Technology Teaching Cases*, *3*(2), 60–69.

De Vries, H., Bekkers, V., & Tummers, L. (2016). Innovation in the public sector: A systematic review and future research agenda. *Public Administration*, *94*(1), 146–166.

Dunleavy, P., Margetts, H., Bastow, S., & Tinker, J. (2006). New public management is dead—Long live digital-era governance. *Journal of Public Administration Research and Theory*, *16*(3), 467–494.

Fernández-Mesa, A., Ferreras-Méndez, J. L., Alegre, J., & Chiva, R. (2014). IT competency and the commercial success of innovation. *Industrial Management & Data Systems*, *114*(4), 550–567.

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, *18*(1), 39–50.

Gefen, D., & Straub, D. (2005). A practical guide to factorial validity using PLS-graph: Tutorial and annotated example. *Communications of the Association for Information Systems*, *16*(1), 5.

Gieske, H., Meerkerk, I. V., & Buuren, A. V. (2018). The impact of innovation and optimization on public sector performance: Testing the contribution of connective, ambidextrous, and learning capabilities. *Public Performance & Management Review*, *42*(2), 432–460.

Hair, J. F., Hult, G. T., Ringle, C. M., & Sarstedt, M. (2017). *A primer on partial least squares structural equation modeling (PLS-SEM)*. SAGE.

Hair, J. F., Risher, J., Sarstedt, M., & Ringle, C. (2019). When to use and how to report the results of PLS-SEM. *European Business Review*, *31*(1), 2–24.

Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the Academy of Marketing Science*, *43*(1), 115–135.

ITGI. (2007). *About IT governance framework: Information systems audit and control foundation—CobiT* (4th ed.). Information Systems Audit and Control Association.

Lang, T. M., Lin, S. H., & Vy, T. N. T. (2012). Mediate effect of technology innovation capabilities investment capability and firm performance in Vietnam. *Procedia—Social and Behavioral Sciences*, *40*, 817–829.

Lavrakas, P. J. (2008). *Encyclopedia of survey research methods*. SAGE.

Lee, D. H., Dedahanov, A. T., & Rhee, J. (2016). Moderating role of external networks and mediating effect of innovation performance on the relationship between technology orientation and firm performance. *Asian Journal of Technology Innovation*, *23*(3), 321–334.

Lohmeier, A. (2013, August 29–31). *eGovernment—A driving force for public sector innovation?* [Conference session]. Third International Conference on Innovative Computing Technology (INTECH 2013), London, England.

Magnusson, J., Koutsikouri, D., & Päivärinta, T. (2020). Efficiency creep and shadow innovation: Enacting ambidextrous IT Governance in the public sector. *European Journal of Information Systems*, *29*(4), 329–349.

Maidin, S. S., & Arshad, N. H. (2010, June 18–20). *Information technology governance practices in Malaysian public sector* [Conference session]. 2010 International Conference on Financial Theory and Engineering, Dubai, United Arab Emirates.

Moore, M. H. (1994). Public value as the focus of strategy. *Australian Journal of Public Administration*, *53*(3), 296–303.

Moore, M. H. (1995). *Creating public value: Strategic management in government*. Harvard University Press.

Moreira, M. R., Gherman, M., & Sousa, P. S. (2017). Does innovation influence the performance of healthcare organizations? *Innovation*, *19*(3), 335–352.

Nemeslaki, A. (2014). ICT driven public sector innovation. In A. Nemeslaki (Ed.), *ICT driven public service innovation: Comparative approach focusing on Hungary* (pp. 9–30). National University of Public Service.

Newcomer, K. E., & Caudle, S. L. (1991). Evaluating public sector information systems: More than meets the eye. *Public Administration Review*, *51*(5), 377–384.

Nfuka, E. N., & Rusu, L. (2011). The effect of critical success factors on IT governance performance. *Industrial Management & Data Systems*, *111*(9), 1418–1448.

O'Toole, L. J. (1997). Implementing public innovations in network settings. *Administration & Society*, *29*(2), 115–138.

Panagiotopoulos, P., Klievink, B., & Cordella, A. (2019). Public value creation in digital government. *Government Information Quarterly*, *36*(4), 1–20.

Pang, M. S., Lee, G., & DeLone, W. H. (2014). IT resources, organizational capabilities, and value creation in public-sector organizations: A public-value management perspective. *Journal of Information Technology*, *29*(3), 187–205.

Peng, D. X., & Lai, F. (2012). Using partial least squares in operations management research: A practical guideline and summary of past research. *Journal of Operations Management*, *30*(6), 467–480.

Peterson, R. R. (2004). Crafting information technology governance for today's turbulent environment. *Information Systems Management*, *21*(4), 7–23.

Peytchev, A. (2013). Consequences of survey nonresponse. *The ANNALS of the American Academy of Political and Social Science*, *645*(1), 88–111.

Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology*, *88*(5), 879–903.

Rai, A., Patnayakuni, R., & Seth, N. (2006). Firm performance impacts of digitally enabled supply chain integration capabilities. *MIS Quarterly*, *30*(2), 225–246.

Rhodes, R. A. W., & Wanna, J. (2007). The limits to public value, or rescuing responsible government from the platonic guardians. *Australasian Journal of Public Administration*, *66*(4), 406–421.

Ringle, C. M., Sarstedt, M., & Straub, D. W. (2012). Editor's comments: A critical look at the use of PLS-SEM in MS quarterly. *MIS Quarterly*, *36*(1), 3–14.

Sarstedt, M., Hair, J. F., Cheah, J., Becker, J. M., & Ringle, C. M. (2019). How to specify, estimate, and validate higher-order constructs in PLS-SEM. *Australasian Marketing Journal*, *27*(3), 197–211.

Tanriverdi, H. (2005). Information technology relatedness, knowledge management capability, and performance of multi-business firms. *MIS Quarterly*, *29*(2), 311–334.

Tehseen, S., Qureshi, Z. H., Johara, F., & Ramayah, T. (2020). Assessing dimensions of entrepreneurial competencies: A Type II (reflective-formative) measurement approach using PLS-SEM. *Journal of Sustainability Science and Management*, *15*(2), 108–145.

Tehseen, S., Ramayah, T., & Sajilan, S. (2017). Testing and controlling for common method variance: A review of available methods. *Journal of Management Sciences*, *4*(2), 142–168.

Tiwana, A., & Kim, S. K. (2015). Discriminating IT governance. *Information Systems Research*, *26*(4), 656–674.

Tonelli, A. O., de Souza Bermejo, P. H., Dos Santos, P. A., Zuppo, L., & Zambalde, A. L. (2017). IT governance in the public sector: A conceptual model. *Information Systems Frontiers*, *19*(3), 593–610.

Walker, R. M., Damanpour, F., & Devece, C. A. (2010). Management innovation and organizational performance: The mediating effect of performance management. *Journal of Public Administration Research and Theory*, *21*(2), 367–386.

Weill, P., & Ross, J. W. (2004). *IT governance: How top performers manage IT decision rights for superior results*. Harvard Business Press.

Wiedenhoft, G. C., Luciano, E. M., & Magnagnagno, O. A. (2017). Information technology governance in public organizations: Identifying mechanisms that meet its goals while respecting principles. *Journal of Information Systems and Technology Management*, *14*(1), 69–87.

Windrum, P., & Koch, P. M. (2008). *Innovation in public sector services: Entrepreneurship, creativity and management*. Edward Elgar.

Yildiz, M. (2007). E-government research: Reviewing the literature, limitations, and ways forward. *Government Information Quarterly*, *24*(3), 646–665.

Zhang, P., Zhao, K., & Kumar, R. L. (2014). Impact of IT governance and IT capability on firm performance. *Information Systems Management*, *33*(4), 357–373.