The impact of IT governance and data governance on financial and non-financial performance

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Abstract

This paper aims to examine the impact of both information technology governance (ITG) and data governance on information technology (IT) performance in the telecommunication industry. A questionnaire of 308 managers was collected from all telecommunication companies that are working in Egypt. Data were analyzed using smart partial least squares (PLS). The results showed that all the hypotheses of the study had been accepted. IT and data governance have a significant impact on both financial and non-financial performance. However, each of them has a different effect on the IT performance dimensions. The financial performance of IT department had been affected by IT governance more than data governance. Also, innovation and flexibility were the most affected by IT governance. On the other hand, data governance affected business processes and ethical compliance more than IT governance. The current study filled the gap on the literature in two ways. First, studying both IT governance and data governance as a critical factors affects financial and non-financial performance. Second, studying IT governance and data governance has become more important, especially in the telecommunication industry as it is a big challenge now to secure the data of the companies.

Keywords　IT governance, Data governance, Financial performance, Decision making, Business processes, Innovation, Flexibility, Legal and ethical compliance

Introduction

Data have become one of the most powerful assets in our life. Managing and securing data plays an important role in implementing an effective cybersecurity strategy [30]. Telecommunication industry is believed to be one of the most industries affected by data security because it deals with big volume of sensitive data. For example, financial messages of customers or financial transactions present a big risk for all interested parties. Therefore, securing data needs more attention in telecommunication companies [52]. Although many studies have pointed out that data governance is very important to protect the organization's data and assets, the literature in data governance is considered insufficient [12, 58].

Literature has not fully taken into account the importance of sharing data across several parties [82]. Most of literature attention has been focused on IT governance. previous studies investigated IT governance impacts in various disciplines. For example, [94] discussed the IT governance impact on employee's satisfaction. Kosasi and Yuliani [65] studied the IT governance in online marketing, and [71] discussed IT governance role in entrepreneurship. IT governance has a critical concern for many organizations in various industries [3], but data governance did not have the same regard in the literature;

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however, they are also considered as assets. Therefore, it also requires similar governance to achieve the strategic objectives [82].

Governance has been presented in the organizational literature since 1960 [100]. It is a broad term that has been discussed in many fields: economics, politics, public administration, sociology, etc. [23]. It refers to self-organizing and interorganizational networks. It is also defined as a formal and informal rules to settle conflicts between interested parties [63]. The main aim of IT governance is to utilize IT assets to achieve the organization goals [82].

When information technology began to spread, it seems to support corporate governance, as it is any form of computer-based information system that can organize, collect, store, or distribute information. Information technology also supports decision making and empowers managers and stakeholders to enhance corporate governance [38]. However, information technology is important for organizations to cope governance, and its benefit depends on people's usage. That problem may impede the utilization of information technology. Therefore, IT governance appeared to ensure that the money invested in information technology would be able to generate the expected value and the mitigate risks associated with information technology [99].

Another gap in the literature of IT governance is that most of the previous studies measured performance at the organizational stage. For example, [8, 54, 88, 96, 103, 107] studied both direct and indirect relation between IT governance and organization performance. More studies in the IT department performance need to be held. The importance of studying IT performance appears in its impact on many aspects of the organization. IT department performance is believed to have a great effect on customer satisfaction and organization competitiveness [40]

The problem that appears also in IT unit can affect organization performance, as organization success depends on IT unit performance [101]. Measuring IT performance is very critical, because it can affect benefits, costs and risks [6]. Many researchers suggested that performance would better be measured at the level of business units, because it can indicate some problems earlier before it gets worse [59]. Unfortunately, financial indicators are not enough for the performance evaluation of IT departments. Non-financial performance measures are also critical to build a whole view of the performance [40]

Moreover, both financial and non-financial measures help in understanding the contribution of IT toward the business [33].

Just a few researchers studied the impact of IT governance on IT unit level [98]. Moreover, traditional IT governance models and frameworks are considered too structured and lack flexibility [18]. Consequently, there is a need to combine the developed IT mechanisms by data governance mechanisms.

Thus, to overcome these gaps, here the study aims to investigate the impact of IT governance mechanisms and data governance on IT department performance. Based on the research objectives, we need to answer the following questions: (1) Does IT governance impact the financial and non-financial performance of IT department? (2) Does data governance impact has the same impact on the financial and non-financial performance of IT department? (3) Which dimensions of IT performance are most affected by IT and data governance?

Here the study contributes to the literature of information system management by identifying the impact of one of the important dimensions of cybersecurity (IT governance) and data governance on IT department performance. Also, this paper will enable academics and practitioners to understand which dimension of financial and non-financial performance will most be affected by IT governance practices. Hence, the result will be useful for IT planners and top managers when taking IT decisions.

The paper is structured as follows. First, we began with an overview of theoretical background, starting with IT governance and data governance and their relation with both financial and non-financial performance. Then we use a quantitative method to investigate these relations. Finally, we discussed the overall findings and the implications for both research and practice.

Literature review
IT governance mechanisms
The 'Governance' word origin is a Greek word, "kyberman"; its meaning is "role, command steering, guiding or governing" [62]. Moving to the English usage, the term governance refers to the exercise of sovereign power by the state; it is a reference to processes and mechanisms for determining and realizing the collective goals [93].

Conventionally, governance is actually considered as a synonym of government [5] Generally speaking—beyond governing a country—governance would be considered referring to the activity of controlling a company or organization (Oxford Advanced Learner's Dictionary). IT governance is a subset of corporate governance [32]. It is one of the most important concerns facing organizations managers from different industries, as it's not just considered a supporting tool but also a strategic driving force for the business [1]. Several studies showed that enterprises should implement IT governance over the use of IT mechanisms. Enterprises embrace IT governance

using a mixture of various structures, processes, and relational mechanisms [70].

Enterprise governance of IT mechanisms

Structures, processes, and relations are considered as IT governance dimensions. Structures are the organization's units and roles responsible for making IT decisions, like committees, executive teams, and business/IT relationship managers [74]. Enterprise governance of IT structure determines the person who will make decisions, which organizational unit creates and who will take part in these units? And what are their responsibilities in these units? [103].

The enterprise governance of IT processes addresses the questions: How IT investment and operation decisions are made? What are the forms of decision-making processes for a proposition, reviewing, agreeing on, and prioritizing IT investments? [10]. Processes also encompass the arrangements of formal decision making and design the forms of monitoring and control procedures for making sure that IT daily operations are consistent and in conformance with firm IT policy [32, 74].

Communication/relational mechanisms address the question of how the outcome of ITG processes and decisions will be monitored, measured and communicated. Communication/relational mechanisms are about the shared knowledge, a bidirectional communication, dynamic participation and the cooperative relationship between the corporate executive managers and IT managers, and also the employees and shareholders [1].

It is important to know that these mechanisms operate in a coordinated way. For example, these structures cannot be effective without supporting processes, e.g., IT steering committee cannot make an appropriate investment decision without an appropriate and mature portfolio management process [70].

Data governance

The future of information technology will be a mixed nature: on-premise and in the cloud, delivered by the internal IT department and by cloud service providers [56]. Cloud computing is characterized as a method of computational "outsourcing" to the cloud [69]. It is a new form of IT system and infrastructure outsourcing as an alternative to traditional information technology outsourcing [79]. It is one of the latest trends to outsource some or entire IT operations, processes or even infrastructure to run a business from the public cloud [28]. It also inherits the "roles and responsibilities" factors from outsourcing [61]. Such technology provides a paradigm shift in the field of information technology [17]. Gartner's study predicts that the market size and growth of the cloud services business will increase in IT services

[80]. Today's competitive environment pushes technology into changing quickly, hence triggering organizations to be ready for such changes. It is believed to be one of the popular evolving information technologies that seem to affect organizations in different ways, and on different levels [60]. For all reasons mentioned above, here the study will concentrate on data governance of cloud computing.

IT governance and data governance

Organizations will have to adopt more liberal governance approaches to manage today's dynamic IT resources [7]. They should take in to consider the restructuring and expansions required in organizations' information technology (IT) governance structures to govern cloud computing services [84, 91]. Cloud computing is forcing firms to rethink traditional IT governance practices while raising new and fundamental questions for scholars and practitioners [104]. Therefore, organizations can benefit from effective coexistence and interaction between cloud computing governance and existing IT governance approaches [27].

Once organizations decide to use cloud computing for some or all IT services, business processes are impacted. Therefore, data governance of cloud computing has become more critical than ever [26]. Some researchers suggested that governing data in cloud services as a component of IT governance offers IT–business alignment by responding to demands of the business in providing system scalability and agility when supporting business goals [43].

Theoretical framework

Agency theory, IT governance, and IT financial performance

Agency theory focuses on the conflict of interests between the owner and the manager. Governance aims to control the management's work to avoid opportunistic behavior resulting in reduced performance [53]. IT governance will ensure efficiency, decrease costs and increase control. Although many studies have investigated the relation between IT governance and performance, most of them focused on the organizational level. Moreover, these studies have shown contradictory results of the relationship between IT governance and financial performance. A group of studies found that IT governance will increase organization accountability, thereby increasing return on assets [39]. Also, [29] and [72] suggested that IT governance improves financial performance. Likewise, [108] results have shown that IT governance has significant effect on firm performance and IT capabilities mediate the relation. On the contrary,

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[48] and [88] have found that IT governance has no impact on the organization financial performance.

Few studies recognized the importance of studying the relationship between IT governance and IT performance. Most of these studies have found that IT governance plays an important role in supporting IT financial performance. For example, a negative relationship between IT governance misalignment and IT performance was found in [44] study, as high IT governance misalignment receives no benefits from their IT investment, while low IT governance misalignment obtains higher value from their IT investments. Therefore, right IT governance decisions can raise the return of IT investment performance [108]. Robinson [86] suggested that IT governance aims to ensure that IT is aligned to the business needs. Thus, the more business–IT alignment the better IT performance.

H1   IT governance has significant effect on IT financial performance.

IT governance and non-financial performance

Previous studies in information systems management show that information governance has two goals: protecting information and maximizing the value of information [100]. Subsequently, implementing effective IT governance (ITG) is important for the success and prosperity of organizations [85]. Thus, IT governance may affect both financial and non-financial performance. Here the study concentrated on decision making, process, innovation, flexibility and ethical compliance as indicators for non-financial performance.

IT governance, decision making, and process

Governance is an activity requires effective and efficient use of resources to achieve desired aims. In corporate level, corporate governance is developed to solve the problems related to control separation in organizations. Therefore, the literature in corporate governance showed that governance can affect decision making. It is also necessary for effective processes [2]. IT governance is a part of corporate governance. It involves building IT capability that is able to offer a business strategic advantages by taking appreciate decisions [106]. IT governance controls and manages IT resources such as infrastructure technology and people in organizations [24]. It includes defining and aligning the IT strategy to the organization's strategy, making IT investment decisions and making overall IT risk management decisions [8]. Thus, IT governance can

support the operations of organizations to the extent that can lead to financial loss or risks [16].

H2   IT governance has significant effect on a) decision-making process and b) business process.

IT governance, innovation, and flexibility

IT governance mechanisms could help organizations to be agile and innovative [51]. That may happen because IT governance leads to new ideas and facilitate interaction between IT and business people [41]. Board of directors and the executive are responsible of IT governance. Their responsibility can impact innovation because they can help create an environment that supports innovation. They can create opportunities and sources of innovation with the knowledge and information they provide [51]. Although many results have shown positive impact of IT governance on innovation [54], few studies found a negative relation. For example, [25] found that IT governance has negative significant effect on innovation product and process when IT governance experience is law.

Decentralized IT governance also found to support IT flexibility [78]. Flexibility refers to the ability to react to a wide range of possible environment. Flexible IT can support sustainable growth and enable firms to develop innovative offerings to their customers [49].

H3   IT governance has significant effect on a) IT flexibility and b) IT innovation.

IT governance and IT ethical compliance

Ethics are beliefs, values, rituals and behavior patterns that people share in their organizations [50]. Corporate governance is closely associated with ethics theory. Business ethics theory focuses on the rights and wrongs in business. It is concerned with norms, values, and beliefs fixed in the social process which is wrong or right for the individual and the group [19]. Corporate governance complies with exhibiting ethical behavior on all business dealings [108]. These ethical issues arise when an individual's behavior can either help or damage others [68]. That problem is getting worth in IT department of telecommunication companies as the employees can access companies' information systems and be in contact, or be connected at any time and any place [67]. Furthermore, Telecoms employees can access several types of data about millions of users. That object can increase the risk of ethical issues [64]. IT governance as a part of corporate governance can affect behavior pattern, legal and

regulatory compliance [87]. So, it can be concluded that IT governance may affect ethical compliance.

H4   IT governance has significant effect on IT ethical compliance.

Data governance for cloud computing and IT financial performance

In the current decade, many organizations adopt and use cloud computing because of its importance in supporting organization performance. Cloud computing allows organization to store and access their data any time. Moreover, various benefits arise from cloud computing such as analytics services and data security [99]. Cloud computing is believed to impact financial performance throw reducing cost by shifting computing cost from a capital expenditure to an operational cost as the provider of cloud service supplies the underlying infrastructure as a part of the service. It also enhances productivity throw collaborative applications which reduce rework [22]. Data governance for cloud computing is a set of policies, processes, roles, responsibilities, and practices used to manage and control cloud computing adoption and implementation. It aims to discipline to address cloud computing challenges and maximize the organizations' return on investment [27].

H5   Data governance for cloud computing has significant effect on IT financial performance.

Data governance for cloud computing and IT non-financial performance

Cloud computing services become increasingly important because they have several benefits. These benefits are not only related to financial aspects, but also non-financial performance such as supporting core business functions, fast performance, employee satisfaction and boost innovation [22]. It can help in analyzing huge volume of data and enhance security [102], scalability and flexibility [97].

Data governance for cloud computing, decision making and process

Using cloud computing services increases the difficulty of effective IT governance. It requires a new approach to governance and management for several reasons. For example, cloud services force customer to accept the control of the service provider on some important issues of business process. Although cloud computing offers many benefits, it has some challenges related to security of data, accountability, responsibility and internal threats. These challenges need organization to take decisions in IT department in order to overcome any risks or disadvantages [20]. Governance related to decision rights,

accountability and responsibilities needs to be fulfilled by management. Cloud services are perceived as a new source of risk that needs new mechanisms to be adapted to the current IT governance [76]. Therefore, implementing data governance will be consequently new decisions as it will change the roles and responsibilities in the internal processes of the organization [13]. Thus, we assumed that data governance can impact IT decisions and processes.

H6   Data governance for cloud computing has significant effect on a) IT decision-making process and b) IT–business process.
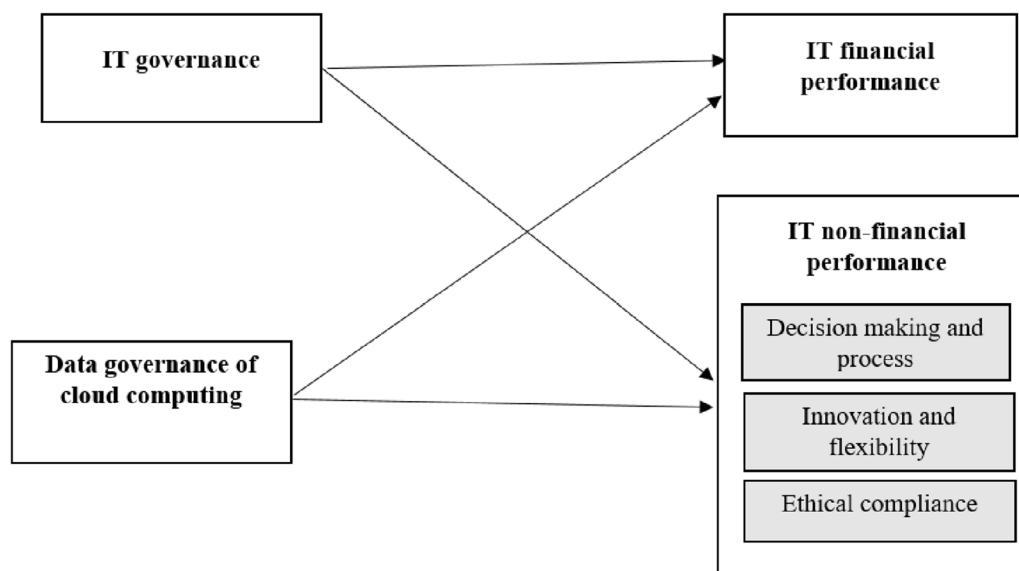
Data governance for cloud computing, innovation and flexibility

Cloud computing lets organizations use open-source computing resources from third-party application providers to augment the cloud platform. This ecosystem provides organization with their technological needs and flexibility. It also enables selecting the required pre-packaged software capabilities. Thus, cloud technology provides organizations with a rich pool of instruments to architect innovative solutions which in turn support innovation [9]. Cloud computing also offers flexibility and freedom for the organization because it can easily change service providers without any troubles and enjoy more up to date solutions [15]. Cloud computing can enhance organization innovativeness and growth, but these benefits depend on managing and adjusting risk appetite and ensure IT alignment [84]. Therefore, cloud computing governance helps organizations to create value by obtaining benefits from cloud computing services and optimizing investment and risk at the same time [57].

H7   Data governance for cloud computing has significant effect on a) IT flexibility and b) IT innovation.

Data governance for cloud computing and ethical compliance

One of the main challenges for cloud computing is legal challenges. Legal contracts between parties are written in complicated statements and organizations find it very difficult to understand these statement. Therefore, legal issues appeared to be a problem for the organizations, especially Middle Eastern and Africa as they lack regulatory support for data protection and privacy (Fig. 1). Data governance here aims to get rid of these problems, but it depends on country regulations and the industry using data governance [14]. Another ethical issue is data privacy and violations of intellectual property. Implementing effective data governance may help reducing these ethical compliances [76].

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Fig. 1 The conceptual framework

H8   Data governance for cloud computing has a signifi-
cant effect on IT ethical compliance.

Research methodology

Type of research

The type of research here is quantitative research which
is believed to be used when we need to answer a ques-
tion by testing a theory, measured with numbers and
analyzing with statistical techniques [45]. Quantita-
tive method has many advantages; for example, it will
minimize the role of researcher's feelings and opinions
which may affect the research results. Policy makers
and other interested parties prefer research that is seen
as wider than one researcher's point of view [89].

Data collection and measures

The measurements were made using a survey. A Lik-
ert 5-point scale was used (1—strongly disagree, and
5—strongly agree). We measured the constructs and
dimensions relying on the existing scales. Specifically, IT
governance and data governance: IT governance mecha-
nisms were measured by 33 items adopted from [34]. Data
governance of cloud computing was measured by 20 items
adopted from [83, 84]. In addition, non-financial perfor-
mance was measured using the following dimensions:
decision making and innovation were measured using the
measurement of [21, 92]. Business processes were meas-
ured using measures of [21, 36, 66]. Flexibility was meas-
ured by the measures adopted from [21, 36, 105]. Legal
and ethical compliance was measured by [55]. Finally, we
used [75] and [4] measures for financial performance to

measure the overall value of IT investments, which cannot
be measured by financial ratios. Therefore, we also used
the survey to know to what extent the objectives of IT
investments may result in revenue [90].

Sampling

The targeted population is the communication compa-
nies in Egypt. All the four companies (Vodafone Egypt,
Orange Egypt, Etisalat Egypt and WE) are approached.
Here we depended on complete census because our
population (telecommunication industry) is small and it
is desirable to examine every unit of population because
there are a comprehensive details need to be studied
[45]. The sampling unit is the unit that have the answers
for the research questions. Many studies have found that
top managers have more information about financial
and non-financial performance such as decision-making
process and innovation [95]. Therefore, top managers in
our study are the sample units (Table 1).

Table 1 The response rates of each company *Source* Author's
fieldwork based on SPSS findings

Company	Frequency	Percent (%)
A	52	16.9
B	78	25.3
C	94	30.5
D	84	27.3
Valid	308	100

ITS, IT structure; CS, cloud structure; ITP, IT processes; CP, cloud processes; ITR, IT
relational; CR: cloud relational

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Analysis of result

Validity for formative indicators

Indicators collinearity: extensive collinearity between the items makes it difficult to distinguish the effect of individual items on the latent variable, and the collinearity of the indicators is measured using the collinearity statistics variance inflation factor (VIF), which should be below a threshold of 5 [47].

Formative measure assessment

Formative observed variables do not need to be correlated with each other; thus, classical discriminant and convergent tests do not work for formative measures; while the removal of a reflective indicator does not affect the meaning of the underlying construct, the removal of a formative indicator does affect it seriously and eliminates a part of it [37]. Accordingly, the issues that should be essential in assessing the formative measures validity are:

Content validity

It should be sure that the formative indicators cover most aspects and facets of the latent construct that is conducted before data collection.

Indicators collinearity

Extensive collinearity between the items makes it difficult to distinguish the effect of individual items on the latent variable, and the collinearity of the indicators is measured using the collinearity statistics VIF, which should be below a threshold of 5 [47].

All VIF values are below 5, so it can be considered there is low co linearity between indicators of each construct. Hair [46] suggests using the items weights and significance levels after running bootstrapping techniques for *t*-statistics; it can be considered the formative measure is valid if the weights are significant, but if the weights are not significant, we should look at the outer loadings and their *T* values. Table 2 shows these values.

Table 2 shows outer weights value to each items (formative indicators) and all items are significant, meaning that also the informative indicators are valid to measure the latent construct. All items achieve the factor loading required which is above 0.70 [47].

Convergent validity, composite reliability, and discriminant validity

Table 3 shows that all variables have convergent validity because all average variance extracted (AVE) values are above 0.50. Table 3 shows all variables have reliability after adjusting because the composite reliability to each

variable is greater than or equal almost 0.70. Table 4 shows all variables have discriminate validity after adjusting because the AVE to each variable is greater than all the corresponding shared variances, but the corresponding between legal and ethical compliance and innovation variable (0.764) is greater than the corresponding between legal and ethical compliance and itself (0.763), and the percentages are close, with the achievement other validity and reliability criteria, so it is kept on these variable of items.

Testing the structure model

By path analysis the hypotheses were tested. It must be pointed out the coefficient of determination R^2 value, R^2 expresses the amount of variance in the dependent variable due to the influence of the independent variable; it is preferable that the R^2 value be higher than 20%, but it may differ from one research to another [47]. It is clear from Table 5 that the research model is able to predict the variable of decision-making process by percentage 51.3%, financial performance 49.5%, flexibility 56.5%, innovation 50.1%, business processes 52.3%, and then legal and ethical compliance 55.7% (Fig. 2).

The calculated *T* value and the level of significance (*P* value) were examined to judge the significant extent of the influence of the independent variable on the dependent variables. Also, the amount of the effect, which is the beta coefficient β, was determined.

** 95% confidence level; whereas the *P* value is less than 0.05, the calculated *t* value is higher than (± 1.96).

IT governance impact

Table 5 shows that 1) IT governance has a positive significant effect on financial performance (β 44.3%, $P < 0.05$). 2) IT governance has a positive significant effect on decision-making process (β 43.2%, $P < 0.05$). 3) IT governance has a positive significant effect on flexibility (β47.8 %, $P < 0.05$). 4) IT governance has a positive significant effect on innovation (β48%, $P < 0.05$). 5) IT governance has a positive significant effect on business processes (β 34.4%, $P < 0.05$). 6) IT governance has a positive significant effect on legal and ethical compliance (β37.9 %, $P < 0.05$).

Data governance of cloud computing impact

Table 5 also shows that 1) data governance has a positive significant effect on Financial performance (β 35.8%, $P < 0.05$). 2) Data governance has a positive significant effect on decision-making process (β38.8%, $P < 0.05$). 3) Data governance has a positive significant effect on flexibility (β 37.6%, $P < 0.05$). 4) Data governance has a positive significant effect on innovation (β 31.1%, $P < 0.05$). 5) Data governance has a positive significant effect on

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Table 2 *T* values *Source* Author's fieldwork based on SPSS findings

Indicators	Outer weight (*t* value)	Indicators	Outer weight (*t* value)
ITS1 → Structure	$(2.723)_{0.007}$	CS1→cloud structure	(4.671)0.000
ITS2 → Structure	$(2.537)_{0.011}$	CS2 →cloud structure	(2.769)0.000
ITS3 → Structure	$(4.151)_{0.000}$	CS3 →cloud structure	(3.570)0.000
ITS4 → Structure	(6.487)0.000	CS4 →cloud structure	(7.409)0.000
ITS5 → Structure	(3.934)0.000	CS5 →cloud structure	(3.999)0.000
ITS6 → Structure	(9.521)0.000	CS6 →cloud structure	(4.889)0.000
ITS7 → Structure	(5.529)0.000	CS7 →cloud structure	(8.319)0.000
ITS8 → Structure	(3.532)0.000	CS8 →cloud structure	(5.317)0.000
ITS9 → Structure	(4.121)0.000	CS9 →cloud structure	(10.085)0.000
ITS10 → Structure	(7.773)0.000	–	–
ITS11 → Structure	(4.233)0.000	–	–
ITS12 → Structure	(8.422)0.000	–	–
ITP1 → processes	(11.034)0.000	CP1 → cloud processes	(10.875)0.000
ITP2 → processes	(4.957)0.000	CP2 → cloud processes	(3.378)0.000
ITP3 → processes	(6.243)0.000	CP3 → cloud processes	(8.416)0.000
ITP4 → processes	(6.596)0.000	CP4 → cloud processes	(7.176)0.000
ITP5 → processes	(6.150)0.000	CP5 → cloud processes	(3.284)0.000
ITP6 → processes	(8.378)0.000	CP6 → cloud processes	(5.514)0.000
ITP7 → processes	(3.521)0.000	CP7 → cloud processes	(4.478)0.000
ITP8 → processes	(5.437)0.000	CP8 → cloud processes	(6.151)0.000
ITP9 → processes	(4.626)0.000	–	–
ITP10 → processes	(13.356)0.000	–	–
ITP11 → processes	(5.623)0.000	–	–
ITR1 → relational	(5.841)0.000	CR1 → cloud relational	(27.275)0.000
ITR2 → relational	(4.954)0.000	CR2 → cloud relational	(25.709)0.000
ITR3 → relational	(6.440)0.000	CR3 → cloud relational	(29.577)0.000
ITR4 → relational	(4.451)0.000	–	–
ITR5 → relational	(3.983)0.000	–	–
ITR6 → relational	(4.249)0.000	–	–
ITR7 → relational	(7.247)0.000	–	–
ITR8 → relational	(5.254)0.000	–	–
ITR9 → relational	(33.936)0.00	–	–
ITR10 → relational	(30.360)0.000	–	–

ITS, IT structure; CS, cloud structure; ITP, IT processes; CP, cloud processes; ITR, IT relational; CR, cloud relational

Table 3 Summary of AVE, composite reliability and R2 *Source* Author's fieldwork based on PLS findings

Variables	AVE	Composite reliability	R^2
Decision-making process	0.629	0.835	51.3%
Financial performance	0.616	0.865	49.5%
Flexibility	0.604	0.859	56.5%
Innovation	0.706	0.878	50.1%
Business processes	0.602	0.858	52.3%
Legal and ethical compliance	0.583	0.848	55.7%

business processes (β, 47.5%$P < 0.05$). 6) Data governance has a positive significant effect on legal and ethical compliance (β45.9%, $P < 0.05$).

Discussion and implications

The result of the study showed that IT governance has a significant positive effect on IT department financial and non-financial performance. This result is agreed with [11] study which had shown that organizations can improve its financial performance by good IT governance. Likewise, our result [88] stated that effective IT

Table 4 Fornell–Larcker criterion (discriminant validity) *Source* Author's fieldwork based on SPSS findings

Variables	Business process	Decision-making process	Financial performance	Flexibility	Innovation	Legal and ethical compliance
Business process	**0.776**					
Decision-making process	0.668	**0.793**				
Financial performance	0.732	0.694	**0.785**			
Flexibility	0.728	0.748	0.769	**0.777**		
Innovation	0.698	0.688	0.706	0.748	**0.840**	
Legal and ethical compliance	0.715	0.696	0.718	0.748	0.764	**0.763**

Bold value refers to the square roots of AVE

Table 5 Summary of the hypotheses results *Source* Author's fieldwork based on SPSS findings

Hypotheses	β	T value	P value	Results
H1: IT governance—> Financial performance	0.443	8.266	0.000	Supported
H2a: IT governance—> Decision-making process	0.432	7.784	0.000	Supported
H3a: IT governance—> Flexibility	0.478	9.663	0.000	Supported
H3b: IT governance—> Innovation	0.480	8.623	0.000	Supported
H2b: IT governance—> business processes	0.344	6.447	0.000	Supported
H4: IT governance—> Legal and ethical compliance	0.379	6.866	0.000	Supported
H5: Data governance—> IT Financial performance	0.358	6.076	0.000	Supported
H6a: Data governance—> Decision-making process	0.388	6.659	0.000	Supported
H7a: Data governance—> Flexibility	0.376	7.108	0.000	Supported
H7b: Data governance—> Innovation	0.311	5.250	0.000	Supported
H6b: Data governance—> Business processes	0.475	9.017	0.000	Supported
H8: Data governance—> Legal and ethical compliance	0.459	8.871	0.000	Supported

H, Hypothesis

governance can affect the performance directly and economic growth of ICT companies indirectly. Here results also had shown that innovation and flexibility are the most dimensions affected by IT governance. This result may be because IT governance is believed to prioritize IT projects and allocate budgets according to prioritizes which means a better use of resources and a clear direction and control. These benefits will help organizations to achieve continuous innovation. Moreover, IT governance enhances knowledge acquisition [73] which in turn support innovation [31]. Another justification for the result is that telecommunication industry is a high environmental dynamism and characterized by fast-paced changes and strong competition and using IT governance will help organization to strength their innovation capabilities [77]. Therefore, IT governance plays a significant role in supporting innovation in telecommunication industry. Here the study has found that IT governance affected financial performance more than data governance of cloud computing. Some authors believed in the importance of data governance in order to gain many financial benefits such as reducing cost and increasing

effectiveness, but the main purpose of data governance is to protect data for stakeholders. That is because protecting data is one of the main challenges that face cloud services. That's why our study also has found that business processes and ethical compliance affected by data governance of cloud computing more than IT governance. Moreover, IT governance is related to decisions about IT investments, application portfolio, and project portfolio, but it is not related to data [14]. For all the above reasons, we can conclude that IT governance does not have the same impact of data governance of cloud computing on financial and non-financial performance. Therefore, studying both IT and data governance nowadays is a basic necessary.

Theoretical contribution
Most of the previous studies were interested in investigating the impact of IT governance on the organizational performance while it is so important to know how can it affect IT department performance. Thus, this study tried to overcome this gap in literature by studying the impact of IT governance on both financial and non-financial
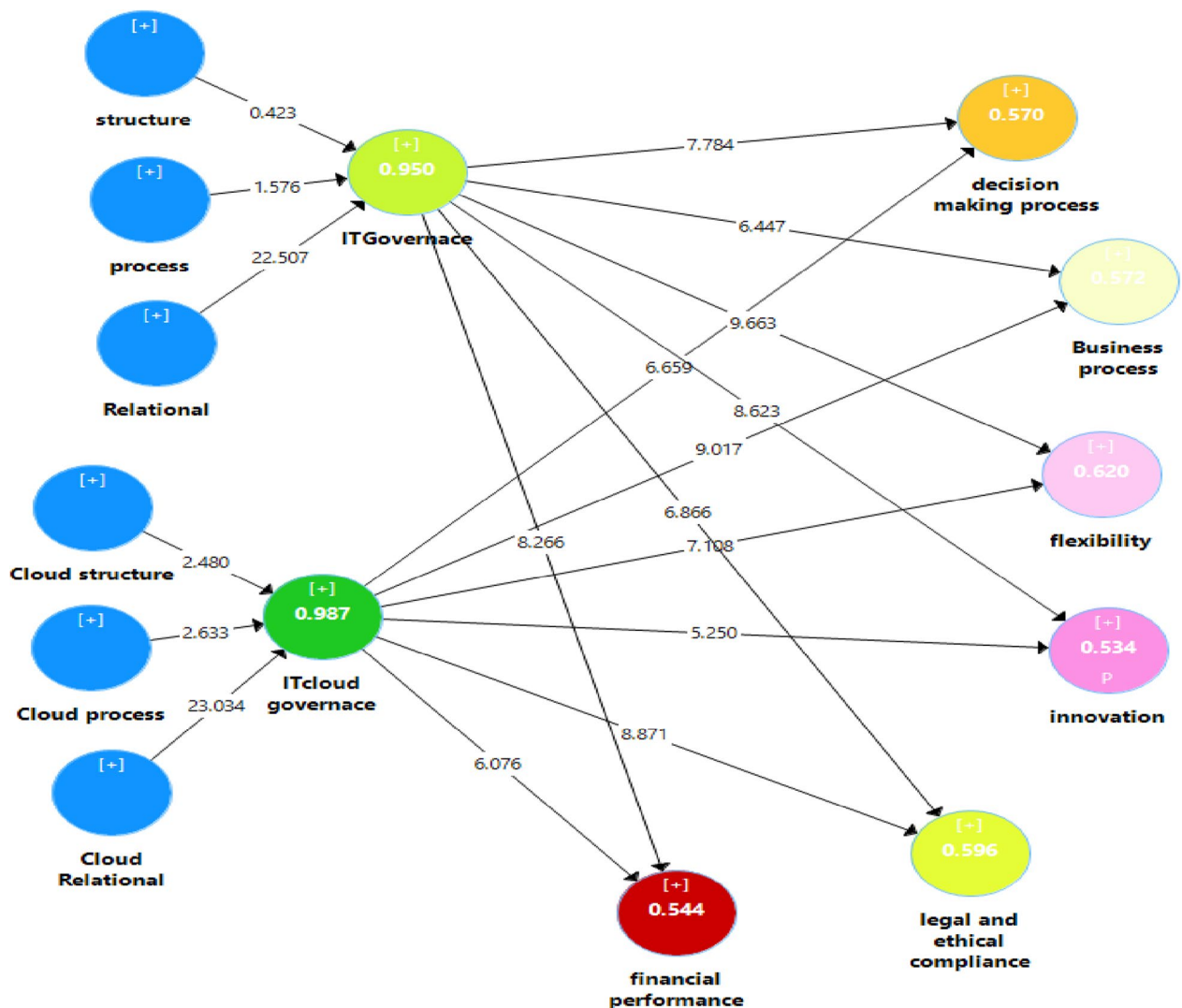
Fig. 2 Testing the model structure

performance of IT department. Moreover, currently studying IT governance is not enough. Organizations need to collect resources, processes and structures to protect their information systems [42]. Therefore, this study filled the gap in the literature by studying the role of both IT and data governance in supporting IT financial and non-financial performance.

Practical implications
Here the study provides insights into practitioners. Adopting digital services has increasingly grown in great numbers of organizations [42]. The advancement of using the digital services raises the need for data security. The result of this study is useful for IT managers, decision makers and CEOs, specially who are working in the Telecommunication industry. Besides helping managers in

planning for information systems and data management, the study has many benefits for different parties. 1) This study is useful for financial manager as, the result showed that IT governance affect the financial performance. 2) Top managers can use the result as a guide when they are planning, as they should take into consideration that any changes in IT governance dimensions may affect the degree of flexibility and innovation. 3) Legal affairs also can benefit from the study as it showed that data governance of cloud computing mostly affects legal and ethical compliance. Subsequently, they have to find a way to get benefits from cloud services and avoid its risks. The current research has a number of limitations: (1) This research examines the impact of IT and data governance on performance. Future studies can be implemented to examine the indirect impact of IT and data governance

on the performance. In addition, more studies need to discuss how to benefit from cloud services without being at risk. The impact of several ways of protecting data on performance also needs more investigations. (2) The current study was applied only to the telecommunication industry; however, it is important to examine the research framework to other industries that are providing online services or dealing with huge amounts of data transfer such as information technology, banking, and airline industries. These industries are exposed recently to face risks related to data security, thus, further investigations are needed on these industries [81]. (3) All four targeted companies are large organizations. However, small and medium companies also need information technology governance studies nowadays [35]. (4) The quantitative research methodology had been used to achieve the research objectives. It is also better to use a qualitative or mixed methods in the future to add more value to the literature.

Conclusion

Nowadays, IT is considered the backbone of any business. Therefore, IT governance has become an important part of any business strategy. The large amount of IT investment increased the importance of measuring IT performance with both financial and non-financial measures. By reviewing the current literature, we have found that most of the studies concentrated on the impact of IT governance on the organizational performance, while data governance is still under-researched and the literature is considered insufficient. Therefore, it is important to study both IT and data governance. This study is useful for academics and practitioners by investigating the impact of IT and data governance on both the financial and non-financial performance of the IT department. The first step in this study was choosing an appropriate industry for the study. The telecommunications industry is believed to be one of the industries that deals with a huge amount of data and needs both IT and data governance. The second step was deciding the relevant measures for the study to achieve the research objectives. The third step was collecting data using a survey questionnaire. The third step was selecting data analysis techniques suitable to the study objectives. The result of this study supported that IT governance and data governance have an impact on IT department performance, but each of them differs in the degree of the impact. IT governance impacts financial performance, flexibility and innovation more than data governance, while data governance

impacts business processes and ethical compliance more than IT governance.

Appendix 1: Questionnaire
Dears,

We are conducting a study to explore the impact of IT/data governance mechanisms with governance of information technology mechanisms on performance of information technology business unit performance.

Because we are strongly value your views on IT/data governance, we have carefully prepared a questionnaire on this subject. we believe that responding to the questionnaire should not take more than 25 minutes of your valuable time. It would be greatly appreciated if your duly filled questionnaire could be returned to me by this month using the enclosed envelope.

We also need the input on the subject from one of the business unit leaders within your organization. Since we do not know his/her name, we would kindly ask you to forward the attached Business unit performance questionnaire to his/her attention. This survey is a critical part of the dissertation required for the completion of my doctoral studies. Therefore, your participation and the one from your colleague are essential for better understanding the relationships under study. Please rest assured that the data collected will remain private and confidential and will be used solely for this research project. The identity of all participants will be protected at all times.

Note that the completion of this questionnaire will be regarded as your consent to participate in this research study. Having both questionnaires filled will enable me to generate a customized executive summary of the results of this survey which I will be glad to send to you if you provide me with a business card in the return envelope or if you send me an email. To keep your responses confidential and anonymous, please do not identify yourself on the survey. I thank you in advance and look forward for your answers.

Section A: IT governance practices
Using the provided scale, please rate the following dimensions related to IT governance structures within your firm by selecting the number that best represents your opinion about its status. Level 1 indicates "Very Ineffective" whereas level 5 refers to "Very Effective".

Within my organization, the ……		Very ineffective	Ineffective	Marginally effective	Effective	Very effective
S1	IT strategy committee, which is at the board of directors' level with a role to oversee and approve the IT strategy, is	1	2	3	4	5
S2	IT expertise at level of board of directors have expertise and experience regarding the value and risk of IT is	1	2	3	4	5
S3	(IT) audit committee at level of board of directors overviewing (IT) assurance activities is	1	2	3	4	5
S4	CIO as a full member of the executive committee is	1	2	3	4	5
S5	CIO (Chief Information Officer) reporting to CEO (Chief Executive Officer) and/or COO (Chief Operational Officer) is	1	2	3	4	5
S6	IT steering committee for determining business priorities in IT investments, & implementation, tracking IT investments is	1	2	3	4	5
S7	IT governance function/officer for promoting, driving and managing IT governance processes is	1	2	3	4	5
S8	Security/compliance/risk officer	1	2	3	4	5
S9	IT project steering committee	1	2	3	4	5
S10	IT security steering committee	1	2	3	4	5
S11	Architecture steering committee	1	2	3	4	5
S12	Integration of governance/alignment tasks in roles & responsibilities	1	2	3	4	5

Section B: data governance of cloud computing practices
Using the provided scale, please rate the following dimensions related to data governance structures within your firm by selecting the number that best represents your opinion about its status. Level 1 indicates "Very Ineffective" whereas level 5 refers to "Very Effective".

Within my organization, the ……		Very ineffective	Ineffective	Marginally effective	Effective	Very effective
cs1	Chief cloud officer	1	2	3	4	5
cs2	Cloud management committee	1	2	3	4	5
cs3	Cloud service facilitation center	1	2	3	4	5
cs4	Cloud relationship center	1	2	3	4	5
cs5	Cloud Management Working Group	1	2	3	4	5
cs6	Cloud Center of Excellence (CCoE)	1	2	3	4	5
cs7	Cloud Computing Governance Board	1	2	3	4	5
cs8	Cloud Computing Governance Development Team	1	2	3	4	5
cs9	Cloud Computing Governance Operation	1	2	3	4	5

Section C: IT governance practices

Using the following scale, please rate the following dimensions related to IT governance processes. Please select the number that best represents your opinion about its status within your firm.

IT governance maturity model

1 Initial—Early evidence that the organization knows there is an ITG process issue that needs addressing and has started out with either non-standard or ad-hoc processes

2 Repeatable—Processes have been developed and implemented to the extent that similar procedures are followed by different people undertaking the same task

3 Defined—People using the now defined and documented procedures are trained, but it is still an individual's responsibility to follow the procedure: it is unlikely to be detected if they do not

4 Managed—Compliance can be monitored and measured for effectiveness and continuous improvement. Automation and tools are used in a limited and fragmented way

5 Optimized—Processes are now defined and documented based on best practice, continuous improvement and maturity modelling. Business and IT planning are integrated and automated, providing workflows and tools to enhance practice, as well as governance efficiency and effectiveness

0 Non-existent—No obvious or recognizable processes. The issue and requirement have yet to be identified

Within my organization, the ……		Initial	Repeatable	Defined	Managed	Optimized
P1	Strategic information systems planning	1	2	3	4	5
P2	IT performance measurement (e.g., IT balanced scorecard)	1	2	3	4	5
P3	Portfolio management (incl. business cases, information economics, return on investment (ROI), payback)	1	2	3	4	5
P4	Charge back arrangements—total cost of ownership (e.g., activity-based costing)	1	2	3	4	5

Within my organization, the ……		Initial	Repeatable	Defined	Managed	Optimized
P5	Service level agreements	1	2	3	4	5
P6	IT governance framework control objectives for information and related technologies (COBIT)	1	2	3	4	5
P7	IT governance assurance and self-assessment	1	2	3	4	5
P8	Project governance/Management methodologies	1	2	3	4	5
P9	IT budget control and reporting	1	2	3	4	5
P10	Benefits management and reporting	1	2	3	4	5
P11	Committee of sponsoring organizations (COSO)/enterprise risk management (ERM)	1	2	3	4	5

Section D: Data governance of cloud computing practices

Using the following scale, please rate the following dimensions related to data governance processes. Please select the number that best represents your opinion about its status within your firm.

Cloud governance maturity model

1 Initial—Missing or inadequate cloud computing governance practices and processes, which are ad hoc, inconsistent and depends on experience of the head of IT department who recognized that cloud computing governance need to be addressed

2 Repeatable—Cloud computing governance policies and processes are defined and implemented by individual managers with senior management involvement and oversight. Business/IT committee is about to formalize. Roles and responsibilities are not explicitly defined. Cloud computing governance policies are not properly communicated

Cloud governance maturity model

3 Defined—Cloud computing governance policies and governed processes are standardized, implemented, documented and communicated through formal training. There is a clear understanding of roles and responsibilities. Governing processes are not fully implemented and therefore deviations of governed process are not detected. Business/IT committee cooperates in deciding on business and cloud computing goals

4 Managed—A set of cloud computing governance performance indicators and metrics is set to measure compliance. Cloud computing governance processes are monitored and evaluated based on statistical and quantitative techniques. Governance processes operate within defined limits. Improvement of cloud computing governance in based on quantitative measures. Cloud computing goals align with business goals so cloud computing governance supports creation of business value through realization of benefits from the use of cloud computing services

5 Optimized—Cloud computing governance is part of enterprise governance. Cloud computing governance is optimized, continuously improved and adapted to particular environment. Business/IT committee coordinates and plans business goals and cloud computing goals, business strategy and cloud computing strategy and jointly decide on investments

0 Non-existent—Cloud computing governance is not implemented. There are no cloud computing governance processes. No recognized need to address cloud computing governance

Within my organization, the ……		Initial	Repeatable	Defined	Managed	Optimized
CP1	Cloud performance measurement	1	2	3	4	5
CP2	Cloud governance & Management Processes	1	2	3	4	5
CP3	Cloud Portfolio Management (CPM)	1	2	3	4	5
CP4	Strategic planning for cloud	1	2	3	4	5
CP5	Cloud Service alignment	1	2	3	4	5
CP6	Benefits Management of Cloud Computing	1	2	3	4	5
CP7	CLOUD Governance maturity model	1	2	3	4	5

Within my organization, the ……		Initial	Repeatable	Defined	Managed	Optimized
CP8	Cloud SLA—Including quality of service and quality of process (QoS, QoP)	1	2	3	4	5

Section E: IT governance practices

Using the provided scale, please rate the following dimensions related to IT governance relational mechanisms within your firm by selecting the number that best represents your opinion about its status. Level 1 indicates "Very Ineffective" whereas level 5 refers to "Very Effective".

Within my organization, the ……		Very ineffective	Ineffective	Marginally effective	Effective	Very effective
R1	Job-rotation	1	2	3	4	5
R2	Business/IT Co-location	1	2	3	4	5
R3	Cross-functional business/IT training and learning	1	2	3	4	5
R4	Knowledge management (on IT governance)	1	2	3	4	5
R5	Business/IT account management	1	2	3	4	5
R6	Executive/senior management giving the good example	1	2	3	4	5
R7	Informal meetings between business and IT executive/senior management	1	2	3	4	5
R8	IT leadership	1	2	3	4	5
R9	Corporate internal communication addressing IT on a regular basis	1	2	3	4	5
R10	IT governance awareness campaigns	1	2	3	4	5
P11	COSO/ERM	1	2	3	4	5

Section F: Data governance of cloud computing practices

Using the provided scale, please rate the following dimensions related to data governance relational mechanisms within your firm by selecting the number that best represents your opinion about its status. Level 1 indicates "Very Ineffective" whereas level 5 refers to "Very Effective".

Within my organization, the ……		Very ineffective	Ineffective	Marginally effective	Effective	Very effective
CP1	Knowledge Management on (Cloud governance)	1	2	3	4	5
CP2	Building Trust	1	2	3	4	5
CP3	Partner-based knowledge sharing	1	2	3	4	5

Part II: Business unit performance questionnaire

This questionnaire is aimed at the IT Business Unit Leader or IT Senior Manager of the Business Units within your organization.

Object: Business unit performance

Section A: Business unit non-financial performance

Using the provided scale, please indicate your perception of the following dimensions related to non-financial performance within your business unit. Level 1 indicates "Very Low" whereas level 5 refers to "Very High.

Within my organization, the ……		Very low	Low	Medium	High	Very high
D1	The speed of decisions that are made within my business unit is	1	2	3	4	5
D2	The accessibility of information when decisions are made is	1	2	3	4	5
D3	The accuracy of available information when decisions are made is	1	2	3	4	5

Within my organization, the ……		Very low	Low	Medium	High	Very high
D4	The availability of strategic alternatives before decisions are made is	1	2	3	4	5
D5	Consensus with other decision makers pertaining to a business unit outcome is	1	2	3	4	5
B1	Usage of objective criteria and systematic analysis in making decisions within my business unit is	1	2	3	4	5
B2	To what extent the employee satisfaction level with the business processes is	1	2	3	4	5
B3	The degree to which the delivered outcomes from our business processes are compliant with the business requirements is	1	2	3	4	5
B4	The satisfaction with the resource allocation among our business processes is	1	2	3	4	5
B5	The cost optimization level of our business processes is	1	2	3	4	5
B6	The satisfaction level of degree of improvement in the speed of reporting and getting feedback	1	2	3	4	5
F1	The flexibility to create new services is	1	2	3	4	5
F2	The satisfaction level of the percentage of resources dedicated to planning and investigating IS activities	1	2	3	4	5
F3	The satisfaction level of the Number of new IT services integrated	1	2	3	4	5

Within my organization, the ……		Very low	Low	Medium	High	Very high
F4	The satisfaction level of the processing efficiency of systems	1	2	3	4	5
F5	the satisfaction level of new initiatives and/ or improved services /upgrades offered in key IT areas	1	2	3	4	5
F6	The satisfaction level with the volume flexibility within my business unit	1	2	3	4	5
F7	The potential to create new services/products by my business unit	1	2	3	4	5
F8	The potential to distribute a variety of information over any technological platform	1	2	3	4	5
F9	To what extent your business unit "technological component" is capable of coordinating and communicating with any other components within the enterprise as well as with the external environment	1	2	3	4	5
F10	To what extent your business unit has the ability to standardize business processes in order for it to be shared and reused	1	2	3	4	5

Please keep using the same scale as provided in the previous section.

Within my organization, the ……		Very low	Low	Medium	High	Very High
I1	The impact of innovation in the design of the services on lowering costs within my business unit in the last year?	1	2	3	4	5

Within my organization, the ……		Very low	Low	Medium	High	Very High
I2	The impact of innovation changes in quality management on lowering costs within my business unit in the last year?	1	2	3	4	5
I3	The impact of innovation on enhancing existing services produced by my business unit within the last year	1	2	3	4	5
I4	The impact of innovation on creating new services produced by my business unit within the last year?	1	2	3	4	5
I5	The impact of innovation on creating better customer service by my business unit within the last year	1	2	3	4	5
I6	The impact of innovation on Number of ideas submitted by employees (over 30, 60, 90 days)	1	2	3	4	5
I7	The impact of innovation on Adding benefits to existing services, either for new or existing customers	1	2	3	4	5
I8	The impact of innovation on Implementation of new or improved procedures regarding service distribution	1	2	3	4	5
L1	The level of security awareness within my business unit	1	2	3	4	5

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Within my organization, the ……		Very low	Low	Medium	High	Very High
L2	The degree of completeness, comprehensiveness and availability of information security policies and procedures	1	2	3	4	5
L3	What is the number of detected unethical behaviors within the business unit (such as visiting non-work-related websites, or printing large personal documents)?	1	2	3	4	5
L4	The level of compliance with IT Organizational requirements	1	2	3	4	5
L5	What is the mitigation level when IT risks are not complied with?	1	2	3	4	5
L6	What is the level of compliance with IT Organizational requirements (as per your audit reports)?	1	2	3	4	5

Section B: Business unit financial performance

Using the provided scale, please indicate your perception of the following dimensions related to financial performance within your business unit. Level 1 indicates "Very Low" whereas level 5 refers to "Very High".

Within my organization, the ……		Very low	Low	Medium	High	Very high
F1	The ratio of IT costs to company costs	1	2	3	4	5
F2	The ratio of estimated costs to actual costs	1	2	3	4	5

Within my organization, the ……		Very low	Low	Medium	High	Very high
F3	The ratio of Estimated advantages to actual advantages	1	2	3	4	5
F4	Income resulting from IT-based products and services	1	2	3	4	5
F5	Evaluating accountability to customer quality of services and products evaluating the degree of innovation managers' understanding of information systems (IS)	1	2	3	4	5
F6	The percentage of total decrease of costs	1	2	3	4	5
F7	The inability degree to integrate business and IT units	1	2	3	4	5
F8	IT budget as a percentage versus total enterprise budget	1	2	3	4	5
F9	Changes in IT budget allocations	1	2	3	4	5

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Appendix 2
See Table 6.

Table 6 Formative indicators collinearity (IT governance/ data governance of cloud computing) *Source* Author's fieldwork based on SPSS findings

Variables	VIF value	Variables	VIF value
IT Structure		**Cloud structure**	
ITS1	1.521	CS1	2.240
ITS2	1.998	CS2	2.188
ITS3	2.169	CS3	2.426
ITS4	2.277	CS4	2.692
ITS5	2.078	CS5	1.960
ITS6	2.793	CS6	2.673
ITS7	2.234	CS7	2.216
ITS8	2.264	CS8	2.041
ITS9	2.217	CS9	2.011
ITS10	2.568	–	–
ITS11	2.371	–	–
ITS12	2.552	–	–
IT Processes		**Cloud processes**	
ITP1	2.336	CP1	2.424
ITP2	2.283	CP2	1.910
ITP3	2.444	CP3	2.457
ITP4	2.260	CP4	2.493
ITP5	2.076	CP5	1.941
ITP6	2.069	CP6	2.325
ITP7	2.316	CP7	2.143
ITP8	2.262	CP8	2.242
ITP9	2.394	–	–
ITP10	2.329	–	–
ITP11	2.455	–	–
IT Relational		**Cloud relational**	
ITR1	2.182	CR1	1.749
ITR2	2.306	CR2	1.997
ITR3	2.445	CR3	1.935
ITR4	2.545	–	–
ITR5	2.385	–	–
ITR6	2.104	–	–
ITR7	2.188	–	–
ITR8	2.800	–	–
ITR9	1.838	–	–
ITR10	2.252	–	–

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Appendix 3

See Table 7.

Table 7 Factors loading for reflective indicators after adjusting

Variables	Decision-making process	Business processes	Flexibility	Innovation	Legal and ethical compliance	Financial performance
Decision-making process1	0.792					
Decision-making process2	0.794					
Decision-making process4	0.793					
Business processes1		0.755				
Business processes3		0.790				
Business processes5		0.806				
Business processes6		0.752				
Flexibility2			0.777			
Flexibility3			0.775			
Flexibility4			0.770			
Flexibility7			0.786			
Innovation4				0.833		
Innovation7				0.832		
Innovation8				0.855		
legal and ethical compliance1					0.763	
legal and ethical compliance4					0.788	
legal and ethical compliance5					0.733	
legal and ethical compliance6					0.768	
financial performance2						0.756
financial performance4						0.808
financial performance5						0.805
financial performance8						0.768

* Source: Author's fieldwork based on PLS findings

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