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Exploring Factors Impacting Information Technology Governance Implementation Maturity in Institutions of Higher Education, South Africa: Application of the Will-Skill-Tool Model

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ABSTRACT

Information technology governance (ITG) is an essential part of ensuring that information technology adds value to business. Despite the increased use of IT for academic, administrative, research and community engagement activities in universities, there is a dearth of studies on ITG in higher education specifically in Africa. The study reported on here combines the will-skill-tool model and the theory of planned behavior to assess the impact of individuals' ITG will, ITG skill and the use of an ITG tool on ITG implementation maturity in the context of South African higher education institutions. A survey was conducted among 121 information technology and business decision makers from five higher education institutions and the data was analyzed using SmartPLS (Version 3). The findings reveal that ITG tools availability and access influence both ITG implementation maturity and ITG skills. In addition, the use of an ITG tool impacts on ITG skill, which in turn has an influence on ITG will. Furthermore, ITG skill mediates the relationship between the use of an ITG tool and ITG will. Interestingly, the results do not reveal a moderation of perceived ITG complexity.

Keywords

Information technology governance, will-skill-tool model, higher education, developing economy, South Africa.

INTRODUCTION

Over the past decades, the major role played by information technologies (IT) in multiple core business areas of African higher education institutions (HEIs) has been recognized. HEIs have also become progressively more reliant on IT and aware of the need to transform their offerings to digital higher education (Hodges et al., 2020; Van Grembergen et al., 2004). Heightened corporate awareness and an acceptance of the value that IT brings has resulted in IT being acknowledged as an essential strategic tool

(Benamati & Lederer, 2001). However, since IT influences all aspects of HEIs operations, this exposes institutions to IT risks (Van Grembergen et al., 2004). IT-enabled, or digital, transformation, together with the integration of 4IR technologies into higher education, has created an ever-more challenging operating environment for African HEIs.

The recent COVID -19 pandemic was characterized by lockdowns and the need for physical distancing. Despite IT for academic purposes having been used for several years (Ma et al., 2000), there was a sudden increase in IT investments and IT-enabled transformation by HEIs during the pandemic. This meant that having an efficient and effective IT environment suddenly became even more essential for sustaining administrative, research, community engagement, teaching and learning activities. The establishment of a sound IT operation is necessary for the attainment of university goals and for it to remain competitive.

HEIs have accepted that IT spending forms a large portion of the overall budget and university expenditure, as they appreciate the value of IT investments (Lunardi et al., 2014a, 2014b). According to Bloem et al. (2005), IT spending in institutions surpassed 60% of the overall spending at the time this research was reported. In practice, digital transformation goes beyond the integration of contemporary digital platforms and related technologies in the workplace (Hess et al., 2016). Investment to create a highly effective IT environment and IT operation is important in digital transformation (Westerman et al., 2014). IT's increasing role has resulted in senior executives being faced with substantial uncertainties linked to decision-making and IT investment (Kauffman et al., 2015).

Emergency implementation of IT projects, so as to align with HEIs academic calendars, does not easily translate to achievement of anticipated goals. Most IT projects in all sectors fail or deliver unsatisfactory outcomes (Oguntade & Erasmus, 2019). These project failures lead to losses of time, capital expenditure, and stakeholder confidence (Hughes et al., 2017). Numerous reports of high capital requirement projects that failed have appeared over time in the Information Systems literature (Weill & Ross, 2004; Hutchinson, 2010). For example, McAfee (2004) reported instances of huge IT investments failing to provide anticipated returns. There are a variety of factors that can lead to IT projects failures, but Alie (2015) points to ITG as the main determinant of the success or failure of IT projects delivery. ITG is a branch of the overall corporate governance (Ko & Fink, 2010).

The IT-enabled transformation journey that HEIs have embarked on is characterized by changes in management practices, processes and organizational structure, culture and relevant skills set (Hess et al., 2016; De Maere et al., 2022). For smooth transitioning during this transformation, effectual ITG practices are of vital importance (De Haes et al., 2020; Erasmus & Marnewick, 2021). ITG must be implemented to monitor and provide strategic direction and thereby to facilitate the attainment of envisioned benefits from complex and high-investment IT (Steuperaert, 2019). ITG promotes clearly defined decision making and accountability processes to ensure desirable behavior in IT implementation and use (Weill & Ross, 2004). It is accepted as an effective practice that can guarantee returns on IT investments (Jacobson, 2009). ITG ensures that all major stakeholders participate in IT decision making including those regarding IT investments (Cervone, 2017). A study by Lunardi et al. (2014a) discovered that after ITG implementation, firms performed better than before implementation periods.

According to Siregar and Harahap (2021), ITG is most important for organizations that operate in uncertain environments that are characterized by rapid changes in IT. South African HEIs face evolving and unrelenting challenges that require continuous changes in their operations. These stem from globalization, the evolving knowledge economy, unforeseen disasters, staff and student protests and even pandemics such as COVID-19. In addition, problems related to a lack of ICT skills among HEI

staff members and data security issues have been reported (Dwivedi & Joshi, 2020). The rapid advancement and adoption of technological innovations that are embedded with artificial intelligence in higher education further increases the concerns (Silander & Stigmar, 2019). The introduction of AI in education brings with it conceptual and technical challenges. For example, the recent introduction and rapid adoption and use of ChatGPT further exacerbates apprehensions around unauthorized AI use in higher education. Scholars have initiated conversations around ChatGPT, raising the concern that the application could easily threaten the integrity of assessments in higher education, as students may outsource assessments while averting plagiarism detection (Rudolph et al., 2023).

These developments also affect South African HEIs which operate in a context that is characterized by inequalities and inequities in terms of access to ICT. Despite some success in narrowing the digital divide, problems persist (Mncube et al., 2021). Both e-Education policies and ICT policies in South Africa have been reported to have failed dismally due to lack of ICT skills, poor ICT infrastructure, high data costs and other factors (Pelgrum, 2008; Vandeyar, 2015; Padayachee, 2017). In addition, there are disparities in South African students' access to technology and fast internet, which worsens already existent imbalances in the higher educational system (Vogels, 2021). The issues noted above deserve attention from an IT governance perspective.

Repeated studies over the past decade have reported that IT governance maturity is poor in the public sector in South Africa. According to Johl et al. (2013), ITG process maturity in South African public HEIs was low overall and was inadequate for managing the crucial role that IT plays in the higher education sector. Low IT project management maturity levels were also found in South African municipalities (Koekemoer & von Solms, 2017). Most recently, Ranga (2022) revealed that South African government departments were unaware of ITG maturity level assessment and did not know how to conduct ITG maturity assessment; the study concluded that the guiding national framework on governance in South Africa is outdated and non-accommodative. Overall, IT governance maturity is still low in the South African context (Mangundu, 2022, 2023). Rubino and Vitolla (2014, p.321) emphasized that for IT systems to be able to meet the changing demands of internal and external stakeholders, "a set of procedures, rules, and human resources must be defined that guarantee the governance of that information".

It is against this backdrop that a study on ITG is relevant in the South African context. As noted above, that environment has recently been challenged by low IT governance maturity levels together with the uncertainties brought by the COVID-19 pandemic and the ever-changing HE business model that brings with it shifting but increasingly sophisticated technology-related demands. Despite academics' and practitioners' increased attention to ITG, there has been insufficient recent research that considered the practical challenges hindering the effective implementation of ITG in South African higher education. Given the low IT governance maturity in the South African environment, this study seeks to empirically examine factors contributing to this in HEI in South Africa through the lens of the Will-Skill-Tool model.

The following concepts are central to this research and are defined as follows:

- ITG is considered to be the positive engagement in IT governance by management;
- ITG skill refers to the expertise to implement IT governance;
- ITG tool indicates access to IT governance frameworks, standards and solutions for implementation guidance.

Problem Statement

Despite the availability of ITG frameworks and standards, and the proven importance of ITG in the HE sector in South Africa, there is low formal institution of ITG globally (Caluwe & De Haes, 2019; Ako-Nai & Singh, 2019). Furthermore, literature reports low ITG maturity levels in various South African economic sectors (Johl et al., 2013; Ranga, 2022; Koekemoer & von Solms, 2017). Despite the sudden, increased dependence on IT, there is a scarcity of research on ITG implementation with respect to the IT-enabled transformation of higher education processes in the African environment (Ngqondi & Mauwa, 2018). According to Wessel et al. (2021, p.1), "IT-enabled transformation involved leveraging on IT in sustaining organizational value propositions and enhancing existing organizational identity". The recent COVID-19 pandemic and its demands have led to South African public HEIs suddenly and heavily investing in IT as a way of sustaining academic business during and after the pandemic. However, despite the increased investments, there have been indications of misalignment between university strategies and IT strategies. Since the researcher has been informed by these concerns, they assert that there is a need for a study on ITG in the higher education environment focusing on antecedents to ITG maturity.

Research Questions

Given the problem statement above, this study seeks to answer the following research questions:

1. How do the individual factors, namely ITG Will, ITG Skill and ITG Tool impact ITG Implementation Maturity in a HEI in South Africa?
2. How does the impact of ITG Will, ITG Skill, and ITG Tool on ITG Implementation Maturity differ depending on perceived complexity of ITG?

Context of the Study

The study was conducted in South African public HEIs, which have their overall governance structures (see Higher Education Act 101 of 1997 (South Africa, 1997)). The act provides guidelines on institutional membership, and procedures for endorsing governance structures within educational institutions. The South African government provides a wide regulatory framework, and the HEIs have the responsibility to establish institutional governance mechanisms informed by the overall regulatory framework. The South African higher education act does not prescribe ITG practices for HEIs in South Africa, however, the King 1V Report (PWC South Africa, 2016) on corporate governance stipulates the need for all registered entities to conform by governance. As such, South African HEIs are required to implement ITG. Furthermore, regulatory demands (see Protection of Personal Information Act (South Africa, 2013) require sound governance of information assets.

Another point to note pertains to the differences between public HEIs and private entities, as these may consequently determine differences in their IT investments and associated ITG practices. Furthermore, HEIs are mainly comprised of two functions, the administrative and the academic side of business operations. Accordingly, HEIs invest in IT infrastructure for administration and academic purposes (teaching, research and community engagement). However, administrative staff are the sole custodians of institutional IT infrastructure including academic IT systems. Furthermore, public HEIs in South Africa are government funded through taxpayers' money and exist to provide a public service. Therefore, competition and profit generation do not characterize the business models of public HEIs unlike private entities. Interestingly, while much work on ITG is linked to private entities, relatively little is known about the applicability of ITG frameworks and standards to public entities such as HEIs.

A call was made by Bianchi and Sousa (2016), for researchers to research ITG in the context of higher education, taking into consideration factors such as regions, private or public sector, culture etc. This study answers that call, and it is in the context described above that this study is undertaken to determine factors that impact ITG maturity in South African higher education. The section that follows reviews ITG literature.

LITERATURE REVIEW

This review is organized as follows; initially a broader global perspective is provided, this is narrowed down to the African context, and finally ITG in South Africa becomes the focus. After the literature review there is a discussion on the theoretical frameworks that guide the study.

IT Governance

There are several definitions of ITG, but it is commonly regarded as a branch of corporate and enterprise governance (De Haes & Van Grembergen, 2009; De Haes et al., 2020). While some IT decision making powers can be delegated to operational level structures within the institution, in principle executive management and the university council retain ultimate accountability for decisions made (Webb et al., 2006). In addition, literature agrees that ITG can be implemented through structures, processes, and relational mechanisms (Weill & Ross, 2004; De Haes & Van Grembergen, 2009; Tallon et al., 2013). The definition of ITG has been updated to reflect all developments that are now considered to take place in the ITG field. Accordingly, in the contemporary definition, ITG is regarded as: "an integral part of corporate governance for which, as such, the board is accountable. It involves the definition and implementation of processes, structures, and relational mechanisms that enable both business and IT stakeholders to execute their responsibilities in support of business/IT alignment, and the creation and protection of IT business value", (De Haes et al., 2020, p.3).

ITG structures refer to the roles and responsibilities that can be executed through committees that are responsible for decision-making (De Haes & Van Grembergen, 2008; Weill & Ross, 2004). In addition, processes involve techniques and tools that facilitate IT decision making, such as the balanced scorecard, service level agreements, portfolio management etc.; these are all designed to align business and IT strategies (De Haes & Van Grembergen, 2008; Weill & Ross, 2004). Relational mechanisms enable involvement and collaboration between business and IT (Webb et al., 2006; Weill & Ross, 2004). ITG guarantees the effective and efficient allocation of IT resources for attainment of strategic business goals (IT Governance Institute, 2020).

Prior Studies on Challenges to ITG

IT governance has been widely studied in several different contexts, industries and in HEIs and in a variety of locations globally. A plethora of studies on ITG practices in private organizations have been published, especially in the financial service sectors of developed countries (De Haes & Van Grembergen, 2009; Pereira et al., 2014). Various studies have considered ITG challenges, referred to as ITG inhibitors, barriers or ITG critical success factors. A study by Lee et al. (2008), on the relationship between ITG inhibitors and success in Korea, suggested that inadequate attention to any of five factors negatively affected ITG initiatives. These factors are: IT principles and policies, clear ITG processes, communication, stakeholder involvement, and financial support. The findings by Lee et al. (2008) concur with but extend those of Letsoalo et al. (2006), whose study concluded that 3 factors namely, 'lack of clear IT processes', 'inadequate human resources' and 'inadequate stakeholder involvement' restricted ITG implementation at a South African enterprise. Management play a major role; a lack skills

needed for implementation of new knowledge results in management being unable to establish structures for ITG responsibilities (De Maere et al., 2022). This is a persistent problem. Further support comes in the form of a study by Othman et al. (2011) in an emerging Asian economy who found that leadership support was the main influencing factor for successful ITG practices. These same authors suggested that ITG barriers are shaped by the organizational, environmental and ITG context.

Despite various factors having been identified as challenges to ITG in the European and Asian contexts, most of these studies focused on the financial services sectors as their research contexts. Findings from different contexts would provide a more robust theoretical foundation that could assist researchers and practitioners to understand the problems that come with ITG implementation. Such a contribution to theory would also be of value when focusing on the higher education context where IT-enabled transformation is occurring. Hence, discussion of ITG in different contexts assists in the current study which is situated in Sub-Saharan Africa where there has been a dearth of studies that focus on ITG implementation and maturity in the higher education contexts. The current study is the first to study ITG in higher education through the will-skill-tool (WST) model by Christensen and Knezek (2008). The following section discusses the research framework and its justification.

IT Governance in HEIs

Effective ITG in HEIs is needed to ensure improved decision making associated with the heterogeneous systems that are being developed, and taking full advantage of existing structures, processes, and relational mechanisms (De Haes & Van Grembergen, 2009; Grama, 2015; Hicks et al., 2012). This is based on substantiated findings from the financial service sector where ITG has been widely studied.

As noted previously, HEIs require a variety of IT systems including academic, administrative and research systems and e-learning platforms (Coen & Kelly, 2007). It becomes particularly important to study the IT governance phenomenon in the context of higher education given HEIs' sudden need for new IT systems often incorporating 4IR elements and in response to the COVID-19 lock down but persisting after the pandemic as well. In higher education, ITG can be related to the implementation and use of enhanced versions of existing systems and requires active engagement between IT decision makers and academic decision makers. This is necessary as these key participants need to share knowledge and expertise so that the new systems can deliver value in line with various end users' expectations. Worldwide, HEIs have recognized the significance of ITG, but only a few have implemented ITG frameworks and standards (Jairak et al., 2015). A recent study by Mangundu (2022) on IT governance practices in a South African university found evidence of incompatibility between ITG resource spending and risk management. Despite the availability of complex governance frameworks, prioritization mechanisms were required to guide the implementation approach in the studied university (Mangundu, 2022). Instances of ITG frameworks' rigidity requiring institutional adjustments have been reported. The next section discusses ITG frameworks and associated challenges.

THEORETICAL FRAMEWORK

An analysis of the theories applied in technological innovation, implementation and diffusion shows that they are most often based on the following: unified theory of acceptance and use of technology (UTAUT; Chakraborty & Al Rashdi, 2018; Venkatesh et al., 2003), technology acceptance model (TAM; Davis et al., 1989; Silva, 2015), diffusion of innovations (DOI), WST (Christensen & Knezek, 2008) and the technology, organization and environment (TOE) framework (DePietro et al., 1990). These theories have been extensively applied in ITG innovation adoption studies, except for the WST and theory of planned behavior (TPB) models. Innovation has been described as a complex, interactive

connection of nodes (i.e., institutions, people, and technology) that results in both the production of the innovation itself and a necessary change in the competence of the agents who are to employ it (Lundvall, 2007). As the current study focuses on IT governance challenges in higher education, where there is a great deal of autonomy, individual level theories can be used to provide a complementary picture to an organizational approach as they interrogate the individual (people-oriented) inhibitors to ITG implementation maturity.

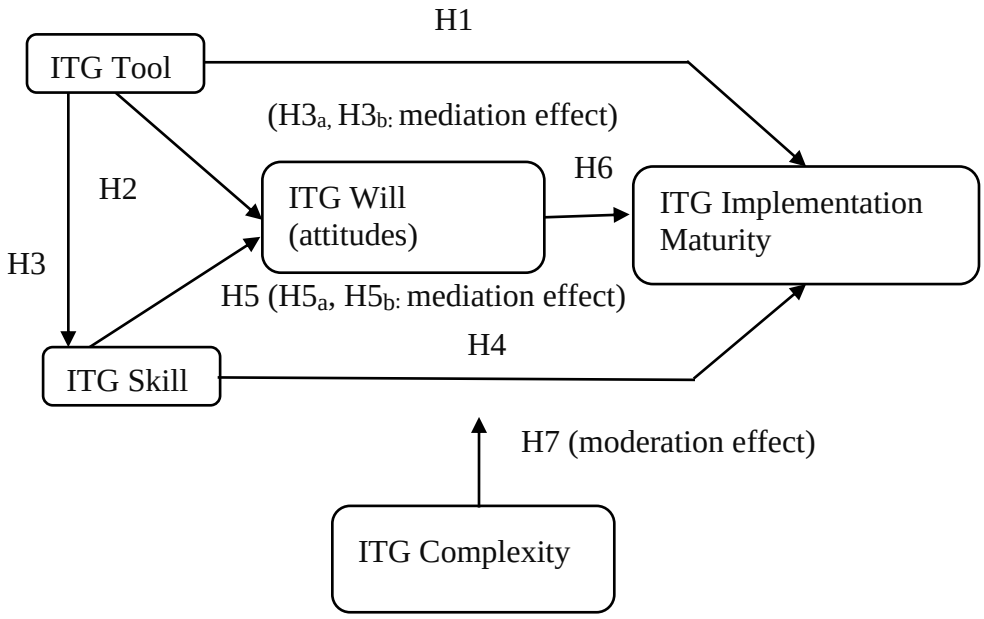
WST and TPB models

The main constructs of WST are will, skill, and tool. The WST model (see Figure 1) proposes that these constructs independently predict the integration of technological innovations into education (Christensen & Knezek, 2008). WST has been applied to study the extensive and sustained use of technological innovations in the context of education (Knezek et al., 2003; Morales et al., 2005; Farjon et al., 2019). This study will extend the use of the model to the ITG context. This study suggests that the will, skill, and tool concepts are essential variables linked to the individuals who advance ITG as a technological innovation that ensures IT delivers business value. In addition, the study employs the Theory of Planned Behavior (TPB) to examine IT governance from the viewpoint of business decision makers' and IT decision makers' attitudes. The WST model's construct of Will converges with and complements the TPB construct of Attitude. TPB has been utilized in research on information systems innovation connected to IT governance, namely adherence to information security policies (Ifinedo, 2012; Chang et al., 2012, Bulgurcu et al.,2010, Leonard et al., 2004). Furthermore, being informed by the TOE framework, the study borrows the construct of ITG complexity as a characteristic of technological innovation and tests for it as a moderator in the ITG implementation maturity process. Figure 1 depicts the constructs under consideration and their associated relationship.

The Research Model and Hypothesis Development

Figure 1

The Proposed Research Model and Hypothesized Relationship



Note. ITG = information technology governance.

ITG Tool

Tools are defined by their creators as: frameworks (Weill & Ross, 2004; IT Governance Institute, 2007; Van Grembergen & De Haes, 2009), set or model of best practices of generic domain (OGC-Office of Government Commerce, 2002), a standard (ISO, 2015), a methodology (OGC-Office of Government Commerce, 2002,) or a system (Kaplan & Norton, 1996). According to Larsen et al. (2006), organizations have two basic options when it comes to governance - they may use an ad hoc approach and establish their own frameworks, or they can accept standards that have been created and improved through the combined expertise of hundreds of organizations and individuals. When applying WST to ITG, the term 'ITG tool' refers to the selected IT governance framework, standard, and solution for implementation of ITG. Importantly, organizations should select ITG tools that facilitate a good alignment of the organizational structure with business (Larsen et al., 2006). Appropriate ITG tools should be applied for solving specific business problems as well as improving governance of digital resources (Lorences & Ávila, 2013). Therefore, the study hypothesizes,

H1: Access to ITG Tool has a positive effect on ITG Implementation Maturity.

H2: ITG Tool has a positive effect on ITG Will.

H3: ITG Tool has a positive effect on ITG Skill.

ITG Skill

To be innovative and meet the competitive nature of a modern global digital economy, organizations have to invest in organizational capacities, capabilities and skills that can effectively utilize the digital assets acquired by the organization. In addition, there is a need to attract a skilled workforce that can implement IT governance, otherwise organizations are at risk of wasting their investments (Van Grembergen & De Haes, 2018). Sharma et al. (2009) propose that sometimes it is necessary to "shake up" and challenge governance. To ensure senior management support, it may be necessary to put in time and effort, add governance skills and expertise, and perhaps even establish or re- establish a governance culture. Lorences and Ávila (2013) suggested preparation and capacitation through training programs that increase knowledge and expertise in IT governance as an organization embarks on its IT governance journey. Therefore, this study hypothesizes,

$H3_a$: ITG Skill mediates the relationship between ITG Tool and ITG Will.

$H3_b$: ITG Skill mediates the relationship between ITG Tool and ITG Implementation Maturity.

H4: ITG Skill has a positive effect on ITG Implementation Maturity.

H5: ITG Skill has a positive effect on ITG Will.

ITG Will

The responsibility for IT governance belongs to the board of directors and top management (IT Governance Institute, 2003). Although involvement by senior management from IT and business is essential for effective IT governance (Huang et al., 2010, De Haes & Grembergen, 2009, Weill & Ross, 2004), accountability for IT governance cannot be delegated (ISO/IEC, 2008). The goals of IT governance are achieved through cascading these activities down to the execution level, hence the involvement IT and ITG practitioners in IT governance projects is crucial. Attitude towards behavior is defined as an individual's favorable or negative feelings (evaluative effect) about engaging in the target behavior (Fishbein & Ajzen, 1977). In psychology, human attitudes and behaviors are often influenced by awareness (Ishak & Zabil, 2012). Based on TPB, it is hypothesized that IT and ITG practitioners' views affect their intentions to participate in IT governance activities and, hence, their actual behavior (participation in) ITG implementation. It is proposed that ITG tools and ITG skills may allow an individual to develop a positive attitude (Will), consequently affecting ITG implementation maturity. Based on the above discussion, the following hypotheses are proposed,

$H5_a$: ITG Will mediates the relationship between ITG Skill and ITG Implementation Maturity.

$H5_b$: ITG Will mediates the relationship between ITG Tool and ITG Implementation Maturity.

H6: ITG Will has a positive effect on ITG Implementation Maturity.

ITG Complexity

ITG complexity is determined by both the importance of and the uncertainty regarding the impact of the envisaged ITG strategies and policies; like any other strategic decisions, those relating to these strategies and policies demand intensive and extensive input from the individuals involved (Ranganathan & Sethi, 2002; Weill & Ross, 2004). The complexity of IT governance depends on the underlying complexity of the business environment (Larsen et al., 2006). Patel et al. (2002) postulate that IT governance frameworks largely rely on the premise that the organization is stable and that nearly all activities are scheduled and hence predictable providing low uncertainty and hence low ITG complexity. On the other

hand, Although the ITIL framework is one of the most frequently used IT governance solutions, the many relationships between processes in the ITIL architecture and the resulting high levels of complexity mean that enterprises find it challenging to implement (Pereira & da Silva, 2012). The COBIT framework also appears to create a very complex structure with numerous relationships across operations. Othman and Chan (2013) concur and argue that the complexity of the ITG frameworks acts as a hindrance to their implementation. Consequently, organizations must manage this complexity. This is possible as, according to De Haes & Van Grembergen (2008), complexity can be reduced through identification of crucial processes for implementation and concentrating only on those. Nevertheless, organizations still fail to implement ITG due to the complexity and overlapping relationships (Pereira & da Silva, 2012). This study hypothesizes,

H7: The impact that ITG Tool, ITG Skill and ITG Will have on ITG Implementation Maturity may differ depending on the perceived complexity of ITG.

RESEARCH METHODOLOGY

Operationalization of the Constructs

The research variables, ITG Skill, ITG Will and ITG Tool, were measured on a five-point Likert scale (from 1=strongly disagree to 5=strongly agree). Furthermore, the moderating effect of ITG Complexity was measured with five items that also probed the respondents' levels of agreement with statements regarding whether the perceived complexity of ITG influenced implementation maturity in any way. The dependent variable, ITG Implementation Maturity, was comprised of five items representing the domains of ITG (i.e., risk management, IT value delivery, IT strategic alignment, IT resource management and IT performance measurement) and these were measured on the capability maturity model scales (initial, repeatable, defined, managed and optimized (refer to the Appendix for the questionnaire).

Data Collection

A research methodology has research procedures and steps required to test the research hypotheses and answer the research question (Creswell & Plano Clark, 2011). The researcher collected data by means of a closed-ended, online survey questionnaire. This was sent to respondents at five public institutions of higher learning in South Africa who had indicated their willingness to participate in the study. Within the selected institutions, non-probability sampling, specifically purposive sampling, was used to recruit research participants who had the required ITG knowledge. In addition, the snowball technique was used to identify additional informed participants for the study; the first group of identified respondents passed the survey link on to new respondents. For purposive sampling the sample must match the aims and objectives of the research (for example they must be sufficiently knowledgeable and interested to be able to answer questions). This good fit between respondents and research aims enhances the rigor of the study and the reliability of the data and results (Campbell et al., 2020). Table 1 below summarizes the data sources for this the study.

Table 1

Research Data Sources

Organizations	Questionnaire Respondents
Public HEIs	Chief Information Officers, Finance Managers, Chief Finance Officers, IT Directors, IT Officers, Deputy Vice Chancellors, Academic Heads of Departments, Human Resources Managers, Deans Of Faculties, IT Committee Members, IT Governance Officers, IT Decision Makers, Senate Members, Governance, Risk and Compliance Committee Members

Note. HEI = higher education institution; IT = information technology.

The online survey was conducted over a six-month period from February 2022 to September 2022. Questionnaire items presented via SurveyMonkey were set up in such a way that each required a response, thereby eliminating submission of incomplete responses. A total of 121 questionnaires were returned. These included 57.5% of respondents who were academic committee members and 42.5% of respondents who were IT and IT governance committee members. After the data collection process was completed, the researcher exported responses in Excel format from SurveyMonkey into SmartPLS (Version 3) for data analysis.

ANALYSIS AND FINDINGS

Measurement Model

The researcher used SmartPLS 3 to conduct statistical analysis. The quality of the study constructs is informed by the evaluation of the measurement model. The measure of quality starts with factor loadings, followed by establishment of construct validity and reliability.

Factor Loadings

Factor loading denotes "the extent to which each of the items in the correlation matrix correlates with a given principal component. Factor loadings can range from -1.0 to +1.0 with higher absolute values indicating a higher correlation of the item with the underlying factor" (Pett et al., 2003:299). None of the items had a factor loading below the suggested value of 0.50 (see Table 2) as advised by Hair Jr et al. (2016). Accordingly, no additional items were dropped.

Table 2

Factor Loadings

	ITG Skill	ITG Tool	ITG Will	ITG Maturity
Skill_1	0.661			
Skill_2	0.815			
Skill_3	0.831			
Skill_4	0.661			

	ITG Skill	ITG Tool	ITG Will	ITG Maturity
Tool_1		0.646		
Tool_2		0.810		
Tool_3		0.814		
Tool_4		0.805		
Will_1			0.887	
Will_2			0.683	
Will_3			0.695	
Will_4			0.853	
ITG IM_1				0.966
ITG IM_2				0.617
ITG IM_3				0.948
ITG IM_4				0.945

Note. ITG = information technology governance; ITG IM = information technology governance implementation maturity.

Reliability Analysis

The most frequently used reliability tests are Cronbach Alpha and Composite Reliability (CR). According to Taber (2013), "reliability is the extent to which a measuring instrument is stable and consistent, the instrument should be able to afford the same results". The Cronbach Alpha values ranged from 0.740 to 0.893 while Composite Reliability values ranged from 0.833 to 0.931 (see Table 3). Since both the indicators of reliability provided a reliability statistic above the threshold of 0.70, results indicated reliability (Hair et al., 2011).

Table 3

Construct Reliability (Cronbach Alpha and Composite Reliability)

	Cronbach's Alpha	Composite Reliability
ITG Skill	0.740	0.833
ITG Tool	0.781	0.854
ITG Will	0.787	0.864
ITG IM	0.893	0.931

Note. ITG = information technology governance; ITG IM = information technology governance implementation maturity.

Validity

According to Bagozzi et al. (1991:425), "convergent validity is the degree to which multiple attempts to measure the same concept are in agreement". When the average is greater than the recommended 0.50

then items converge to measure the construct and, therefore, convergent validity is attained (Fornell & Larcker, 1981). The convergent validity results based on the AVE statistic in this study were greater than 0.50 for all constructs. In addition, discriminant validity which is "the degree to which measure of different concepts are distinct", Bagozzi et al. (1991:425), was achieved as the square-root of AVE (printed in bold in Table 4) for each construct was greater that its correlation with other constructs (Fornell & Larcker, 1981). The constructs' average extracted square root of variance was consistently higher than off-diagonal correlations, demonstrating the latent variables' strong discriminant validity (Hair Jr et al., 2021).

Table 4

Construct Convergent Validity (AVE) and Discriminant Validity

	AVE	ITG IM	ITG Skill	ITG Tool	ITG Will
ITG IM	0.777	***0.881***			
ITG Skill	0.557	0.418	***0.747***		
ITG Tool	0.596	0.457	0.789	***0.772***	
ITG Will	0.616	0.201	0.515	0.395	***0.785***

Note. Bold and italics represents the square-root of AVE.
ITG = information technology governance; ITG IM = information technology governance implementation maturity; AVE = average.

Structural model

The variance inflation factor (VIF), path coefficients, *f*-squared, *R*-squared, and Q-squared values are all used to assess the structural model (Hair Jr et al., 2021). When VIF values are less than 4, multi-collinearity is absent. None of the VIF values in Table 4 were greater than 4, which shows that multicollinearity had no effect on the structural model's projected coefficients. After determining that the structural model does not exhibit multicollinearity, the relevance of the path coefficients was examined using a bootstrapping approach and 1000 subsamples. Table 5's findings show that three of the six hypotheses, were statistically significant at the 0.05 levels.

Table 5

The Structural Model

	Std Beta	Std error	T Statistic	*p*	Decision	*f*-squared	VIF
H1: ITG Tool-> ITG IM	0.336	0.125	2.677	0.007	Accepted	0,386	1,947
H2: ITG Tool->ITG Will	-0.031	0.119	0.258	0.796	Rejected	0,002	1,653
H3: ITG Tool-> ITG Skill	0.789	0.025	31.512	0.000	Accepted	0,379	1,000
H4: ITG Skill -> ITG IM	0.161	0.145	1.045	0.296	Rejected	0,003	2,584

H5: ITG Skill-> ITG Will	0.539	0.123	4.378	0.000	Accepted	0,384	2,087
H6: ITG Will -> ITG IM	-0.014	0.137	0.106	0.916	Rejected	0,002	1,546

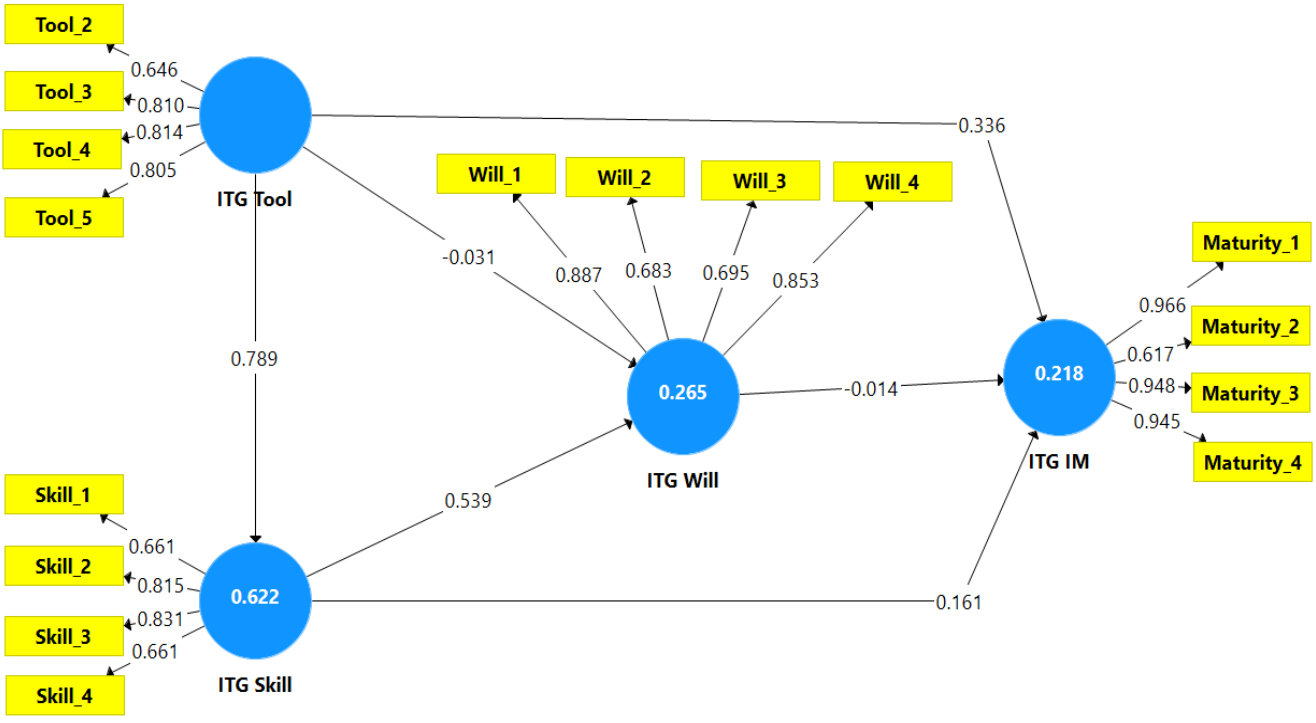
Note. ITG = information technology governance; ITG IM = information technology governance implementation maturity; VIF = variance inflation factor.
$p < .05$

The *f*-squared test is used to evaluate how the exclusion of an exogenous variable from the model affects the *R*-squared of the endogenous variable. Cohen (1992) defined small, medium, and large effect sizes as an *f*-squared of 0.02, 0.15, and 0.35. According to the findings (see Table 5), the effect sizes of ITG Tool to ITG IM, ITG Tool to ITG Skill and ITG Skill to ITG Will are large. On the other hand, the effects of ITG Tool to ITG Will, ITG Skill to ITG IM, Will and ITG IM are small.

The structural model (see Figure 2) consists of four constructs. ITG Tool, ITG Skill, ITG Will and ITG IM. ITG Tool and ITG Skill are predictors of the construct ITG Will and ITG implementation maturity. ITG Will is an antecedent of IT Governance Implementation Maturity (ITG IM).

Figure 2

The Structural Model



Note. ITG = information technology governance; ITG IM = information technology governance implementation maturity.

The standardized root mean square residual (SRMR) was used to measure the model fit. According to Hu and Bentler (1999), a value less than 0.10 is a good fit. In addition, using Hair Jr et al. (2014)'s proposed standards for acceptable fit, a SRMR of 0.080 is deemed good. The SRMR value in the present study stood at 0.081.

The route coefficients and the coefficient of determination (*R*-squared) are shown in Figure 2. The total impact of exogenous variables on the endogenous latent variables is measured by *R*-squared (Hair Jr et al., 2021). In this scenario, the combined impact of ITG Tool, ITG Skill, and ITG Will on ITG Implementation Maturity is assessed by the *R*-squared value. *R*-squared values of 0.02, 0.13, and 0.26, according to Cohen (2013), indicate weak, moderate, or significant predictive accuracy. ITG Tool, ITG Skill, ITG Will, and ITG Implementation Maturity have *R*-squared values of 0.622, 0.265, and 0.218, respectively (see Figure 2). These *R*-squared values are regarded as substantial (Cohen, 2013).

The structural model's Q-squared values were generated using the blindfolding approach. The Q-squared values were in the range of 0.179 to 0.596. All the Q-squared values were higher than zero, demonstrating the structural model's ability to anticipate future events (Sarstedt et al., 2017). According to this, ITG Tool, ITG Skill, ITG Will, are reliable indicators of IT Governance Implementation Maturity.

Mediation Analysis

$H3_a$: ITG Skills Mediate the Relationship Between ITG Tool and ITG Will.

Mediation analysis was conducted to assess the mediation effect of ITG Skill on the relationship between ITG Tool and ITG Will. The results (see Table 6) revealed that the total effect of ITG Tool on ITG Will was significant ($\beta = .395$, $t = 5.179$, $p < .001$). With the inclusion of the mediator ITG Skill, the direct effect of ITG Tool on ITG Skill was insignificant ($\beta = -.031$, $t = .258$, $p = .796$). The indirect effect of ITG Tool on ITG Will through ITG Skill ($\beta = .425$, $t = 4.652$, $p < .001$) was found significant. This shows a complete mediatory role of ITG Skill in the relationship between ITG Tool and ITG Will. Hence, $H3_a$ was accepted.

$H3_b$: ITG Skills Mediate the Relationship Between ITG Tool and ITG Implementation Maturity (IM).

Mediation analysis was conducted to assess the mediation effect of ITG Skill on the relationship between ITG Tool and ITG IM. The results (see Table 6) revealed that the total effect of ITG Tool on ITG IM was significant ($\beta = .457$, $t = 5.815$, $p < .001$). With the inclusion of the mediator ITG Skill, the direct effect of ITG Tool on ITG IM was significant ($\beta = .336$, $t = 2.685$, $p < 0.05$). The indirect effect of ITG Tool on ITG IM through ITG Skill ($\beta = .127$, $t = 1.036$, $p = .301$) was found to be insignificant. This shows that ITG Skill does not play a mediatory role of in the relationship between ITG Tool and ITG IM. Hence, $H3_b$ was rejected.

$H5_a$: ITG Will Mediate the Relationship Between ITG Skill and ITG Implementation Maturity (IM).

Furthermore, mediation analysis was conducted to assess the mediation effect of ITG Will on the relationship between ITG Skill and ITG IM. The results (see Table 6) revealed that the total effect of ITG Skill on ITG IM was insignificant ($\beta = .153$, $t = 1.095$, $p = .274$). With the inclusion of the mediator ITG Will, the direct effect of ITG Skill on ITG IM was also insignificant ($\beta = .161$, $t = 1.045$, $p = .296$). The indirect effect of ITG Skill on ITG IM through ITG Will ($\beta = -.008$, $t = 0.107$, $p = .915$) was also found to be insignificant. This shows that there is no mediation by ITG Will in the relationship between ITG Skill and ITG implementation maturity. Hence, $H5_a$ was rejected.

$H5_b$: ITG Will Mediate the Relationship Between ITG Tool and ITG Implementation (IM).

In addition, mediation analysis was conducted to assess the mediation effect of ITG Will on the relationship between ITG Tool and ITG IM. The results (see Table 6) revealed that the total effect of ITG Tool on ITG IM was significant (β = .457, t = 5.815, p < .001). With the inclusion of the mediator ITG Will, the direct effect of ITG Tool on ITG IM was also significant (β =.336, t = 2.685, p < .005). The indirect effect of ITG Tool on ITG IM through ITG Will (β = .000, t = .107, p = .915) was found to be insignificant. This shows a no mediatory role of ITG Will in the relationship between ITG Tool and ITG IM. Hence, $H5_b$ was rejected.

Table 6

Mediation Results

Total effect		Direct effect		Indirect effects				
Coefficient	*p*-value	Coefficient	*p*-value	Hypothesis	Coefficient	SD	*t*-value	*p*-value
.395	.000	-.031	.796	$H3_1$: ITG Tool –>ITG Skill –> ITG Will	.425	.097	4.652	.000
.457	.000	.336	.009	$H3_2$: ITG Tool –>ITG Skill –> ITG IM	.127	.123	1.036	.301
.153	.274	.161	.296	$H5_1$: ITG Skill–>ITG Will–> ITG IM	–.008	.073	.107	.915
.457	.000	.336	.009	$H5_2$: ITG Tool–>ITG Will–> ITG IM	.000	.018	.025	.980

Note. ITG = information technology governance; ITG IM = information technology governance implementation maturity. p < .05

Moderation Analysis

Moderation analysis was performed to evaluate the moderating role of ITGC (see Table 7). The results revealed an insignificant moderating role of ITGC on the relationships between: ITG Will and ITG IM (β = 0.306, t = 1.050, p = 0.294), Skill and ITG IM (β = 0.227, t = 0.838, p = 0.402), and Tool and ITG IM (β = -0.239, t = 0.789, p = 0.430). Therefore, H7 was rejected. Since H7 was rejected, it is not reported as part of the structural model (Figure 2).

Table 7

Moderation Results

	Beta coefficients	Standard Deviation	T Statistic (O/STDEV)	*p* Values
Mod_ Will–ITG IM–> ITGC	0.306	0.291	1.050	0.294
Mod_ Skill–ITG IM–> ITGC	0.227	0.271	0.838	0.402
Mod_ Tool–ITG IM–> ITGC	–0.239	0.303	0.789	0.430

Note. ITGC = information technology governance complexity; ITG IM = information technology governance implementation maturity; O/STDEV = standard deviation.

DISCUSSION

The aim of this study was to understand the phenomenon of IT governance and its implementation maturity in South African higher education through individuals' ITG will, skills and tools and considering perceived ITG complexity. This study proposed a structural model based on the WST model's constructs of Will, Skill and Tool, as the antecedents to ITG implementation maturity. The analysis yielded meaningful findings.

Answering Research Question 1

First, the structural model analysis showed that the path ITG Tool to ITG IM is significant. As ITG implementation is resource intensive, demanding extensive financial and human resource, its success depends on executive management support and resultant provision of the required resources. This argument is in line those of Cervone (2017) and Lee et al. (2008), whose studies show the need for resource commitment from all management levels in the organization if an ITG structure is to be implemented and sustained. In addition, availability and access to IT governance tools such as frameworks, solutions and standards for implementation promote IT governance implementation maturity. Therefore, as suggested by Bianchi and Sousa (2016), higher education institutions need to adopt ITG tools that suit their type of industry. Lin et al. (2010), emphasized that it is important that executive management understand the need for ITG and that they develop accountability structures at the executive level of the institution. However, results demonstrate that access to ITG tools does not necessarily translate to ITG will. In other words, the availability of IT governance tools does not increase the desire to implement IT governance. Interestingly, availability and access to ITG tools does have a positive influence on ITG skill. This finding resonates with Van Grembergen et al. (2004), who argued that besides ensuring that IT managers have the necessary IT tools, ITG structures need ITG tools to accomplish their roles.

Second, mediation analysis showed that ITG Skills positively mediate the relationship between ITG Tool and ITG Will. Therefore, the findings suggest that improving ITG skills and competences improves the IT and business decision makers' desire to utilize IT governance frameworks. This finding resonates with that of Korac-Kakabadse and Kakabadse (2001), who argue that among others, IT governance encompasses development of an IT skill base.

Despite ITG Tool demonstrating a positive relation with ITG Implementation Maturity, contrary to the hypothesis, ITG Skill does not mediate this relationship. This finding suggests that availability of ITG frameworks and standards leads to ITG implementation maturity regardless of the skills set available.

However, the issue of a lack of ITG skills has been widely reported in literature; for example, Lin et al. (2010) and Ismail et al. (2008) reported that there is a misalignment between executive management and ITG teams' knowledge and skills. This is due to the rapidly evolving nature of ITG as related to advances in technology, compared to the managers' professional experience and skills which are less likely to need regular updating. More recently, Razak and Zakaria (2017) propose that ITG personnel need to have both technical and non-technical skills, such as the ability to do strategic planning, to advance ITG implementation.

ITG Will did not mediate the relationship between ITG Skill and ITG Implementation Maturity despite the positive relationship between ITG Tool and ITG Implementation Maturity. The results suggest that ITG is implemented if ITG solutions are available and that it is not dependent on individuals' will. However, this does not agree with Van Grembergen et al. (2004) who states that IT governance success factors include competences, conditions and attitudes that are critical to being successful in the practices.

Answering Research Question 2

The third finding was contrary to the formulated hypotheses. The moderating effect of ITG Complexity on the direct relationships between a) ITG Will and ITG IM, b) ITG Skill and ITG IM, and c) ITG Tool and ITG IM were not significant. This finding contradicts Kappelman et al. (2019), who argued that IT governance is one of the top five most time-consuming activities for Chief Information Officers. However, our conflicting results might be as a result of the nature of the higher education environment which differs from the private financial service sector where ITG complexity has predominantly been reported. There is no 'one size fit all' ITG; the level of ITG complexity and its moderating effect is partly determined by the organization's product-service complexity and market mix complexity (Weber et al., 2009). As demonstrated by Larsen et al. (2006), the complexity of IT governance can be driven by the underlying complexity of the business environment that shapes the associated risks. The public higher education sector in South Africa is service driven rather than profit driven, hence, the complexity of ITG and its potential moderation on ITG will, skill and tool might be reduced. Pereira and da Silva (2012) demonstrated that, because of the many relationships between processes in ITG solutions such as in the ITIL architecture, ITG becomes complex and challenging for the enterprises to implement. Furthermore, the complexity of IT governance solutions depends largely on the stability of the organizational activities (Patel, 2002). With these findings in mind, we further argue that processes in universities were generally scheduled and stable, calling for uncomplicated and fewer ITG processes and pragmatic controls. However, with the disruptions of COVID-19 and the rapid proliferation of artificial intelligence in HE, the environment becomes more dynamic rather than very stable.

Being informed by these findings, we further argue that individuals responsible for IT governance need to make efforts to improve their ITG skills through certification on ITG frameworks such as COBIT and ITL. In addition, institutions should provide financial support for upskilling, IT governance culture shift through change strategies, as well as creating enabling environments for ITG governance to flourish. Enabling environments drive individuals to regard ITG positively and acquire skills necessary for their job roles.

Study Contributions

The present study examined the significance of ITG will, ITG tools and ITG skills as antecedents to ITG governance implementation maturity and how these three factors relate to ITG implementation maturity levels. First, the study contributes to theory by borrowing and applying the WST model to the ITG field. The study demonstrated the applicability of the WST model in ITG research. Second, the study could

assist organizations to develop and advance effective ITG implementation strategies from both a human capacitation and a development perspective. Most importantly, this study suggests ITG skills development strategies that drive the voluntary use of ITG solutions, thereby ultimately improving ITG implementation maturity.

Limitations and Prospects for Future Work

Findings from this study may be of interest to South African higher education policy makers, and others in regional and sub-Saharan higher education, and has the potential to be of value when used in comparable global higher education contexts. The study discusses factors that impact ITG implementation maturity in the higher education environment from a Will-Skill-Tool model perspective. However, the findings should be generalized cautiously as the study is based on feedback from only five of the twenty-six public universities in South Africa. Hence these findings may not truly reflect the challenges faced by other institutions. Future, more comprehensive surveys on ITG might involve other or even all the South African higher education institutions and use random sampling techniques to improve the generalizability of the findings. In addition, higher education institutions are currently investigating ways to integrate 4IR elements and artificial intelligence (AI) into their IT systems, into student recruitment drives, student support and retention. Therefore, future studies need to consider the governance of AI which is an emerging branch of ITG as contemporary applications of AI can generate unforeseen and unintended new consequences.

CONCLUSION

The Will-Skill-Tool model was validated and demonstrated a good model fit. The results revealed that ITG tool availability and access influences both ITG implementation maturity and the acquisition of more advanced ITG skills. In addition, good ITG skills influence ITG will or attitude to improved ITG. The results demonstrated the need to improve the availability of ITG tools such as frameworks, standards, and solution. Furthermore, the results demonstrate that ITG skill mediates the relationship between ITG tool and ITG will. Interestingly, results reveal no moderation of perceived ITG complexity.

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APPENDIX

The Questionnaire

Exploring factors to Information Technology governance implementation maturity in institutions of higher education, South Africa. Application of the WST model.

Discipline: Governance of Information Systems and Technology

Application Field: IT Governance in Higher Education

Thank you for participating in this study on Information Technology (IT) governance in higher education. The purpose of this research is to build an understanding of the challenges to IT decision making processes (IT governance) in higher education institutions.

In this context IT governance, which is also termed ICT governance can be defined as the decision rights, accountability and responsibility of board of directors of executive management and management in ensuring that information and communication technologies sustains, supports and extends the university strategy, goals and objectives.

The researcher adheres that all the information provided remains confidential and will only be used for the research purpose. No information will be provided to third parties and will be discarded upon completion of this study. Organizations' names, participants' names will not be used, where needed, organizations will be pointed as A, B, C etc. Participating organizations are very welcome to receive the recommendations from the study and best ways to improve their IT governance based on the findings.

Please answer **ALL** the questions, may you not leave any question empty.

Section 1: Background Information

1. Type of position
    - Academic committee member IT and IT governance committee member

2. Position in the institution
    - Chief information officer
    - IT director
    - IT officer
    - Dean of faculty
    - Heads of department
    - Deputy vice chancellor
    - Senate member
    - Other executive committee member

3. Professional work experience in academic/IT decision making.
- <4 years 4–<8 years 8–<12 years 12–15 years >15 years

4. Indicate your agreement that ICT technologies are important for academic business **at your institution**. On a scale *1 (Strongly disagree) to 5 (Strongly agree).*
- Strongly disagree Disagree Neutral Agree Strongly agree

5. Indicate the extent on the usage of IT by the administrative community **at your institution**. On a scale *1 (Strongly disagree) to 5 (Strongly agree).*
- Larger extent Somewhat extent Neutral Less extent Much less extent

6. Indicate your agreement on the alignment between IT strategy and business strategy **at your institution**. On a scale *1 (Strongly disagree) to 5 (Strongly agree).*
- Strongly disagree Disagree Neutral Agree Strongly agree

Section 2: ICT Governance Implementation

2.1 Indicate your agreement regarding the will to implement IT governance. On a scale *1 (Strongly disagree) to 5 (Strongly agree).*

	1	2	3	4	5
I enjoy participating in governing our IT					
I am comfortable with our IT governance journey					
IT governance is important in higher education					
IT governance brings many benefits to our institution					

2.2 Indicate your agreement regarding the IT governance skills. On a scale *1 (Strongly disagree) to 5 (Strongly agree).*

	1	2	3	4	5
I possess the skills needed for IT governance					
I have the knowledge required for governing IT					
I have the experience in IT governance					
I am certified to implement IT governance solutions					

2.3 Indicate your agreement regarding IT governance tools. On a scale *1 (Strongly disagree) to 5 (Strongly agree).*

	1	2	3	4	5
I have access and utilize established ITG frameworks					
I utilize IT governance standards					
Our institution has established adequate ITG structures					
Our institution follow established ITG processes					
Our institution implemented ITG relational mechanisms					

2.4 Indicate your agreement that the following IT governance complexity as they relate to ITG implementation **at your institution**. On a scale *1 (Strongly disagree) to 5 (Strongly agree).*

	1	2	3	4	5
IT governance is a costly initiative					
Incompatibility between required IT governance structures and existing structures					
Difficult to prove financial benefits of IT governance					
High implementation time requirements					
High effort requirement					

2.5 Indicate the maturity regarding the following IT governance focus areas. On a scale *1 (Initial) to 5 (Optimised).*

	1(Initial)	2(Repeatable)	3(Defined)	4(Managed)	5 (Optimised)
IT risk management					
IT value delivery					
IT Strategic alignment					
IT Resource management					
IT Performance measurement					

The end, thank you for the time