THE ADVANCES OF INFORMATION TECHNOLOGY GOVERNANCE IN UNIVERSITIES: A SYSTEMATIC REVIEW

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ABSTRACT

This study analyzes the advances of information technology governance (ITG) in the university context, through a systematic review of the literature. The following research questions are addressed: What progress has been made? What implementation studies have been developed? What factors influence success? What models have been created? And lastly, what are the relevant case studies? In the period from 2006-2017, 17 studies reported advances in the five areas of IT governance, 9 studies referred to aspects related to implementation, zero studies were identified that analyzed critical success factors, 6 studies developed ITG models and 34 studies analyzed implementation initiatives. Our analysis of the relevant studies shows that the advances of ITG in the university context are still incipient.

Keywords: *Systematic Literature Review (SLR), IT Governance, Information Technology Government; Universities; Information Technologies Government Systems; Higher Education.*

1. INTRODUCTION

During recent years, information technology (IT) has played an important role in the field of education [1]. Its role has been redefined from being a support resource to a strategic factor. However, its incipient role has been tempered by indiscriminate use, underestimated utility and a high share of waste [2]. Universities are increasingly organized and managed through digital data and new and complex IT infrastructures, including human and non-human actors, all framed by new economic and social policies [3]. The functionality of this system requires adopting new forms of resource governance, if one considers the importance and contribution of IT in achieving the strategic objectives of an organization.

The most widely accepted definition of information technology governance (ITG) is the one provided by ISO/IEC 38500 (2008) [4], which states that ITG "is the system through which the use of current and future IT is directed and controlled. It involves the evaluation and management of IT utilization plans that support the organization and monitoring of said use to achieve the objectives established in the plans. It includes the strategies and policies for the use of IT within the organization."

The implementation of ITG has become a critical element for the success of organizations around the world. There are several contexts in which the strategic importance of ITG has been demonstrated [5]; one of them is the university context, where a positive relationship has been found between the effectiveness of ITG and organizational performance in higher education. The governance of information technology in universities plays a very important role in the fulfillment of strategic objectives and university vision [6], which is why this subject requires a greater investigative effort by the scientific community.

Although there are several researchers interested in analyzing the progress of ITG [7,8,9], we have not found any studies or systematic reviews that analyze the various advances of ITG in universities regarding implementation, factors that influence the success of ITG, ITG models, or case studies of universities that have implemented IT governance initiatives. Therefore, our systematic review seeks to answer the

following research question: What progress has been made in IT governance in the university context?

Therefore, this article presents a systematic review of the literature related to the governance of information technologies in the university context through assessing the advances of IT governance in universities. The review demonstrates that there have been few advances in relation to the non-university context. Of the five areas defined by the IT Governance Institute [10], the most widely analyzed area is value delivery, focusing on maximizing costs and demonstrating the value of IT. On the other hand, it is evident that there have been few studies related to the implementation of ITG, which could be a determining factor for universities deciding whether or not to develop implementation initiatives. In addition, no studies have been identified regarding critical factors that influence the success of the ITG in the university context. We also report on studies that have proposed models of IT governance, which have gradually evolved over the last decade and represent a valuable managerial contribution. In relation to the ITG implementation case studies, Australian and European universities predominate in the literature. The results obtained in our review are crucial because they should be taken as a starting point for future studies in this field, since this study aims to provide a holistic view of the advances in IT governance in the university context, which is still incipient in relation to other contexts.

2.   METHODOLOGY

Three phases were performed throughout this study: planning, conducting and results. These phases have been reflected in various literature review papers related to ITG, such as Delgado & Velthuis [11] and Noraini et al. [12]. The phases are described below:

a. Planning: this stage consisted of developing research questions, search protocols and keywords, as well as resource assessment and creating inclusion and exclusion criteria.

b. Conducting: the primary studies were selected according to the planning phase.

c. Results: This stage consisted of statistical analysis and assessment of the selected articles, which is presented in section 3.

2.1 Planning

In order to assess the advances of IT governance in universities, we proposed the following research questions:

- Q1: What progress has been made in ITG?

- Q2: What efforts have been made in the implementation of ITG?

- Q3: What factors influence the success of ITG?

- Q4: What governance models of IT have been developed?

- Q5: What are the relevant ITG case studies?

To perform our search for relevant information, we utilized the ACM Digital Library databases, DOAJ (Directory of Open Access Journal), Emerald, IEEE Xplore, Science Direct, Springer, Taylor & Francis, Proquest, EBSCO and Scopus. Our review covers the period between January 2006 and March 2017, since 2006 was the first year that the publications referring to ITG in universities were found.

The selected articles were found using the following search string: ("IT Government" OR "IT Governance" OR "Information Technology governance" OR "Information Technology government" OR "Governance of IT" OR "Government of IT") AND ("university" OR "universities" OR "higher education" OR "college" OR "Education"); This search string was applied to the title, abstract and keywords. These terms were adapted to the individual needs of each search engine, as can be seen in Table 1.

Table 1. Query syntax

Source	Query syntax	Search result count
DOAJ	("IT Government" OR "IT Governance" OR "Information Technology governance" OR "Information Technology government" OR "Governance of IT" OR "Government of IT") AND ("university" OR "universities" OR "higher education" OR "college" OR "Education")	82

EBSCO	("IT Government" OR "IT Governance" OR "Information Technology governance" OR "Information Technology government" OR "Governance of IT" OR "Government of IT") AND ("university" OR "universities" "higher education" OR "college" OR "Education")	175
Emerald	("IT Government" OR "IT Governance" OR "Information Technology governance" OR "Information Technology government" OR "Governance of IT" OR "Government of IT") AND ("university" OR "universities" "higher education" OR "college" OR "Education")	93
IEEE	(("IT Government" OR "IT Governance" OR "Information Technology governance" OR "Information Technology government" OR "Governance of IT" OR "Government of IT") AND ("university" OR "universities" OR "higher education" OR "college" OR "Education"))	63
ProQuest	("IT Government" OR "IT Governance" OR "Information Technology governance" OR "Information Technology government" OR "Governance of IT" OR "Government of IT") AND ("university" OR "universities" OR "higher education" OR "college" OR "Education")	61
Science Direct	("IT Government" OR "IT Governance" OR "Information Technology governance" OR "Information Technology government" OR "Governance of IT" OR "Government of IT") AND ("university" OR "universities" OR "higher education" OR "college" OR "Education")	17
Scopus	("IT Government" OR "IT Governance" OR "Information Technology governance" OR "Information Technology government" OR "Governance of IT" OR "Government of IT") AND ("university" OR "universities" OR "higher education" OR "college" OR "Education")	147
Springer	(("IT Government" OR "IT Governance" OR "Information Technology governance" OR "Information Technology government" OR "Governance of IT" OR "Government of IT") AND ("university" OR "universities" OR	188
	"higher education" OR "college" OR "Education"))	
Taylor & Francis	("IT Government" OR "IT Governance" OR "Information Technology governance" OR "Information Technology government" OR "Governance of IT" OR "Government of IT") AND ("university" OR "universities" OR "higher education" OR "college" OR "Education")	35
Web of Science	("IT Government" OR "IT Governance" OR "Information Technology governance" OR "Information Technology government" OR "Governance of IT" OR "Government of IT") AND ("university" OR "universities" OR "higher education" OR "college" OR "Education")	16
TOTAL		2603

Once the scientific articles were located, the selection and exclusion criteria established in Table 2 were applied. With respect to the search sources, we have included journal papers, conferences proceedings and book chapters.

Table 2. Inclusion and Exclusion Criteria

Inclusion criteria	Exclusion criteria
Peer-reviewed studies including journal articles, conference proceedings and book chapters.	Papers that do not relate to the research questions
Studies that focus on ITG in the university context	Duplicate papers (by title or by content)
Studies that respond to the research questions	Posters, editorials, letters, errata and theses

2.2. Conducting the Review

The primary studies identified in the search process were subjected to a selection process according to the inclusion and exclusion criteria established in Table 2. A preliminary review of the content was then performed in order to determine the relevance for this study. Most of the papers were discarded because they corresponded to other contexts such as banking and various unrelated industries. The applied process is represented in Figure 1. One book was added that did not comply

with the search protocol because it contained relevant information that was considered to be essential for a thorough review. We then proceeded to analyze the articles to answer the research questions.
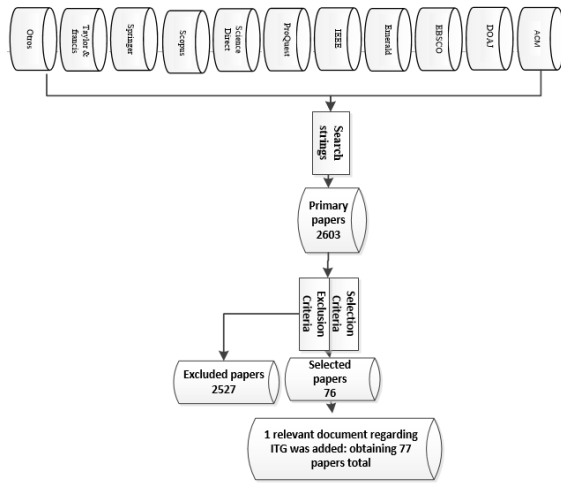

Figure 1. Applied process for conducting the Systematic Literature Review

3.   RESULTS

3.1 Tendencies in the Selected Publications

As a result of the systematic review process, 2605 studies were obtained, of which, 76 were selected according to inclusion and exclusion criteria. In Table 3, the studies selected from each resource can be observed.

Table 3. Potentially eligible studies and selected studies

Source	Potentially eligible studies	Selected studies
ACM Digital Library	3	3
DOAJ	2	2
EBSCO	1	0
Emerald	4	4
IEEE	15	14
ProQuest		5
Science Direct	3	2
Scopus	29	24

Springer	14	13
Taylor & Francis	3	3
Web of Science	9	9
TOTAL	85	76

3.2 Data Sources

Table 4 shows the distribution of the selected articles according to the type of document, journal repository and the number of studies selected for the review according to the type of study. Note that 49% of the selected articles are from conference proceedings, which represents the largest contribution in this work. Articles from journals have the second highest at 45%, and book chapters are in third place at 7%.

Table 4. Distribution of the documents by type and database

Source	Journal Articule	Conference Paper	Book Chapter	TOTAL
ACM Digital Library		3		3
DOAJ	1	1		2
EBSCO		0		0
Emerald		1	3	4
IEEE	1	13		14
Proquest				
Science Direct			2	2
Scopus	3			24
Springer	3	9		13
Taylor & Francis	3			3
Web of Science	8	1		9
Total	34	37	5	76
Percentage	45%	49%	7%	

4.   FINDINGS

4.1 Q1: What Progress has Been Made in ITG?

For our review, we considered the areas of ITG established by the IT Governance Institute [10]: Strategic Alignment, Value Delivery, Resource Management, Risk Management and Performance Measurement.

Strategic Alignment focuses on maintaining the link between the business plan and IT plans by defining, maintaining and validating the IT value proposition, and aligning IT operations with the operations of the organization [10]. In this area, the following advances have been recorded: Martins et al. [13] propose a new approach to IT governance, where the interests of the actors involved in the decisions, implementation and control were considered in strategic alignment. Herdiansyah et al. [14] propose an IT strategy map using IT Balanced Scorecard (BSC) framework in order to evaluate the university's business strategy and gaps in IT. Sadikin et al. [15] propose an Information System (IS) Strategic Plan.

Value Delivery is based on obtaining specific and well-cared for processes so that a project avoids difficulties in execution. The purpose is to ensure that IT delivers the promised benefits with respect to the strategy, concentrating on the optimization of costs and the provision of the intrinsic value of IT [10]. The main objectives of IT value management are as follows: to allow organizations to obtain an optimal value of IT-enabled investments at an accessible cost with an acceptable level of risk; to clearly define and communicate their vision of what constitutes value, and for whom; and to select and execute investments [16]. Zhen & Xin-yu [17] propose a service management model based on ITIL theory for Chinese universities. Juiz et al. [18,19] present a model for the communication of value provided by IT Management and Governance. They also propose a process of approval of IT project portfolios. Knahl [20] also performed an analysis of the practices and standards for the management of university IT services. Khther & Othman [21] propose a framework for improving and increasing IT services in universities and applied it in a Malaysian private university. Finally, Erfurth & Erfurth [22] perform an analysis of the general challenges in obtaining requirements to develop and establish IT services.

Resource Management is responsible for optimal investment, as well as the proper management of critical IT resources: applications, information, infrastructure and people [10]. Some progress has been made in this area: Kwon [23] suggests an IT Governance strategy to improve the performance and security of a university's information system. Hung et al. [24] propose a maturity model of Information Security Governance (ISG) and applied it to technological colleges and universities in Taiwan. Suwito et al. [25] present a model for information security which is based on the standards of COBIT,

ITIL and ISO 27001. Shaoyong et al. [26] propose a model of university IT architecture composed of six layers, including hardware infrastructure, data and information resources, software systems, user services, cyber security and IT governance.

Risk Management is the process of identifying, analyzing and quantifying the probability of losses and secondary effects that arise from disasters, as well as the corresponding preventive, corrective and reductive actions that must be undertaken [27]. Risk management requires that the top executives of an organization have an awareness and a clear understanding of the risks facing an organization, compliance requirements, transparency of significant risks, and the inclusion of the organization's risk management responsibilities [10]. Al-Talhi & Al-Ghamdi [28] propose a framework for risk assessment, and Jnr et al. [29] propose an automatic computational system for ITG risk mitigation based on agents whose objective is to measure risk probability and impact.

Performance Measurement is the area that establishes mechanisms and controls the implementation strategy of each project, including the use of resources, the performance of projects and the delivery of services, using, for example, the BSC [10]. An initiative to measure Green IT using the BSC was conducted by N. K. S. Putri [30]. An analysis of the impact of *ITG Absorptive Capacity* (i.e. organizational competence in recognizing, acquiring or creating valuable new business-IT knowledge) in the performance of ITG, and a conceptual ITG evaluation model has been proposed by Ajayi & Hussin [31].Table 5 demonstrates a summary of the progress made in the different areas of ITG.

Table 5. Advances in ITG

Area	Key Advances	Reference
Strategic Alignment	A new focus of IT Alignment through Actor-Network Theory	[13]
	Analyzed the alignment of Universities IT strategy and business strategy using IT BSC framework	[14]
	IS strategic plan for higher education institutions	[15]
Value Delivery	Model for IT services management	[17]

	Model for the communication of value provided by ITG	[32]
	Approval process of IT project portfolios	[18,19]
	Analysis of practices and standards of IT service management	[20]
	A framework to improve and enhance IT Services at universities	[21]
	Challenges in eliciting requirements to develop and establish IT services.	[22]
Resource Management	A strategic approach of IT governance for university information systems	[23]
	A maturity model for ISG	[24]
	An Information Security Model and Assessment Security Maturity	[25]
	Reference model of university IT architecture	[26]
Risk Management	Risk management evaluation model	[28]
	Risk mitigation model	[29]
Performance Measurement	Measurement of Green IT initiatives using BSC	[30]
	Analysis of ITG Absorptive Capacity and its influence on performance	[31]

4.2 Q2: What Efforts Have Been Made in the Implementation of ITG?

According to De Haes & Van Grembergen [33], three aspects must be considered for the implementation of IT Governance: processes, structures, and relational mechanisms.

Processes are closely related to strategic decision making of IT within the business, the strategic planning of IT systems, the management of the services and the monitoring, control and tools of process definition (COBIT , ITIL, IT BSC, etc.), as well as the management of project and service portfolios, infrastructures, talent and innovation. The

Structures include the organization and assignment of IT functions to specific people or departments, and the existence of clearly defined roles and responsibilities, including the creation of a series of committees related to IT planning and operation.

Relational Mechanisms facilitate the communicative relationships between people, between the business units and IT units, and between the business and suppliers. It also refers to the management of organizational change, training, human resources, and the exchange of knowledge regarding mergers and acquisitions.

Considering the three aspects of implementation, as well as an additional aspect identified after the review: the *obstacles*, the efforts to implement ITG have been determined, as shown in Table 6.

Table 6. Studies on the implementation of ITG

Aspect	Advances	Reference
Structures	Perception of Structural Capability of IT	[34]
Processes	Perception of Process Capability of IT	[34]
	Process Capability Assessment model of IT Governance	[30]
	A conceptual model of ITG implementation that includes IT Infrastructure	[35]
	Method for IT Governance Based on Enterprise Modelling	[36]
Relational Mechanisms	Perception of Relational Capability of IT	[34]
	ITG mechanisms that higher education institutions have implemented	[37]
	The obstacles of ITG	[38]

Obstacles and drivers of ITG Implementation	implementation in Thai universities	
	The drivers and barriers to pursuing formal ITG in Ghanaian Universities	[39]

4.3 Q3: What Factors Influence the Success of ITG?

Critical Success Factors (CSF) are a limited number of areas in which the results, if satisfactory, will ensure successful competitive performance for the individual, department or organization [40]. Leidecker & Bruno [41] defines them as characteristics, conditions or variables that when properly supported, conserved or managed, have a significant impact on the competitive success of a company.

There are no studies in the literature that refer to factors that influence the success of ITG in the context of higher education; however, there are studies in other contexts that may be relevant. Examples include Urbach et al. [42], Buchwald et al. [43] and Nfuka & Rusu [44,45], which demonstrate the importance of this field of study.

4.4 Q4: What Governance Models of IT Have Been Developed?

In regards to ITG models, it must be noted that according to Fernández & Llorens [46], several universities have implemented ITG via different models and perspectives since 2006. However, Higher Education Institutions (HEIs) have typically been based on experimental models, and it has since been discovered that different institutions have been using distinct models with different norms. Among these are COBIT (Control Objectives for Information and Related Technologies), as well as the case of ISO 38500:2008, which is one of the most widely used and accepted. However, the literature has identified few documents that demonstrate a standard ITG model or framework, as presented in Table 7.

Table 7. ITG Models proposed in the university context

The Joint Information Systems Committee (JISC) designed an ITG model as a reference for the UK's university system. It is a simple model with easy-to-use support tools and a high level of

adaptation to the environment of higher education institutions [47].

The model of ITG for the Spanish university

Model	Reference
Information System Management and Governance ISMG Model	[47]
ITG4U Model	[46]
ITG Framework in Education	[48]
Green information technology governance model	[49]
Conceptual model of IT governance	[50]
IT governance framework for achieving the development of academic programs in higher education institutions	[51]

system (GTI4U) is a model that pursues the objectives of its university and can be certified without difficulties by the ISO 38500 standard. This model is fundamentally based on the ISO 38500:2008, the model developed by JISC for UK universities and other elements extracted from the main existing frames of reference. In addition, it has the necessary instruments for performing first a local analysis (of each university), and then a global analysis of the actualized situation [46].

Ajami & Al-Qirim [48] developed an ITG framework that helps HEIs govern their IT projects. This framework focuses on evaluating decisions regarding the alignment and compatibility of IT with the overall strategies and goals of the HEI.

Our review also allowed the observation of the emergence of the Green Information Technology Governance Model (GITG), which was applied in private HEIs in Jakarta to help reduce costs by providing affordable tuition fees and reducing losses in daily operating costs [49].

Nugroho [50] proposes an ITG model for higher education that is based on the Cobit 5 framework. This model is essentially built on the principles of governance contained in the ISO 38500 standard: responsibility, strategy, acquisition, performance, conformity and human behavior. The proposal of this model argues that the principles should work well for

governance practices and management practices. Governance practices consist of evaluating the process of evaluation, direction and monitoring, whereas management practices consist of the processes of planning, construction, execution and monitoring. This model illustrates how ITG should be aligned with corporate governance, which signifies that ITG is no longer purely the responsibility of the IT unit, but an integral part of the university.

Musa et al. [51] present a conceptual framework by identifying the elements of governance for achieving the development of academia using twelve elements: IS/IT vision, IS/IT management strategy, policy, standards, software, hardware, procedures, communication protocol, people, organizational values, employee values and norms, culture and beliefs. This framework was validated within the Universiti Malaysia Sarawak (UNIMAS).

Within the analysis, we also identified authors who have presented preliminary model proposals. Bianchi & de Sousa [52] highlight the importance of developing an ITG framework specifically for universities. They developed a proposal for the public universities of Brazil and Portugal, which includes adoption guidelines in terms of structures, processes and relational mechanisms. Valverde-Alulema & Llorens-Largo [53] propose an IT Governance framework for Ecuadorian public universities.

4.5 Q5: What are the Relevant ITG Case Studies?
After our analysis, it has been determined that the majority of studies related to IT governance in the context of higher education refer to cases in which an IT governance initiative has been implemented, as summarized in Table 8.

Table 8. Cases of ITG in Universities

University	Description	Reference
Higher Education in Australia	This study analyzed how central IS departments in four institutions of higher education in Australia are transforming organizational attitudes and approaches to governing IT by implementing structural and process changes and	[54]
	establishing relational mechanisms.	
Australian Higher Education	This exploratory study examined and compared how ITG is implemented through a number of structures, processes, and relational mechanisms in two Australian HEIs, and how the adoption of industry best practice frameworks such as COBIT, ITIL and ISO17799 have been utilized in the implementation.	[54]
Australian Higher Education	This study examined how ITG was implemented in four Australian HEIs	[55]
Australian Higher Education	This paper analyzed how formal IT governance was implemented in two major Australian institutions of higher education.	[56]
High Public Portuguese Educational Institution	A case study of the implementation and use of COBIT for IT Governance in an Institution	[57]
Bucharest Academy of Economic Studies	This study presented the main aspects for developing and implementing actual phase in an information systems audit, to recognize the risks and establish the necessary measures to eliminate them	[58]
Australian university	This study explored the criteria of effective ITG processes employed in universities and their impact on the diffusion of appropriate technology to base level users	[59]

Thai Universities-Thailand	This study analyzed the status of ITG in Thai universities and ITG performance measures	[38]
Portuguese Private School	This study implemented ITIL and COBIT frameworks with the purpose of IT management and control	[60]
Satya Wacana Christian University, Salatiga	This study measured IT performance using COBIT framework version 4.1	[61]
Thai universities	The authors assessed the current situation and future improvement for IT governance and controls in a developing country like Thailand.	[62]
Australasian public university	This article examined how public university IT governance responds to the challenges of operational needs and the IT unit	[63]
Taiwan's college	This study investigated the maturity of ISG	[64]
Germany Universities	This author analyzed the current practices and standards in the areas of IT Service Management and IT Governance	[20]
Egypt Higher Education and Research Institutes	These authors reported on the state of ITG in one of the Egyptian research institutes as a case study that shows how ITG is being considered in Egypt Higher Education and Research Institutes.	[65]
Malaysian Public University	This study analyzed the evolution of IT Government and its application in the university context	[66]
University Malaysia Sarawak (UNIMAS)	These authors validated the IT governance framework for achieving the	[51]
	development of academic programs in higher institutions	
Higher Education sector in Sweden	This case study showed that the peer-to-peer principles, such as peer production, can offer more suitable governance over current EA frameworks as they are able to better match the decentralized components of the university's organizational structure.	[67]
Malaysia Public University	This study show how ITG is being implemented in the Malaysia Public University	[68]
Australian universities	This study determined which elements of decision making processes may be expected to lead to the successful identification and funding of projects that best maximize the overall contribution to the university mission.	[69]
Universitas Bina Darma	These authors analyzed the alignment of IT strategy and business strategy at their University	[14]
Universidad de Alicante and University of Salamanca	This study presented the common core between two subjects in two different universities in order to explain how to organize the service learning approach.	[70]
Thai university	This study developed a formal set of ITG practices based on sufficiency economy philosophy (SEP) to support the generic context for Thai universities.	[71]
Ghanaian Universities	These authors determined the status of IT governance in	[39]

	universities in a developing country, Ghana, and determining ITG maturity level	
Zimbabwe Polytechnics	These authors analyzed the state of ITG in Zimbabwe Polytechnics	[72]
Universidad de Ghana	This study analysed maturity levels of ITG in universities in Ghana	[39]
Universidad de Alicante	This study evaluated the situation of Technological ecosystem maps for IT governance	[73]
Brazilian federal universities	This study analyzed of the strategic alignment of the strategic objectives of the universities.	[74]
Universitas Pendidikan Indonesia (UPI)	These authors analyzed the performance of ITG at UPI	Wijayanti, Setiawan, & Sukamto [75]
Private High Education Institutions in Bogota	This study analyzed the current state of ITG in private HEIs in Bogotá, Colombia	Perea Muriel, Díaz-Piraquive, Crespo, & Rozo Rojas [76]
Brazilian Higher Education Institutions	This study analyzed how the top managers of Brazilian public sector federal universities perceive risk management.	de Freitas Alves, Neto, Sant' Ana, & Salgado [77]
Portuguese HEIs	These authors studied the influence of personality traits of Chief Information Officers (CIO) on the type of strategy adopted by Higher Education	Pinho & Franco [78]
Higher education institutions (HEIs) in Brunei Darussalam-Asia	These authors evaluated and highlighted the performance of achieving IT Governance using a performance measuring COBIT framework	[79]
Federal Rural University of Pernambuco (UFRPE)-Brazil	These authors studied how to guarantee that planning IT solutions by federal public organizations legally conformed to IN 04/2014	[80]

5. DISCUSSION & CONCLUSIONS

This study presented a systematic review of the literature related to the governance of information technology in the university context. 77 research papers were selected, allowing an analysis of the advances in each of the five areas defined by the IT Governance Institute [10]. The review demonstrates that there have been few advances in relation to the non-university context. The most widely studied area is *Value Delivery*, which focuses on maximizing costs and obtaining IT value through, for example, the management of IT services.

The studies consulted were consistent in the idea that the implementation of ITG, as an inseparable part of the university management system, requires a framework that considers processes, structure, and relationship mechanisms. However, there are very few studies in this regard that determine whether universities should implement IT governance initiatives.

In addition, no studies have been identified regarding factors that influence the success of ITG in universities. However, there are studies that have analyzed this topic in other contexts, such as Urbach et al. [42], Buchwald et al. [43] and Nfuka & Rusu [44,45]. Identifying critical success factors is a vital practice, which indicates a gap in the literature, and a need to study which factors have effective IT governance. According to ITGI [81], effective ITG generates benefits, such as improving an organization's reputation, trust, product or service leadership and cost reduction. A study by Weill & Ross [82] indicates that a well-structured ITG can have positive effects on corporate performance. The results of their survey of 256 companies suggests that the companies with the best results show a return on assets (ROA) of more than 40% compared to the values reached by their competitors.

We also reported on studies that have proposed models of IT governance, which have gradually evolved over the last decade and represent a valuable managerial contribution. Six models have been identified, each one distinct and although most follow the ISO 38500 standard, a standard ITG

model for any university has not yet been achieved. This could be explained by the existence of diverse governance models, organizational structure, processes, and particularities.

In relation to the case studies on the implementation of ITG initiatives in the university context, the presence of Australian, European and minority universities in Latin America and Africa predominates in the literature. It should be noted that what has been identified does not necessarily reflect the reality of universities, since there are reports of implementation of ITG initiatives that, due to not meeting the inclusion criteria contemplated for this work, were discarded, for example: Velásquez et al. [83], Gómez et al. [84] and Cordero [85].

However, there are essential issues regarding universities that have not been considered. This review demonstrates the lack of studies related to ITG and the essential functions of the university (research, technology transfer, university extension and teaching), which are necessary in improving the competitiveness of universities.

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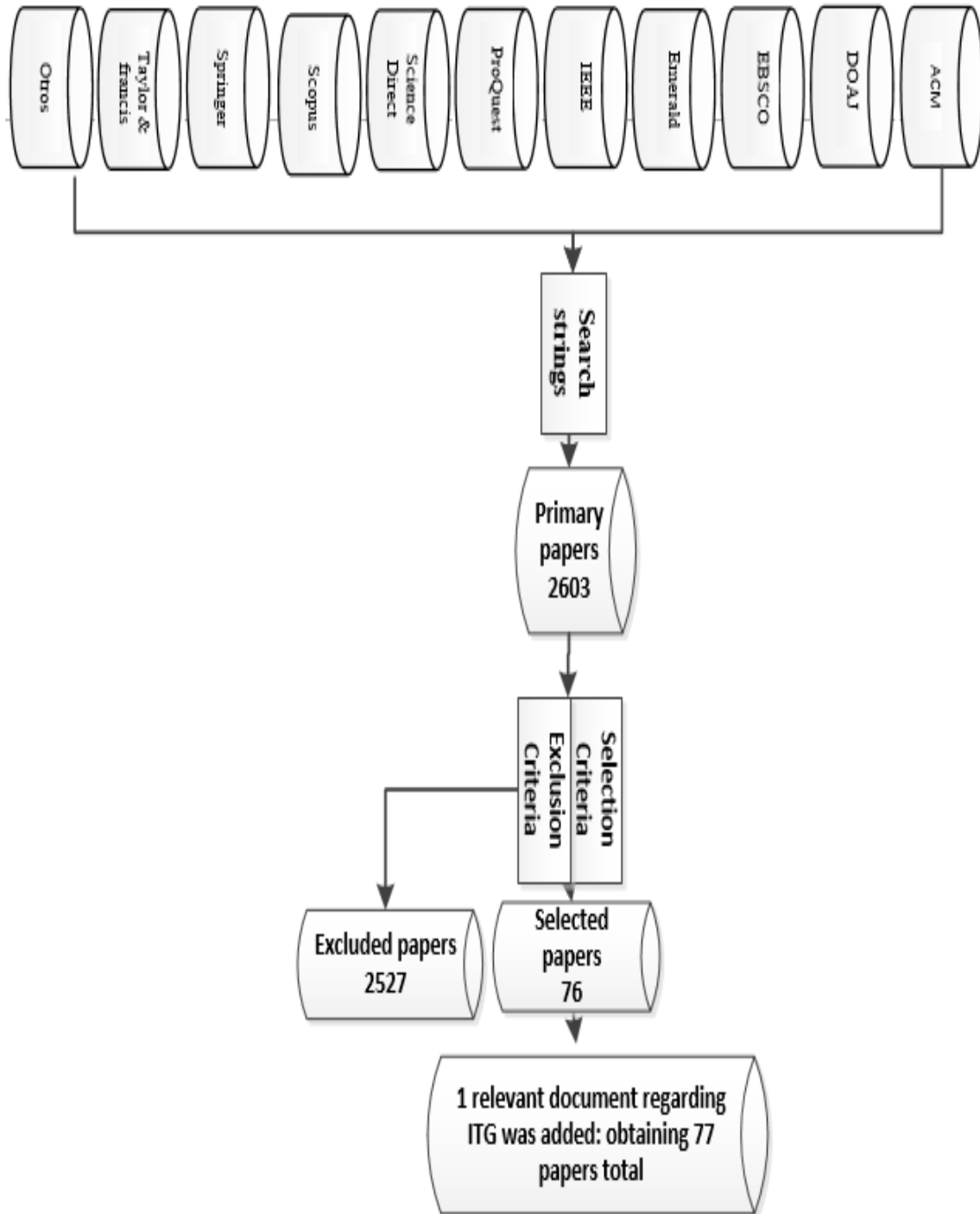
Figure 1. Applied process for conducting the Systematic Literature Review

Table 5. Query syntax

Source	Query syntax	Search result count
DOAJ	("IT Government" OR "IT Governance" OR "Information Technology governance" OR "Information Technology government" OR "Governance of IT" OR "Government of IT") AND ("university" OR "universities" OR "higher education" OR "college" OR "Education")	82
EBSCO	("IT Government" OR "IT Governance" OR "Information Technology governance" OR "Information Technology government" OR "Governance of IT" OR "Government of IT") AND ("university" OR "universities" "higher education" OR "college" OR "Education")	175
Emerald	("IT Government" OR "IT Governance" OR "Information Technology governance" OR "Information Technology government" OR "Governance of IT" OR "Government of IT") AND ("university" OR "universities" "higher education" OR "college" OR "Education")	93
IEEE	(("IT Government" OR "IT Governance" OR "Information Technology governance" OR "Information Technology government" OR "Governance of IT" OR "Government of IT") AND ("university" OR "universities" OR "higher education" OR "college" OR "Education"))	63
ProQuest	("IT Government" OR "IT Governance" OR "Information Technology governance" OR "Information Technology government" OR "Governance of IT" OR "Government of IT") AND ("university" OR "universities" OR "higher education" OR "college" OR "Education")	61
Science Direct	("IT Government" OR "IT Governance" OR "Information Technology governance" OR "Information Technology government" OR "Governance of IT" OR "Government of IT") AND ("university" OR "universities" OR "higher education" OR "college" OR "Education")	17
Scopus	("IT Government" OR "IT Governance" OR "Information Technology governance" OR "Information Technology government" OR "Governance of IT" OR "Government of IT") AND ("university" OR "universities" OR "higher education" OR "college" OR "Education")	147
Springer	(("IT Government" OR "IT Governance" OR "Information Technology governance" OR "Information Technology government" OR "Governance of IT" OR "Government of IT") AND ("university" OR "universities" OR "higher education" OR "college" OR "Education"))	188
Taylor & Francis	("IT Government" OR "IT Governance" OR "Information Technology governance" OR "Information Technology government" OR "Governance of IT" OR "Government of IT") AND ("university" OR "universities" OR "higher education" OR "college" OR "Education")	35
Web of Science	("IT Government" OR "IT Governance" OR "Information Technology governance" OR "Information Technology government" OR "Governance of IT" OR "Government of IT") AND ("university" OR "universities" OR "higher education" OR "college" OR "Education")	16
TOTAL		2603

Table 6. Inclusion and Exclusion Criteria

Inclusion criteria	Exclusion criteria
Peer-reviewed studies including journal articles, conference proceedings and book chapters.	Papers that do not relate to the research questions
Studies that focus on ITG in the university context	Duplicate papers (by title or by content)
Studies that respond to the research questions	Posters, editorials, letters, errata and theses

Table 7. Potentially eligible studies and selected studies

Source	Potentially eligible studies	Selected studies
ACM Digital Library	3	3
DOAJ	2	2
EBSCO	1	0
Emerald	4	4
IEEE	15	14
ProQuest		5
Science Direct	3	2
Scopus	29	24
Springer	14	13
Taylor & Francis	3	3
Web of Science	9	9
TOTAL	85	76

Table 8. Distribution of the documents by type and database

Source	Journal Articule	Conference Paper	Book Chapter	TOTAL
ACM Digital Library		3		3
DOAJ	1	1		2
EBSCO		0		0
Emerald		1	3	4
IEEE	1	13		14
Proquest				
Science Direct			2	2
Scopus	3			24
Springer	3	9		13
Taylor & Francis	3			3
Web of Science	8	1		9
Total	34	37	5	76
Percentage	45%	49%	7%	

Table 5. Advances in ITG

Area	Key Advances	Reference
Strategic Alignment	A new focus of IT Alignment through Actor-Network Theory	[13]
	Analyzed the alignment of Universities IT strategy and business strategy using IT BSC framework	[14]
	IS strategic plan for higher education institutions	[15]
Value Delivery	Model for IT services management	[17]
	Model for the communication of value provided by ITG	[32]
	Approval process of IT project portfolios	[18,19]
	Analysis of practices and standards of IT service management	[20]
	A framework to improve and enhance IT Services at universities	[21]
	Challenges in eliciting requirements to develop and establish IT services.	[22]
Resource Management	A strategic approach of IT governance for university information systems	[23]
	A maturity model for ISG	[24]
	An Information Security Model and Assessment Security Maturity	[25]
	Reference model of university IT architecture	[26]
Risk Management	Risk management evaluation model	[28]
	Risk mitigation model	[29]
Performance Measurement	Measurement of Green IT initiatives using BSC	[30]
	Analysis of ITG Absorptive Capacity and its influence on performance	[31]

Table 6. Studies on the implementation of ITG

Aspect	Advances	Reference
Structures	Perception of Structural Capability of IT	[34]
Processes	Perception of Process Capability of IT	[34]
	Process Capability Assessment model of IT Governance	[30]
	A conceptual model of ITG implementation that includes IT Infrastructure	[35]
	Method for IT Governance Based on Enterprise Modelling	[36]
Relational Mechanisms	Perception of Relational Capability of IT	[34]
	ITG mechanisms that higher education institutions have implemented	[37]
Obstacles and drivers of ITG Implementation	The obstacles of ITG implementation in Thai universities	[38]
	The drivers and barriers to pursuing formal ITG in Ghanaian Universities	[39]

Table 7. ITG Models proposed in the university context

Model	Reference
Information System Management and Governance ISMG Model	[47]
ITG4U Model	[46]
ITG Framework in Education	[48]
Green information technology governance model	[49]
Conceptual model of IT governance	[50]
IT governance framework for achieving the development of academic programs in higher education institutions	[51]

Table 8. Cases of ITG in Universities

University	Description	Reference
Higher Education in Australia	This study analyzed how central IS departments in four institutions of higher education in Australia are transforming organizational attitudes and approaches to governing IT by implementing structural and process changes and establishing relational mechanisms.	[54]
Australian Higher Education	This exploratory study examined and compared how ITG is implemented through a number of structures, processes, and relational mechanisms in two Australian HEIs, and how the adoption of industry best practice frameworks such as COBIT, ITIL and ISO17799 have been utilized in the implementation.	[54]
Australian Higher Education	This study examined how ITG was implemented in four Australian HEIs	[55]
Australian Higher Education	This paper analyzed how formal IT governance was implemented in two major Australian institutions of higher education.	[56]
High Public Portuguese Educational Institution	A case study of the implementation and use of COBIT for IT Governance in an Institution	[57]
Bucharest Academy of Economic Studies	This study presented the main aspects for developing and implementing actual phase in an information systems audit, to recognize the risks and establish the necessary measures to eliminate them	[58]
Australian university	This study explored the criteria of effective ITG processes employed in universities and their impact on the diffusion of appropriate technology to base level users	[59]
Thai Universities-Thailand	This study analyzed the status of ITG in Thai universities and ITG performance measures	[38]
Portuguese Private School	This study implemented ITIL and COBIT frameworks with the purpose of IT management and control	[60]
Satya Wacana Christian University, Salatiga	This study measured IT performance using COBIT framework version 4.1	[61]
Thai universities	The authors assessed the current situation and future improvement for IT governance and controls in a developing country like Thailand.	[62]
Australasian public university	This article examined how public university IT governance responds to the challenges of operational needs and the IT unit	[63]
Taiwan's college	This study investigated the maturity of ISG	[64]
Germany Universities	This author analyzed the current practices and standards in the areas of IT Service Management and IT Governance	[20]

Egypt Higher Education and Research Institutes	These authors reported on the state of ITG in one of the Egyptian research institutes as a case study that shows how ITG is being considered in Egypt Higher Education and Research Institutes.	[65]
Malaysian Public University	This study analyzed the evolution of IT Government and its application in the university context	[66]
Universiti Malaysia Sarawak (UNIMAS)	These authors validated the IT governance framework for achieving the development of academic programs in higher institutions	[51]
Higher Education sector in Sweden	This case study showed that the peer-to-peer principles, such as peer production, can offer more suitable governance over current EA frameworks as they are able to better match the decentralized components of the university's organizational structure.	[67]
Malaysia Public University	This study show how ITG is being implemented in the Malaysia Public University	[68]
Australian universities	This study determined which elements of decision making processes may be expected to lead to the successful identification and funding of projects that best maximize the overall contribution to the university mission.	[69]
Universitas Bina Darma	These authors analyzed the alignment of IT strategy and business strategy at their University	[14]
Universidad de Alicante and University of Salamanca	This study presented the common core between two subjects in two different universities in order to explain how to organize the service learning approach.	[70]
Thai university	This study developed a formal set of ITG practices based on sufficiency economy philosophy (SEP) to support the generic context for Thai universities.	[71]
Ghanaian Universities	These authors determined the status of IT governance in universities in a developing country, Ghana, and determining ITG maturity level	[39]
Zimbabwe Polytechnics	These authors analyzed the state of ITG in Zimbabwe Polytechnics	[72]
Universidad de Ghana	This study analysed maturity levels of ITG in universities in Ghana	[39]
Universidad de Alicante	This study evaluated the situation of Technological ecosystem maps for IT governance	[73]
Brazilian federal universities	This study analyzed of the strategic alignment of the strategic objectives of the universities.	[74]
Universitas Pendidikan	These authors analyzed the performance of ITG at UPI	[75]

Indonesia (UPI)		
Private High Education Institutions in Bogota	This study analyzed the current state of ITG in private HEIs in Bogotá, Colombia	[76]
Brazilian Higher Education Institutions	This study analyzed how the top managers of Brazilian public sector federal universities perceive risk management.	[77]
Portuguese HEIs	These authors studied the influence of personality traits of Chief Information Officers (CIO) on the type of strategy adopted by Higher Education	[78]
Higher education institutions (HEIs) in Brunei Darussalam-Asia	These authors evaluated and highlighted the performance of achieving IT Governance using a performance measuring COBIT framework	[79]
Federal Rural University of Pernambuco (UFRPE)-Brazil	These authors studied how to guarantee that planning IT solutions by federal public organizations legally conformed to IN 04/2014	[80]