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Governing IT in HEIs: Systematic Mapping Review

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Abstract

Background: Higher Education Institutions (HEIs) are aware of the immense importance of achieving their strategic objectives to increase their impact on the society and to be competitive. As a board responsibility, information technology governance (ITG) plays an important role in the overall HEIs performance. Numerous HEIs are making great efforts to properly govern information technology (IT) by using ITG frameworks. **Objectives:** This study investigates the overall adoption of ITG frameworks in different HEIs through a systematic mapping review. **Method:** We analyzed forty relevant papers, filtered from 6 selected online libraries, and answered six research questions on ITG implementations at universities worldwide. **Results:** The results show an increasing number of publications on ITG usage in HEIs in the last decade. The largest number of applications is described in Asian countries, while the most popular used frameworks are COBIT, ISO versions, and in-house developed frameworks. Finally, we describe the top challenges and benefits of ITG implementation mentioned in research papers. **Conclusion:** This paper provides a deep insight into the level of integration of ITG in universities worldwide. The results will be presented to the involved stakeholders at our university to increase the awareness of ITG in HEIs and help its implementation process.

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Introduction

With the rapid evolution of Information Technology (IT), today's organizations are using technology in increasing the number of services, so they can assure their competitiveness and survival. Leveraging IT is becoming a guarantee for numerous benefits like the organization's good performance, efficiency, quality of service, improved risk management, increased customer satisfaction, etc. (Ribeiro & Gomes, 2009; Tjong et al., 2017).

Along with the use of IT, many issues regarding its planning, budgeting or controlling, arise, asking for detailed attention and caution from the authorities of an organization. This situation presented the concept of ITG.

Weill and Ross (2004, p.4) describe ITG as "specifying the decision rights and accountability framework to encourage desirable behaviour in using IT". ITG serves as a guide for the proper alignment of IT actions and performance goals. It also increases the level of accountability for actions and results in the IT area, by making clear the responsibilities of each of the actors involved.

According to Weill and Ross (2004), organizations can achieve 20% higher profits if ITG is applied effectively. However, they also point out that there is no single formula on how to implement ITG. Top-performing enterprises, on purpose, spend time to carefully design effective ITG under strategic alignment (Haes & Grembergen, 2010)

Most of the publications discuss the adoption of ITG in business but not in universities. Generally, and despite the recent efforts, there is a lack of research papers regarding ITG on HEIs. According to Tjong et al. (2017), only 17% of the revised studies considered HEIs as the object of their research.

Although there are several systematic literature reviews on ITG (Khouja et al., 2018; Tjong et al., 2017; Yudatama et al., 2017), there is a lack of systematic mapping reviews on ITG issues for universities. Our study aims to help to fill the knowledge gap about ITG adoption at Universities worldwide, choosing a systematic mapping review as a research method.

For our review, we have systematically selected 40 relevant papers and raised six research questions. By these research questions, we would like to reveal: (i) the research interest on the topic in the last decade; (ii) the involved countries in applying ITG on HEIs; (iii) the features of HEIs that have implemented an ITG framework; (iv) the most popular ITG frameworks in HEIs; (v) the reported challenges and benefits of using ITG at universities, and (vi) the most used ITG frameworks and their confusion with IT management framework.

We believe this paper will be useful for all stakeholders in ITG for HEIs to guide them towards the adoption of the best practices and supporting the learning from errors reported by other actors.

This research paper contains five sections as follows. The second section describes the state of the art of ITG for HEIs. The third section defines the methodology we have used to conduct our research, including the search terms, online databases, research questions and the systematic mapping process. In the fourth section, the obtained research results and findings are presented. Finally, conclusions are described and discussed in the last section.

Background

ITG has been explored according to different conflicting definitions since the late 90s. The importance of the topic could be the root of this panoply of definitions (Juiz et al., 2019) giving the increasing set of sectors and activities adopting ITG (Dzombeta et al., 2014). Currently, these definitions are converging to a more consolidated standard:

ITG is the process of directing and controlling from a business perspective the use of IT (Juiz & Toomey, 2015). The aim of IT governance mechanisms is to enhance business/IT alignment with an increased level of IT governance performance.

The earliest research report on ITG belongs to the beginning of this millennium (Van Grembergen et al., 2004). Other research papers emphasize the use of ITG as important for Small and Medium Enterprise, and larger organizations, to increase the performance of the organization (Tjong et al., 2017; Huygh & De Haes, 2020).

Few of the well-known ITG frameworks worthy to be mentioned are ISO/IEC 17799, ISO/IEC 38500, COBIT, etc. The famous nonprofit association, Educause, published in 2008 a reference to COBIT, ITIL and ISO 17799, and their impact on business benefits (Yanosky & Caruso, 2008). ITIL (Information Technology Infrastructure Library) promotes best practices on process management, while ISO 17799 tends to achieve the British Standard for IT Service Management regarding security and protection processes. COBIT, on the other hand, provides IT governance guidance. Composed of 34 high-level control objectives, it ensures an adequate control system for the IT environment. COBIT is used widely in many financial institutions like banking, insurance, audit, risk and security, and others (Vugec et al., 2017).

Although ITG emerged from corporate governance, HEIs are considered a special type of organization in need of IT to support teaching, learning and research activities (Coen & Kelly, 2007). A HEI can be considered as an organization that governs academics for running education as its main business. Certainly, different mechanisms enhance ITG effectiveness in a HEI. The ITG structure type directly impacts the ITG success. The federal structure is claimed to be the most favourable arrangement for ITG in HEIs (Bianchi et al., 2017).

Several ITG frameworks have been proposed and applied by HEIs to improve their overall efficiency. The objectives of these ITG frameworks are to provide guiding principles for directors to efficiently direct and control the use of IT within their organizations. ITG frameworks support the governance of IT regardless of their size or strategy, thus the use of ITG frameworks from the top is strongly advised to generate business value from investment (Juiz & Toomey, 2015).

Apart from the international standards used in IT governance in general, there are a few standards on ITG used specifically by certain countries. As such, Australia universities have applied AS 8015-2005 standard for ITG decision making (Bhattacharjya & Chang, 2006). In the UK, the Joint Information Systems Committee (JISC) Institution has developed its own ITG framework (Coen & Kelly, 2007). ISO/IEC 38500 was first developed and implemented by Spanish Universities (Gómez et al, 2018). Several ITG frameworks implemented in HEIs will be discussed more in details at Research Question 3.

The rest of the paper shows our research and its results-focused on papers related to ITG in HEIs worldwide.

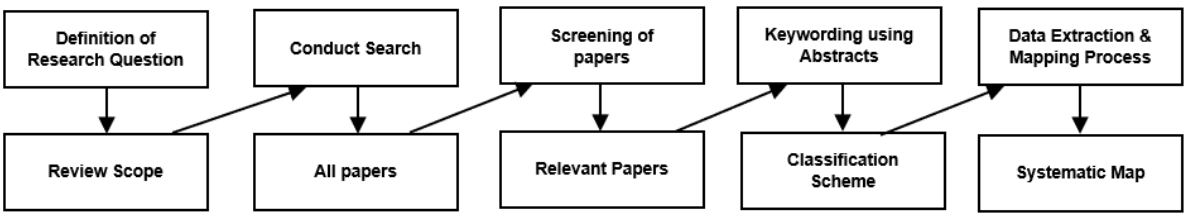
Methodology

Systematic Mapping review methodology

A Systematic Mapping is a research methodology frequently applied to summarize research findings in social sciences and medical studies, which has also drawn interest and awareness in other research disciplines. This methodology aims to classify research publications through visual synopsis (Petersen et al., 2008). The main goal of a systematic mapping is to structure a research area by searching, selecting, analyzing and presenting a thorough overview of the research findings. Figure 1 shows the essential process steps based in (Petersen et al., 2008; 2015).

A Systematic Mapping supports different stakeholders by making evidence of knowledge gaps, research redundancy and by suggesting improvements or best practices (Haddaway et al., 2016). In this paper, we applied a systematic mapping to structure the area of ITG in HEIs. We analyzed the results based on the frequencies and coverage (geographically and thematically) of the selected publications.

Figure 1
The essential process steps of systematic mapping



Source: Petersen et al. (2008)

Research questions

To accomplish the goals of our systematic mapping, we raised the following research questions:

- RQ1: What is the evolution of the interest in ITG in HEIs in the last decade?
- RQ2: What is the geographical coverage of ITG effects (in terms of countries and continents)?
- RQ3: What are the reported ITG frameworks used by HEIs?
- RQ4: What IT management frameworks have been reported as ITG frameworks by HEIs?
- RQ5: What are the main features of ITG adopters? (University size, lifespan, public/private, maturity level, etc.)• RQ6: What are the reported challenges and benefits of ITG frameworks? Searching Strategy

The search strategy is composed of three phases: search string generation, online libraries definition, and search process in all databases, as illustrated by Figure 2.

Search string

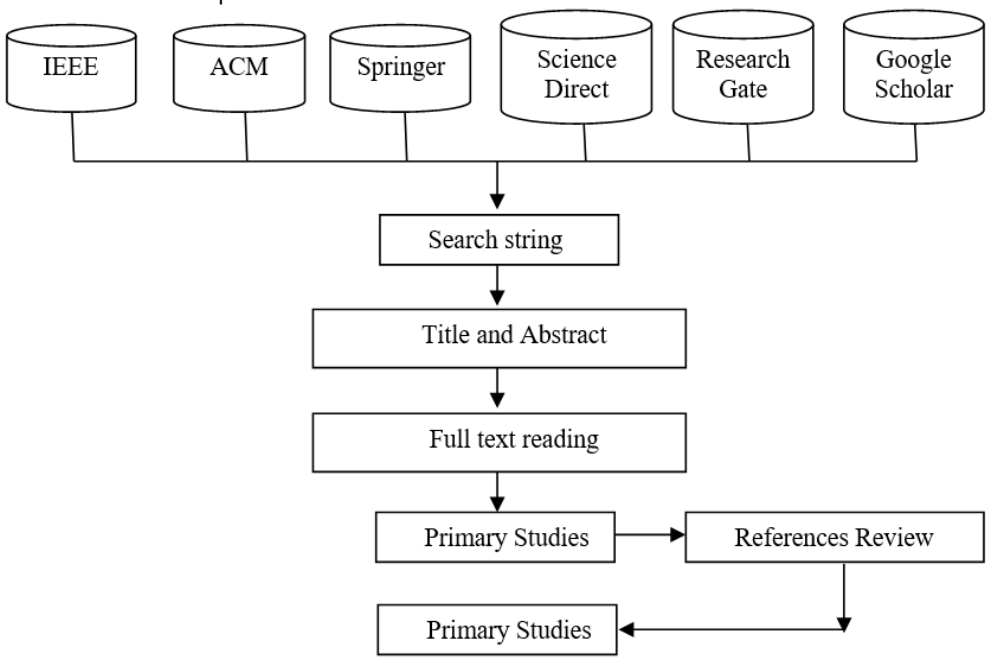
The search string we composed, made of keywords and Boolean operators, is as follows: ("IT Governance" OR "Information Technology Governance" OR "ICT Governance") AND ("higher education" OR "university" OR "universities"). This initial search string was adapted to work in different databases: IEEE Digital Library, ACM Digital Library, SpringerLink, ScienceDirect, ResearchGate, and Google Scholar. This set of sources was chosen given that they are among the most relevant sources of information in the computing field. Grey literature was covered by the use of Google Scholar. Zotero reference manager was used to store studies and to avoid duplications.

Search process

Our systematic mapping review was conducted as follows. First, we adapted and executed the search string in 6 selected online libraries. Second, we reviewed the list of publications by title and abstract to estimate if they are relevant to the topic. We have prioritized the order of indexing so that: if the paper wasn't found in any of the first 5 databases and was found in Google Scholar, we put it in the latter category. Afterwards, we conducted a full-text review, which generated a set of primary studies. Fourth, we reviewed the primary studies to find any other related paper referred to.

A set of inclusion and exclusion criteria were established to eliminate studies considered not relevant to the set of research questions defined previously.

Figure 2
Studies selection process



Source: Bisant and Lyle (1989)

The exclusion criteria were defined as follows: (i) the paper refers totally to IT management (no ITG is mentioned), (ii) the ITG framework is not implemented in HEIs but in a company/organization, (iii) the paper doesn't provide information on any of these fields: the ITG framework used or studied, maturity level, or university where the study was conducted, (iv) the paper is not a research paper, so we exclude books, dissertations, private reports.

The data that we extracted from each paper was documented and organized as follows: the paper title, year of publication, source (one of the 6 databases), country where the study is performed, the framework they are studying, maturity level, if reported, if a specific university where the study is conducted is mentioned, we gathered its name, the size, the year of foundation, and if it is a public or private HEI, and challenges and benefits from ITG framework implementation. Once this information was collected, we answered the research questions defined earlier.

Search execution

We searched the databases in early 2019. The initial search included 74 papers. After reading the title and abstract, we excluded duplicated papers and applied exclusion criteria for a set of 65 papers.

Among the papers excluded, there are reports from the University of Waikato, New Zealand, Texas A&M University, USA, and Guelph University, Canada given that they are not meeting the requirements defined in the previous section. Out of the remaining 65 papers, after reading the full content, we excluded 21, as the content was not directly related to our research. Finally, 4 of the papers in the final set were literature reviews, not giving specific answers to our research questions, so a total of 40 papers is the final collection of primary studies. The overall result, showing the number of papers per database, is given in Table 1.

Table 1
Extracted Papers per Database

Database	Number of papers
IEEE	10
ACM	2
Springer	5
Science Direct	1
Research Gate	11
Google Scholar	11
Total papers	40

Source: Authors' work

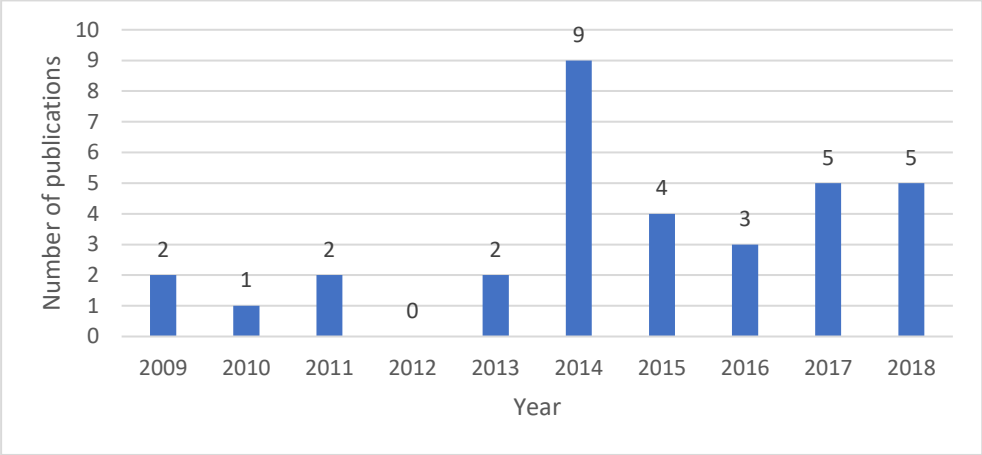
Results and Findings

RQ1: What is the interest evolution in ITG in HEIs in the last decade?

The oldest published paper out of 40 selected papers appeared back in 2003. This paper reports a case at Queensland University, Australia (Fraser & Tweedale, 2003). In total, there are seven papers which are published before 2009. During the last decade, 2009 – 2018, we found a total of 33 papers.

Figure 3 shows the number of publications per year in the last decade. In 2012 there were no papers published about the topic. In contrast, the highest number of papers is produced in 2014 with 9 papers. As the graph shows, the interest in the topic has been increased during the second part of the decade nearly 4 times compared to the first part. The average number of publications during the whole decade is 3.3 papers per year. Out of 33 papers, approximately 75% of them are written during the last 5 years. This indicates the increasing popularity of the ITG topic in HEIs as a field of study.

Figure 3
Number of Publications on ITG per Year in the Last Decade



Source: Authors' work

RQ2: What is the geographical coverage of ITG effects?

This section highlights the participation of the countries worldwide in implementing or studying ITG at their University, by producing a paper with results. We have shown this indicator on the country and continental level.

Table 2 shows the number of countries and the number of papers for each continent. The lead is held by Asia while the continent less involved in the topic is North America.

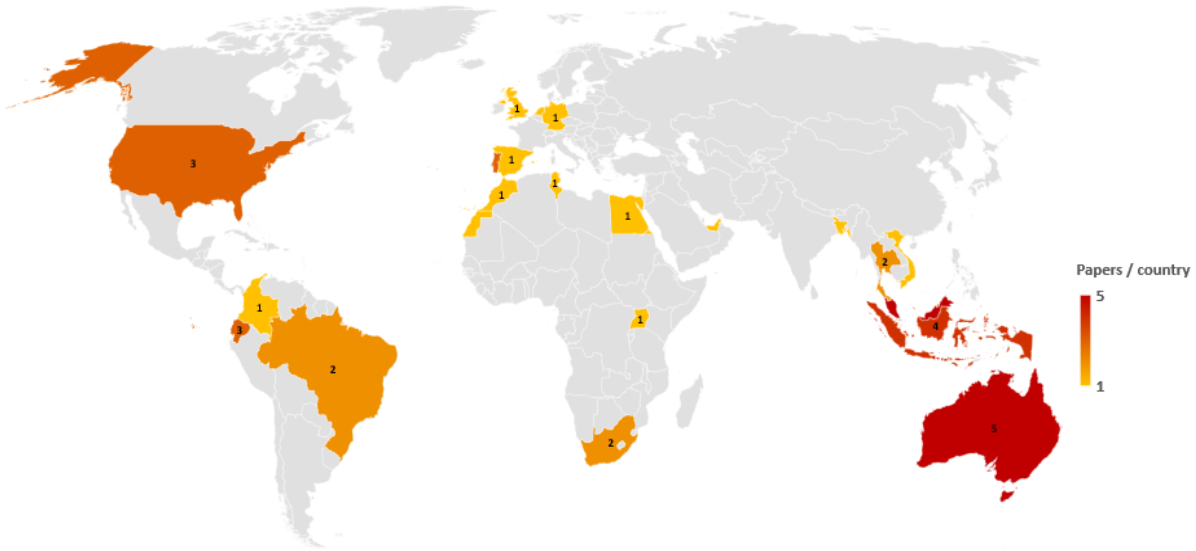
Table 2
Number of Countries and Number of Papers on ITG per Continent

Continent	No. of countries	No. of papers
Asia	8	16
Europe	5	7
Africa	5	6
South America	3	6
Australia	1	5
North America	1	3

Source: Authors' work

Figure 4 illustrates that the countries with the highest number of publications are Australia and Malaysia with 5 papers each, followed by Indonesia with 4 papers. There is a total of 23 countries writing on ITG in HEI's. As the colour varies from yellow to red, the number of papers per country varies from 1 to 5. Table 3 shows the number of papers per continent by a pie graph.

Figure 4
Heat Map Illustration for the Number of Publications per Country in 23 Countries Worldwide, on a scale from 1 to 5



Source: Authors' work

Table 3
Distribution of ITG in HEI's Publications through Continents (in Number of Papers)

Continent	Total number of papers
Asia	16
Europe	7
South America	6
Africa	6
Australia	5
North America	3

Source: Authors' work

RQ3: What are the reported ITG frameworks?

Universities have adopted different frameworks to govern IT within their institutions (Table 4). We noticed from the papers that the adoption of ITG frameworks in HEIs needs further and considerable improvement. Some universities are still evaluating their ITG maturity level to propose an appropriate ITG framework. Other universities are facing challenges in proposing or implementing ITG framework.

Part of the papers on ITG concluded their results based on surveys conducted on different levels. The study of Seyal et al. (2017) elaborates on data obtained from interviews of the directors of ICT centres to four universities in Brunei. COBIT framework was used to evaluate various IT processes. Jairak and Praneetpolgrang (2011) performed a survey of 117 Thai universities, while Sadikin et al. (2014) performed a self-assessment of the Mercu Buana University based on COBIT 4.1 framework. The same framework was used to measure the maturity level of 30 private universities in Pontianak, Indonesia (Kosasi et al., 2017). A web-based CIO and executive survey regarding ITG was conducted in the United States and Canada universities (Yanosky & Caruso, 2008). Johl et al. (2014) seek to explore the presence of ITG in HEIs in South Africa through a detailed analysis of cooperative governance and inter-institutional cooperative governance. At last, promising steps towards ITG development are undertaken after research in a single but large Australian university (Hicks et al., 2010), where key personnel were interviewed, serious shortcomings on ITG were identified and new initiatives were implemented.

Table 4

Number of Papers per Category: Evaluation or Implementation of ITG

	No. of Papers
Universities evaluate their ITG status	6
Universities implement/propose FWs for ITG	34

Source: Authors' work

As shown in Table 5, COBIT is the most popular ITG framework that universities have adopted or had plans to adopt in the future. As such, COBIT is mentioned as a new ITG framework fully implemented in South Louisiana Community College, USA (Council, 2006) and a framework serving as a standard to measure the maturity level of Integrated ITG framework in Indonesia (Kosasi et al., 2017) and Brunei (Seyal et al., 2017). Another use of COBIT was found at a University in Morocco for the implementation of multi-criteria decision-making platform for prioritizing projects at universities (Ahriz et al., 2018).

Many universities find it more appropriate to govern IT in their way. For instance, Tunisian Universities adopted an ITG framework based on ISO/IEC 38500, taking into account their actual situation and the expected maturity level (Gómez et al., 2018). Likewise, in Thailand, they adopted an integrated framework which uses modules from ISO38500 combined with SEP (Sufficiency Economy Philosophy) (Jairak et al., 2015), whereas, Brazil and Portugal (Bianchi & Sousa, 2015) preferred to combine modules from COBIT and ITIL to simultaneously govern and manage IT. An earlier implementation of ITG is reported by Syracuse University in New York (Clark, 2005) by modifying Weill's framework to fit their institution needs.

Table 5
Number of Papers per Framework Used

Documented ITG framework	No. of papers/ universities
ISO	3
COBIT	11
Integrated ITG framework	7
Their own	14
No ITG framework	6

Source: Authors' work

RQ4: What IT management frameworks have been reported as ITG frameworks for HEIs?

We noticed that several universities report IT management (ITM) frameworks as ITG frameworks, that is shown in Table 6.

Table 6
ITG versus ITM Exploration

	No. of papers
Claim to explore only ITG framework	35
Claim to explore ITG + ITM framework	5
ITM framework reported as ITG framework	4

Source: Authors' work

Table 7 shows the list of universities that misinterpret the adoption if IT management frameworks. It is worth mentioning that some of the papers claiming to explore ITG frameworks in some universities, in reality, explore the actual situation of ITG in these universities without discussing a concrete ITG implementation. This is the case of a university in Ecuador (Cajo et al., 2017) where IT is considered more an operational utility than a strategic entity, thus resulting in a lack of ITG. A similar approach is seen in a study conducted in HEIs in Malaysia (Kaur et al., 2011) which attempted to identify the mechanisms for effective ITG but no ITG framework is reported. Furthermore, another paper (Islami et al., 2014) discusses the alignment of the university existing structure with a prototype based on COBIT 4.1 and CISR (Certified Insurance Service Representative). CISR is also used as a base model for ITG for the research conducted to three private HEI's in Bogota, Colombia (Perea et al., 2017). Because of the study, the lack of knowledge on ITG was emphasized and the importance of IT as a key resource of the organization was acknowledged. We want to underline that, this confusion is quite common also in industry. These relevant papers reveal the lack of knowledge in the topic by few researchers.

Table 7
A Short Description for ITG and ITM Confused Papers

Country	Publication year	Description
Thailand	2011	Partially implemented COBIT, ITIL, ISO/IEC 27001, COSO (Jairak & Praneetpolgrang, 2011)
United Arab Emirates (Abu Dhabi)	2013	Proposed theoretical Framework: COBIT + Six Sigma (Ajami & Al-Qirim, 2013)
USA	2008	EDUCAUSE report: COBIT or ITIL or ISO 17799 and ISO 9000 (Yanosky & Caruso, 2008)
Vietnam	2014	Claims to implement its ITG but it is ITM (Le et al., 2014)

Source: Authors' work

RQ5: What are the main features (University size, lifespan, public/private, maturity level, etc.) of ITG adopters?

After reading all the selected papers needed to process our RQs, we have extracted specific Universities information. The metrics we have collected for each mentioned HEI are the number of students, the lifespan based on the year it was founded, if the HEI is public or private, and the maturity level (if mentioned). Within 40 papers, there are 15 specific Universities mentioned where the study has been conducted or the framework has been applied. They represent 10 different countries worldwide. The majority of the HEI's are public (11), while just four of them are private. Regarding the utilized frameworks, six of the identified universities report to have used COBIT, 7 have implemented its framework, and two Universities have applied an integrated framework, by using different frameworks to handle different processes of ITG.

The data we found regarding University size and lifespan is presented in Table 8. The University size varied from 5000 to 60000 students, and the lifespan from 4 centuries up to 16 years old. Regarding the question, if there is any relation between the size or lifespan and the type of ITG framework used, we did not find any valid correlation. The universities that have applied COBIT vary in size from 5000 students at the Viana De Castelo Polytechnic Institute, Portugal (Ribeiro & Gomes, 2009) to 58000 students at the Curtin University of Technology, Australia (Khther & Othman, 2013). Those universities that have implemented its framework vary from 5,500 students at the Independent University Bangladesh (Dey & Sobhan, 2007) to 60,000 students at the University of Pretoria, South Africa (Petrorius, 2006) and Ho Chi Minh City Open University, Vietnam (Le et al., 2014) to 58,000, and those that have implemented its framework vary from 5,000 to 60,000. Equally, the university foundation year varies from 1651, Central University of Ecuador (Valverde-Alulema & Llorens-Largo, 2016) to 1997, South Louisiana Community College, USA (Council, 2006) for COBIT- using universities; and from 1870, Syracuse University, USA (Clark, 2005) to 2003, Gulf University, Bahrain (Sahraoui, 2009).

Table 8
Features' Aspects of Universities that Has Adopted ITG Frameworks

	University Size	University Foundation Year
Min	5000	1651
Max	60000	2003

Source: Authors' work

The maturity level is defined on a scale from 1 to 5 with regards to their ITG processes. Out of 40 papers, only five of them have reported a measured maturity level. According to the survey conducted to four HEIs' CIOs in Brunei, the level of maturity is evaluated from 1.4 to 1.72, which indicates initial phases of ITG (Seyal et al., 2017). The situation in Spain, as of 2008, shows a maturity level of 1.44, before implementing any ITG framework (Fernández & Llorens, 2009). The results of the USA universities survey, which got replies from 438 respondents, shows a maturity level of 2.51(Yanosky & Caruso, 2008). A better level is measured in Indonesia, with an average of 3.25 on 30 private HEIs (Kosasi et al., 2017). Finally, Abu Dhabi Universities have reported the level of maturity of 2.5 to 3 for two Institutions A and B (Ajami & Al-Qirim, 2013).

RQ6: What are the reported challenges and benefits of ITG frameworks?

Many Universities have acknowledged the need for an ITG framework to enhance the quality of education and increase the overall performance. Although some of them have achieved and reported the improvements, several difficulties have been met during the implementation of the ITG frameworks. At times, these barriers have slowed down the process, even to the point of having fully stopped the implementation process. The organization's culture too is an influencing factor on the success of the ITG implementation, presented by the study of Stockholm University (Aasi et al., 2017). By detailed reading, we extracted the challenges and benefits mentioned in each of the papers. Afterwards, we sorted them in descending order based on the number of papers they are mentioned.

Specific challenges and/or benefits are reported in 17 papers of the set of studies, presented in Table 9.

Table 9
Challenges and benefits reported in 17 papers

Challenges	No. of papers mentioned	References
Resistance to change (difficulties to break the traditional thinking)	5	(Ajami & Al-Qirim, 2013; Bhattacharjya & Chang, 2009; Hotzel et al., 2016; Jairak & Praneetpolgrang, 2011; Sahraoui, 2009)
Communication problems among all parties involved	5	(Ajayi & Hussin, 2016; Bhattacharjya & Chang, 2009; El-Morshedy, et al., 2014; Fraser & Tweedale, 2003; Nyeko et al., 2018)
Budget constraints	4	(Ajami & Al-Qirim, 2013; Council, 2006; El-Morshedy et al., 2014; Jairak & Praneetpolgrang, 2011)
Lack of knowledge/clarity on ITG principles, and need for continuous training	3	(Ajayi & Hussin, 2016; Jyotirmoyee et al., 2009; Jairak & Praneetpolgrang, 2011)
Lack of organizational vision for IT	3	(El-Morshedy et al., 2014; Fraser & Tweedale, 2003; Sahraoui, 2009)
The very low maturity level on ITG	3	(El-Morshedy et al., 2014; Kosasi et al., 2017; Sahraoui, 2009)
Lack of human resources in terms of delays, size, or knowledge	3	(Ajami & Al-Qirim, 2013; Jyotirmoyee et al., 2009; Council, 2006)
Finding appropriate IT performance metrics.	2	(Bhattacharjya & Chang, 2007; Bhattacharjya & Chang, 2009)
Culture	2	(Bhattacharjya & Chang, 2009; Nyeko et al., 2018)
Existing ITG frameworks are not appropriate with university context	2	(Jairak & Praneetpolgrang, 2011; Montenegro & Flores, 2016)

Source: Authors' work

The most often reported challenges when implementing ITG are resistance to change and communication issues among parties (found in 5 papers). These are followed by budget limitations, lack of knowledge/training for ITG principles, and lack of vision for IT. Meanwhile, the most commonly reported benefits for using ITG are

improved quality of service and user satisfaction (mentioned in 4 papers), along with better alignment in IT planning and management with University and/or business goals. According to the literature review (Tjong et al., 2017), generally, it is accepted from authors that using ITG improves the overall performance and conformance to the regulations. Besides, there is not much difference, in terms of the benefits of implementing ITG, between industry and HEI.

Discussion and conclusions

In this paper, we conducted a systematic mapping review to observe the current situation of research on ITG frameworks in HEIs. To achieve this goal, we formulated 6 RQs. To answer these questions, we executed a search within multiple scientific databases, returning 40 primary studies. Because of the RQ1 results, we can state that the research interest in the last 5 years has been increased nearly 4 times compared to 5 earlier years. These results are also supported by review papers. The authors of (Oñate-Andino et al., 2019) cite similar results as well. The same steady growth is seen for ITG in other areas than universities. However, the number of publications regarding ITG in universities for the year 2014 represents only 3% of the total amount of papers on ITG for the same year. This conclusion addresses the need for a greater interest in implementing and publishing of ITG in HEIs.

The geographical distribution of these research papers is mainly concentrated in Australia, Malaysia and Indonesia according to the number of papers in the topic reporting cases in these countries. This is mainly identified to be due to the present culture of ITG and support and vision from top-level authorities.

COBIT and Ad-Hoc frameworks are the most common ITG frameworks used over all the countries. ITIL and ISO 17799 along with ISO 9000 are also popular frameworks used for ITM, sometimes mixing the concept of ITG and ITM. Therefore, four of the forty selected papers have confused the terminology used for ITG with ITM, which prompts the need for better clarity of ITG, in terms of training and publications.

Regarding the connection between the size or lifespan of the HEI and the type of ITG framework used, we did not find any valid correlation.

Finally, we also provide a list of challenges and benefits of using ITG in HEI's as described in 17 papers. The most common reported benefits for using ITG are improved quality of service and user satisfaction, along with the better alignment of IT planning and management with University and/or business goals. Meanwhile, the most reported challenges when implementing an ITG framework are resistance to change and communication issues among parties.

This paper showed the importance of using ITG in HEIs worldwide, especially in the last few years. Taking the needed time to design, implement, and communicate ITG is worth it, despite the challenges. HEIs can exploit the same benefits from using ITG, as companies or other organizations do.

Furthermore, it is of great importance to identify the maturity level of HEIs and elaborate afterwards the steps to implement an ITG framework, which suits best to the HEIs needs and objectives.

We also have to mention the limitations of our study. First, we chose only research papers and not white papers, book chapters or reports as the primary set of research. Therefore, we disregarded a few countries and Universities from our list. Secondly, only 15 of the research papers stated the University where ITG was implemented, the others were anonymous. So, the answer for RQ5 was based on a limited amount of data.

As future work, we aim to advance in the development of a framework to measure ITG maturity level and suggest actions to reach the needed maturity model. Given that literature presents a good number of such frameworks, we are willing to develop

a way to measure ITG maturity level utilizing a set of semi-automatic assessment. To achieve this, natural language processing will be used to analyze governance documents to elicit aspects supporting ITG (Chief Information Officer Role, committees, decisions).

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