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Information technology governance in the government public sector: a systematic mapping of the scientific production

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Abstract: The greater technological dependence and the increase of investments made in information technology (IT) by organisations in the public sector are some of the factors that have contributed considerably to the implementation of IT governance (ITG) in these organisations, which seek to offer better services and increase their public value. So, based on a systematic literature review, we aimed to map the research carried out on ITG in the government public sector. A total of 48 articles published in the Scopus and Web of Science databases comprise this study's portfolio. The results showed that the topic has gained relevance, especially in recent years, evidencing it as a research area in development and with opportunities for application in different organisations linked to the public area. Four themes stood out in the analysed studies: ITG mechanisms, critical success factors, ITG models, and ITG focus areas. In addition, we provide information to guide a future research agenda on ITG in the public sector, thus expanding the existing body of knowledge on the topic.

Keywords: IT governance; ITG; public sector; systematic mapping; government.

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1 Introduction

Organisations from different sectors of the economy (industry, commerce, services, and even the government) have relied heavily on information technology (IT) to carry out much of their operations (Lunardi et al., 2014; Meirelles, 2019). This greater technological dependence – whether since IT is used as an operational support tool and, more recently, as a tool to support organisational strategies and objectives – has shown the need to treat IT more broadly, not limited to its management, but also thinking about its governance processes (Ajayi and Hussin, 2016). In this sense, the implementation of IT governance (ITG) has become a critical element for the success of many organisations around the world (Oñate-Andino and Mauricio, 2019), being pointed out by technology managers as one of the most time-consuming activities (Kappelman et al., 2019).

In the government public sector, more specifically, the need for an effective ITG has greatly intensified in recent years, because governments have started to make high investments in technology, aiming to modernise the public administration and offer better services to society (Marzullo and Souza, 2009; Mendonça et al., 2013; Pang, 2014). Issues such as performance, transparency, and efficiency have become essential aspects for many government organisations, thus requiring the transformation of their management style – shifting from a strictly internal and bureaucratic focus to a more external focus, concerned with the citizens' needs (Campbell et al., 2010; Luciano and Macadar, 2016; Pang, 2014). In this scenario, ensuring transparency, efficiency in investments, and accountability are fundamental principles in the current state of the public sector, especially since many of its services have been made available using different and innovative technologies.

The purpose of ITG, whether in public or private organisations, is to play a strategic role, since it addresses the decision-making process concerning the investments made in technology, the prioritisation of projects, and the definition of IT strategies focused on corporate objectives (Amali and Katili, 2018). Considering the current context in which government institutions find themselves, increasingly dependent on technology to carry out their activities and organisational processes which consequently has required greater investments, having an efficient ITG contributes to offering better services to citizens and increasing public value (Tonelli et al., 2017).

The importance of ITG for organisations has called the attention of several researchers to the development of studies in this area. However, some authors recognise that studies applied to the public area are still scarce compared to research in the private sector (Al-Farsi and Haddadeh, 2015; Laita and Belaissaoui, 2017; Pang, 2014). Tonelli et al. (2017) state that it is difficult to generalise findings about the effects of ITG in

private organisations to public organisations, since the public sector considers different aspects of private companies, such as transparency and the focus on improving public services – in contrast, to increase profits. Lunardi et al. (2017) also point out one of the possible causes of the lack of a consistent and established body of research on ITG, which also impacts the government area.

In this sense, this paper presents a systematic mapping of the literature on the theme of ITG in the government public sector, aiming to identify aspects that may contribute to a better understanding of the evolution of studies in the IT area in public organisations. To achieve this objective, we sought to answer the following questions:

1 What are the characteristics of research on ITG in the government public sector?

2 What topics are addressed in research on ITG in the government public sector?

The paper is structured as follows: in Section 2, a review of the literature on ITG in the government public sector is presented; Section 3 describes the methodology used in this study; Section 4 highlights the methodological procedures followed in the development of the systematic review; in Section 5, the main results of the study are presented, while in Section 6, a brief discussion of the obtained results is presented. Finally, in Section 7 are the final research considerations.

2 ITG in the government public sector

The development of new technological solutions, the increase in the data volume, and the greater reliance on computerised environments for the performance of operational transactions are some of the factors that have contributed considerably to changing the perspective of IT use by organisations, especially for those that seek to improve their performance through better use of technology (Al-Farsi and Haddadeh, 2015; Almeida and Souza, 2019; Mascarenhas Sirqueira et al., 2018; Mendonça et al., 2013; Valencia et al., 2018).

In this new scenario, IT has come to be considered a strategic factor for organisations, requiring a closer relationship between business and IT units, and consequently the need to think about broader ways of directing and managing technology to meet the expectations of different stakeholders. Therefore, to meet this reality, several organisations have started implementing ITG processes in their organisational environments (Almeida and Souza, 2019; Wiedenhöft et al., 2020). According to Alreemy et al. (2016), ITG is a process that directs and controls factors such as resources, decisions, investments, and practices related to the technological area, in order to ensure that IT meets organisational objectives. Therefore, it can be said that ITG assists top management in the efficient management of its human and technological resources, aiming to provide the best results about its services efficiently and transparently (Veerankutty et al., 2018).

In public administration, ITG assists managers in defining factors that determine the best way to govern, control, and put their technology into operation, meeting the fundamentals of good governance through transparency, accountability, and efficiency in IT assets, that is, guaranteeing that IT is effective in carrying out organisational activities and providing the citizens with better public services (Al-Farsi and Haddadeh, 2015; Tonelli et al., 2017; Valencia et al., 2018). Furthermore, the ITG structure in the public

sector must ensure that investments and the implementation of technologies by business areas are aligned with long-term organisational objectives and strategies to ensure the increase of public value and the best performance for the organisation (Amali et al., 2014; Pang, 2014).

In this sense, it should be pointed out that for putting the ITG into operation in the organisational environment, it is essential to implement mechanisms that should, for example:

1 guarantee the continuity of IT services against interruptions and failures

2 enable the alignment of the IT to regulatory frameworks

3 determine the responsibilities of IT related decisions, to align technologies to the organisation's objectives and goals (Campbell et al., 2010; Laita and Belaissaoui, 2017).

In this way, ITG contributes to the achievement of several benefits for public organisations, such as risk reduction management, the guarantee of organisational effectiveness, compliance with laws and regulations, the adequacy of investments related to technology (Veerankutty et al., 2018; Wiedenhöft et al., 2020), as well as providing high-quality services that aim to meet the expectations of stakeholders and society as a whole (Al-Farsi and Haddadeh, 2015; Arshad et al., 2014). Next, we describe the methodology applied to the study.

3 Methodology

The research was developed based on the methodological principles of the systematic literature review (SLR) whose method is indicated for mapping the existing studies on a given phenomenon. According to Denyer and Tranfield (2009), SLR is a specific methodology that allows for identifying, analysing, and interpreting all relevant research on a certain topic.

Mendes-Da-Silva (2019) also points out that the publication of systematic reviews can build a continuous dissemination of relevant contributions to the field of research, making this methodology one of the most attractive to researchers and practitioners interested in researching specific topics.

It is important to note that a systematic review is not the same as a literature review because of its different and more demanding principles. For example, the researcher, when conducting a SLR, must define inclusion/exclusion criteria for the studies, which need to be transparent to other researchers, academics, practitioners, and policymakers (Denyer and Tranfield, 2009). In addition, formulating a determined question to guide the review makes it possible to carry out both a quantitative and qualitative analysis of the relevant evidence and identify knowledge gaps for future research (Denyer and Tranfield, 2009; Mendes-Da-Silva, 2019).

Tranfield et al. (2003), when comparing Cochrane (2020) – style systematic reviews – which are reviews of primary studies on human health and health policy – in the application of management and organisation studies, noted that the use of this type of review may be questionable and undesirable because they are based on principles that are limited when applied in the management area. In this context, Denyer and Tranfield

(2009), aiming to help researchers to improve management practice and research, stated that a systematic review should be carried out following five distinct steps:

1 formulating the question

2 locating the studies

3 selecting and evaluating the studies

4 analysis and synthesis

5 reporting and using the results.

Brereton et al. (2007), on the other hand, suggest that the various activities that involve this methodology can be grouped into three main phases:

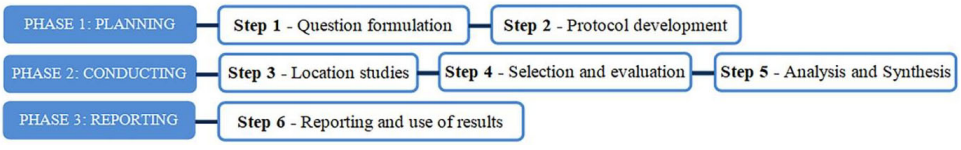
1 planning – which comprises the activities that involve specifying the research questions, developing and validating the review protocol

2 conducting the review – which comprises the activities to identify relevant research, select primary studies, assess the quality of the study, extract the necessary data, and synthesise the data

3 reporting the review – which comprises the activities that involve writing and validation of a review report.

Thus, to operationalise the systematic review proposed in this study – which seeks to collaborate with research on the ITG subject in the government public sector – the two guidelines presented by the authors Denyer and Tranfield (2009) and Brereton et al. (2007) were combined, as shown in Figure 1.

Figure 1 Phases and steps of the systematic review (see online version for colours)



Source: Adapted from Brereton et al. (2007) and Denyer and Tranfield (2009)

In the next section, we describe the main steps followed in the planning, conducting, and reporting phases of the review applied in this study.

4 Phases of the SLR

This section presents the methodological procedures used to conduct the SLR in this study.

4.1 Phase 1: planning

A systematic review should start from the formulation of one or more main questions, which will guide the next steps in the review. In the case of this research, the general

objective of the study (mapping the research on ITG in the government public sector) was divided into two main questions:

Question 1 What are the characteristics of the research on ITG in the government public sector (regarding the year of publication, authors' country of origin, main communication channels, and most cited works)?

Question 2 What subjects are covered in the research on ITG in the government public sector (in terms of keywords and themes)?

Another essential element when conducting an SLR is to establish a protocol for the study. According to several authors, a previously prepared protocol should detail precisely how the review will be conducted, which allows for minimising possible biases in the study, since it assists the reviewers with feedback on the methods adopted to identify any errors and make the necessary changes (Brereton et al., 2007; Denyer and Tranfield, 2009).

In this sense, the study protocol was developed with the support of the software state-of-the-art by systematic review (StArt) tool, which has been used to support the employment of this method, making the process more agile, precise, and replicable. The protocol, as presented in Table 1, defined the various topics that should be observed in the review, in order to meet the study's objective and answer the proposed research questions.

Table 1 Systematic review protocol

Topic	*Definition*
Keywords	'information technology governance'; 'IT governance'; 'information technology enterprise governance'; 'enterprise governance of IT'; 'public sector'; 'public organisation'; 'public institution'; 'public company'; 'public corporation'; 'public administration'; 'public university'.
Languages of the articles	English, Spanish, and Portuguese.
Research sources	Scopus and Web of Science (WoS) databases.
Selection criteria	• *Inclusion criteria:* Inclusion of articles addressing themes associated with ITG. • *Exclusion criteria:* Exclusion of duplicate articles by title, articles with the same content not specifically addressing the researched topic, and written in languages other than the ones specified.
Types of studies	Only articles published in peer-reviewed scientific journals.
Initial selection criteria	Articles containing the keywords defined for search in the abstract, title, or keyword fields.

4.2 Phase 2: conducting the review

Data collection was carried out in the months of December 2021 and January 2022, on Scopus and Web of Science databases. These databases were selected because they stand out in the area of Administration, being the most used as a reference in the field of management and because they are indexing bases, that is, they encompass journals that have undergone a careful analysis process (Dwivedi et al., 2021). In addition, the impact factor of publications on these databases should be highlighted, given that the journals

indexed in WoS are calculated by the impact factor known as FI or *Journal Impact Factor* (*JIF*), while Scopus' journals use the *SCImago Journal Rank* (SJR). With the aim of broadening the scope of the research, we decided not to define the period to be researched, since the objective of the study was to capture the state-of-the-art of the proposed theme. The only time limitation was to consider the articles published until the end of 2021, disregarding the articles that were already in the researched databases for 2022.

The definition of the search strategy to identify possible records in the databases considered the words chosen in the planning phase, which were combined using the AND and OR descriptors, together with the truncation character ('*'), thus forming the string. Such a string was used in the search for words in the title, abstract, and keywords. Only articles published in journals (article) and that met the eligibility criteria (Table 2) were selected, thus disregarding other textual forms such as books, book chapters, conference articles, and reports.

Table 2 The search strategy used in the SLR

Base	*String*	*Search fields*	*Refine results*
Scopus	(('information technology governance' OR 'IT governance' OR 'enterprise governance of IT' OR 'information technology enterprise governance') AND ('public sector*' OR 'public organisation*' OR 'public institution*' OR 'public compan*' OR 'public corporation*' OR 'public administration' OR 'public universit*'))	Title, keywords, abstract	Document type = article
Web of Science		Topic	Document type = article

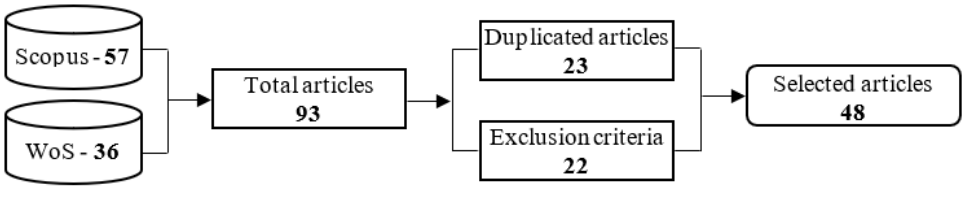
As a result of the search, 57 articles were obtained in Scopus and 36 in the Web of Science database, totalling 93 scientific papers. For the selecting stage of the raw article database, the software StArt was used again, which made it possible to import the identified papers to a new database. The portfolio was organised using the same tool that found 23 repeated publications, which were removed from the portfolio. The final database was composed of 70 articles, whose abstracts were read, evaluated, and submitted to a new selection filter, aiming to meet the other exclusion criteria:

1 publications that had the same content

2 publications that did not specifically refer to the researched topic (e.g., e-government, cloud computing, IT outsourcing, and open data)

3 publications in languages other than those specified in the protocol.

Figure 2 Step of selection and evaluation of publications



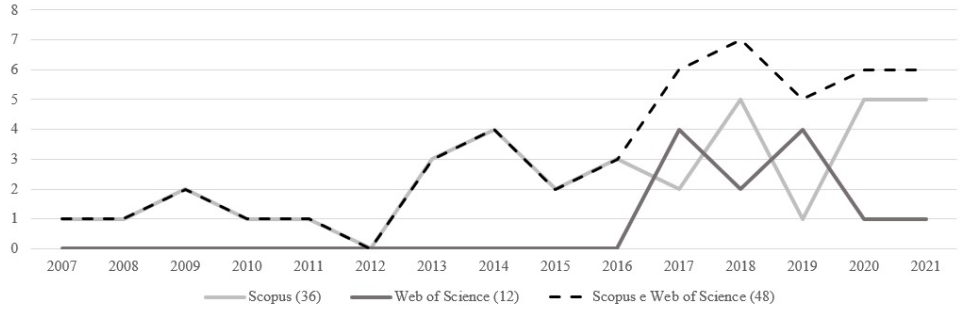
The article selection and evaluation steps were carried out through a double analysis process, in which the authors of the research selected the papers according to the previously established criteria, identifying and defining the studies that were suitable for inclusion in the review, that is, articles whose central theme was ITG in the government public sector. After this analysis, 22 articles were excluded for not dealing directly with the investigated theme or for meeting one or more exclusion criteria, resulting in a final sample of 48 articles, which are part of the study's bibliographic portfolio, as shown in Figure 2.

4.2.1 Analysis and synthesis of the bibliographic portfolio

In the analysis procedure, the bibliographic portfolio with the selected studies (n = 48) was used. All the papers were read in full by the two authors of the research, seeking to meet the objective of the study and the proposed research questions. Different information about each article was extracted and organised in a spreadsheet, and a new column was added to include the results of the qualitative analysis in order to identify the researched topics. The spreadsheet was filled with different metadata available in each article (such as year of publication, authors' country of origin, communication channel, number of citations, and keywords). These data, except the keywords, were analysed quantitatively, attending to the first research question defined in the study.

The analysis of the temporal distribution (Figure 3) of the articles that compose the bibliographic portfolio highlights the years between 2017 and 2021 as the period with the largest number of publications (2017 – six; 2018 – seven; 2019 – five; 2020 – six; and 2021 – six articles per year). When analysing the ITG in the private sector, it can be seen that research started in the 1990's, however, it has intensified since the 2000's. When doing a quick search on the ITG theme in the Scopus database, between the period 2000–2021, 2,251 documents were retrieved, which represents an average of 107 articles published per year – on the other hand, in the public sector, an average slightly higher than three articles per year is found.

Figure 3 Time evolution of articles in the bibliographic portfolio by year of publication and databases



Analysing the geographical distribution of the published research, it was found that the production in the bibliographic portfolio involved researchers from 26 countries (Figure 4), with Brazil standing out with the largest number of publications (n = 14; 29.2%), followed by Malaysia (seven publications; 14.6%), and the USA and Spain (five

publications each; 10.4%). These four countries account for 64.6% of the articles identified in the portfolio published on ITG in the government public sector.

Table 3 Most cited bibliographic portfolio articles on ITG in the public sector

R	*Article*	*Author(s)*	*Journal*	*Y*	*TC*	*TC/Y*
1	The effect of critical success factors on IT governance performance	Nfuka and Rusu	*Industrial Management and Data Systems*	2011	190	17.27
2	IT governance mechanisms in public sector organisations: an Australian context	Ali and Green	*Journal of Global Information Management*	2007	166	11.07
3	Public and private sector IT governance: identifying contextual differences	Campbell et al.	*Australasian Journal of Information Systems*	2010	164	13.67
4	IT governance and business value in the public sector organizations – the role of elected representatives in IT governance and its impact on IT value in US state governments	Pang	*Decision Support Systems*	2014	109	13.63
5	IT governance in the public sector: a conceptual model	Tonelli et al.	*Information Systems Frontiers*	2017	92	18.40
6	An examination of effective IT governance in the public sector using the legal view of agency theory	Dawson et al.	*Journal of Management Information Systems*	2016b	87	14.50
7	Information technology governance, funding and structure: a case analysis of a public university in Malaysia	Ismail	*Campus-Wide Information Systems*	2008	60	4.29
8	Governing innovation in US State Government: an ecosystem perspective	Dawson et al.	*Journal of Strategic Information Systems*	2016a	54	9.00
9	Critical success framework for implementing effective IT governance in Tanzanian public sector organizations	Nfuka and Rusu	*Journal of Global Information Technology Management*	2013	47	5.22
10	Efficiency creep and shadow innovation: enacting ambidextrous IT governance in the public sector	Magnusson et al.	*European Journal of Information Systems*	2020	44	22.00

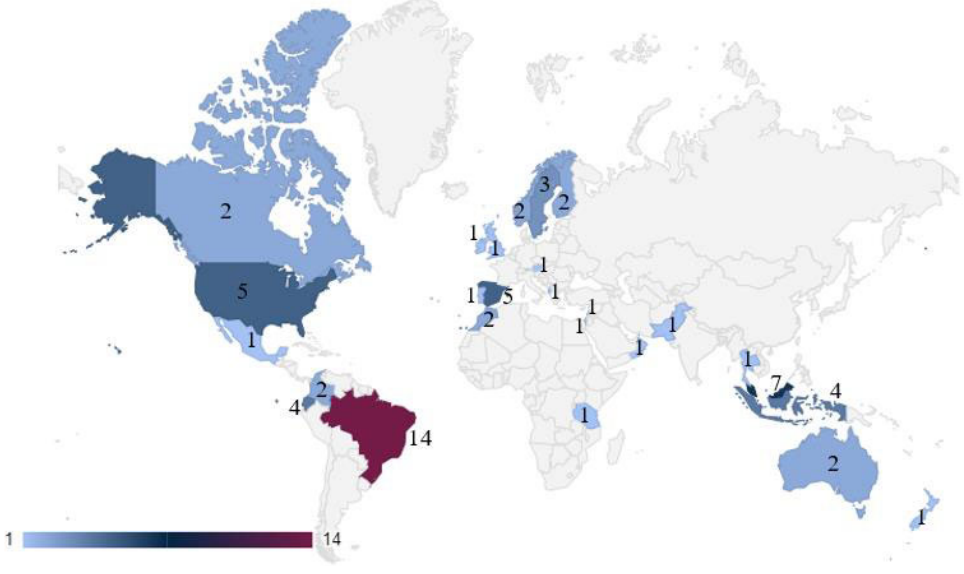
Notes: R = ranking; TC = total citations; Y = year; TC/Y = total citations per year; TC data collected on 17th November 2022.

Table 3 Most cited bibliographic portfolio articles on ITG in the public sector (continued)

R	*Article*	*Author(s)*	*Journal*	*Y*	*TC*	*TC/Y*
11	Information technology governance on audit technology performance among Malaysian public sector auditors	Veerankutty et al.	*Social Sciences*	2018	35	8.75
12	Information technology governance institutionalization and the behavior of individuals in the context of public organizations	Wiedenhöft et al.	*Information Systems Frontiers*	2020	34	17.00
13	IT governance from practitioners' perspective: sharing the experience of a Malaysian university	Ajayi and Hussin	*Journal of Theoretical and Applied Information Technology*	2016	24	4.00
14	Cobit 5-based approach for IT project portfolio management: application to a Moroccan university	Ahriz et al.	*International Journal of Advanced Computer Science and Applications*	2018b	23	5.75
15	Information technology governance framework in the public sector organizations	Amali et al.	*Telkomnika*	2014	23	2.88

Notes: R = ranking; TC = total citations; Y = year; TC/Y = total citations per year; TC data collected on 17th November 2022.

Figure 4 Map chart of countries of the authors present in the bibliographic portfolio with impact on research (see online version for colours)



Concerning the main communication channels, that is, the journals that published most of the work, the number of articles published in each journal was analysed as well as their respective field of knowledge. It was found that among the selected articles, the vast majority (79.2%) were published in different journals. Only five journals had more than one publication, namely the *Electronic Journal of Information Systems in Developing Countries*, *Espacios*, *Information Systems Frontiers*, *Journal of Management Information Systems*, and *NAVUS-Revista de Gestão e Tecnologia* with two articles published in each.

Finally, to estimate the scientific recognition of the main articles about the investigated theme, Harzing's Publish or Perish software was used, which allows for retrieving and analysing academic citations, through the Google Scholar search site. We chose to create a list with the 15 most cited articles in the bibliographic portfolio, which represent 31.2% of it, however, representing 86.9% of the number of citations associated with the total of articles identified in the study (Table 3).

Aiming to identify the main subjects addressed in the research on ITG in the government public sector, two specific analyses were performed: the first observed the frequency of keywords used in the articles; and the second considered the main themes worked on, categorised by the authors through content analysis. Before analysing the 220 keywords of the articles in the bibliographic portfolio, a grouping of equivalent words was done, such as: 'IT governance' and 'information technology governance', 'security information management' and 'security policy information', 'university' and 'universities', among others.

Figure 5 Word cloud generated from the retrieved keywords (see online version for colours)

In the keyword frequency analysis, the descriptor 'ITG' stood out with the highest number of occurrences (34 articles; 70.8%), followed by the grouping of words linked to public organisations (with 26 occurrences; 54.2%), in which the keywords 'public sector', 'public organisations' and 'public administration' (with 13, 8, and 5 occurrences, respectively) stand out. Another descriptor that stood out about the kind of organisation was the term 'universities' (with ten occurrences; 20.8%), and the terms 'public university', 'institutes of higher learning', and 'ITG and university', referring to studies

carried out in this type of organisation. Finally, the descriptors 'COBIT' and 'project management' (with five occurrences each; 10.4%) also stand out. Figure 5 illustrates the cloud graph formed by the representation of the most significant keywords (with at least two occurrences) found in the articles on the researched topic. This set of words corresponds to the main indexers associated with published research on ITG in the public sector.

Still present, but less frequent were the words associated with management, performance, strategy, best practices, projects, and theory. One interesting aspect concerns the presentation of basic theories used in the studies that were listed as keywords, for example, 'agency theory', 'absorptive capacity', and 'theory of political control'. It was also observed that some studies used terms in their keywords to emphasise the techniques used for data analysis, among them the structural equation modelling technique – 'partial least squares' (with two occurrences; 4.2%), as well as the 'casual relationship model' and 'correlated effect' techniques. Finally, the descriptor 'best practices' (with four occurrences; 8.3%) stood out, showing that research has generically dealt with the topic related to governance practices.

In content analysis, the activities of analysing and coding the portfolio articles were carried out jointly by the two authors of the study. According to Bardin (2016), the process of content analysis involves breaking up the text into units of analysis, following an analogous grouping, for example, into thematic categories, in which the main themes are investigated and which are grouped according to their similarity. Thus, the activities consisted, firstly, in analysing the objectives described in each of the articles of the portfolio, aiming to identify the main theme addressed by the research in the study. Then, these themes were grouped into specific thematic categories related to the theme of ITG. Since the objectives identified in the studies were very specific, there was no discrepancy of opinion between those involved in the process of categorisation of the main themes addressed in the articles. The results obtained from this analysis of the bibliographic portfolio are described in more detail in Section 5.

4.3 Phase 3: reporting

According to Denyer and Tranfield (2009), the output of a systematic review should be structured similarly to an empirical research report, which should have the following textual elements: introduction, methodology, findings and discussion, and conclusion. Thus, the phase reporting the review of this study comprises the development of this paper with the description of the main results obtained in the analysis of the bibliographic portfolio of this study.

5 Results

From the analysis and data presented in Subsection 4.2, it was possible to identify and map the characteristics of research on ITG in the government public sector and, thus, to answer the first question that guided this review – what are the characteristics of the research on ITG in the government public sector. Through these characteristics, some relevant points of the research present in the bibliographic portfolio became evident, such as:

1 the evolution of publications on the topic over the last 15 years

2 the identification of the countries that have conducted research on ITG in the government public sector

3 the identification of the main journals

4 the identification of the most cited works in the portfolio, i.e., the most relevant on this topic.

A more in-depth discussion of the results obtained is presented in Section 6.

The second research question – what subjects are covered in the research on ITG in the government public sector – was answered based on the word cloud formed by the representation of the most significant keywords about the research topic and the categorisation of the main ITG subjects addressed in the articles, which were supported by the content analysis method. In short, it was observed about the terms defined by the authors in the keywords a set of words that correspond to the main indexers associated with the research published on ITG in the public sector. These indexers range from a more general view (in which broader terms are used, such as ITG, public sector, public organisation, IT, and governance) to a more specific view, in which the following terms are defined: critical success factors, mechanisms, and frameworks such as COBIT. Regarding this last descriptor, of the five articles that addressed this framework, three focused on its COBIT5 version. Some particularities were also identified in the descriptors used in the studies, such as:

1 the use of specific descriptors to exemplify the organisations that were the focus of the research, for example, 'government'

2 through the terms chosen, it was found that the government public organisations investigated were located in countries such as Brazil, Thailand, and Malaysia

3 some authors used the descriptor 'ITG mechanisms' addressing them to their classification – relational, procedural and structural mechanisms, while others addressed some mechanisms in a specific way, such as IT strategic planning, project portfolio, security policy information, and IT steering committee.

Table 4 The main themes covered in the bibliographic portfolio

R	*Themes*	*Quantity*	*%*
1	IT governance mechanisms	19	39.6%
2	Critical success factors (CSF)	8	16.6%
3	IT governance models	6	12.5%
4	IT governance focus areas	5	10.4%
5	Impact of IT governance on public organisations	5	10.4%
6	IT governance scenario in public organisations	4	8.3%
7	Theoretical study	1	2.1%
Total		48	100%

Note: R = ranking.

In order to identify the main issues addressed in the bibliographic portfolio, the different themes present in the articles were categorised. This categorisation was done by coding

the revised and analysed contents of the different units of analysis, which presented meaning and generated the main categories of this study (Bardin, 2016). As a result, it was possible to verify that despite the diversity of studied topics (Table 4), most research (79.1%) focused on four specific themes:

1 ITG mechanisms

2 critical success factors (CSF)

3 ITG focus areas

4 ITG models.

The next subsections present a mapping of each of the four main themes identified in the studies of this portfolio.

5.1 ITG mechanisms

Analysing in more depth the articles that addressed the first specific theme – ITG mechanisms/practices – two main topics of research were identified. The first topic includes studies focusing on specific practices, being the most researched mechanism the IT project management. The great interest in this mechanism in government public organisations may be related to the fact that these organisations have to manage a great number of projects in the technological area, which requires the definition of very clear selection criteria, by the principles of transparency and accountability on the public resources spent on IT (Pang, 2014; Tonelli et al., 2017).

The second topic, on the other hand, grouped the studies that proposed research models to test different relationships between implemented ITG practices/mechanisms and IT performance. Among the mechanisms that most influence the effectiveness of ITG in public organisations are the procedural mechanisms aimed at managing the portfolio of investments made in IT and in the portfolio of IT projects, justified by the fact that these organisations are making high investments in technology, requiring greater transparency in making decisions about such investments (Medeiros et al., 2017). Some studies analyse the support of top management and the IT strategy committee (both structural mechanisms), and corporate communication systems (a relational mechanism). These results support several studies that point out the need to identify a set of structural, procedural, and relational mechanisms to assist organisations in effective implementations of ITG. In this sense, Tonelli et al. (2017) stressed the importance of relational mechanisms being the first step for the development of ITG in public organisations, as these mechanisms provide a basis for the subsequent implementation of other mechanisms, whether they are procedural or structural, which are also relevant for these institutions because they assist in complying with regulatory requirements – which is still one of the ITG's main objectives in the public area.

Moreover, the adoption of ITG mechanisms influences how organisations use their technological resources, that is, their implementation makes the management and the use of technological resources more efficient than in organisations where ITG is not present (Veerankutty et al., 2018). Still, Pérez et al. (2021) implemented the model SITPP – strategic IT project portfolio in public universities, identifying several improvements, such as the increasing of the level of governance maturity in institutions, greater involvement of senior management in IT projects, and greater agility in identifying IT

projects aligned with the institution's business objectives. The authors concluded that a portfolio of strategic IT projects can be considered an effective ITG practice for organisations, generating added value to the business and promoting the digital transformation of the business (Pérez et al., 2021).

5.2 Critical success factors

Regarding the second most researched theme, critical success factors (with eight articles), some structures were proposed describing different factors to assist government public organisations in the implementation and improvement of a more effective ITG. Nfuka and Rusu (2013), for instance, proposed a structure composed of 11 CSFs to help IT and business managers to identify the practices with the greatest impact, that is, the factors that provide the continuous improvement of the ITG implementation and consequently the improvement of the provision of public services.

It was also possible to identify those CSFs pointed out as the most significant in terms of their influence on the ITG performance in public organisations, namely:

1 consolidation of IT structures to optimise costs and improve responsiveness and accountability

2 the involvement and support of top management.

Frogeri et al. (2020), when analysing a higher education institution in Brazil, pointed out that the lack of staff, the need for training, the project planning, the absence of communication between IT and senior management, and the absence of monitoring practices are the critical success factors that most influence the effective implementation of ITG. These results demonstrate the importance of adopting structural mechanisms in government public organisations as a way to contribute to the alignment of strategies in business and IT areas, to meet organisational objectives more efficiently (Kurti et al., 2014; Nfuka and Rusu, 2011).

5.3 ITG models

The third most investigated theme was the ITG models. According to Juiz et al. (2014), the ITG models are intended to assist organisations in the process of implementing an ITG standard, and this can occur through the development of their own models, by the adoption of frameworks, or by the use of reference guides. From the analysis of this theme, the presence of articles on the development of ITG models for public governmental organisations was identified, as well as suggestions about the implementation of different governance structures for these organisations. Each of these models is summarised in Table 5.

The joint analysis of these different works allowed pointing out common aspects of the development of ITG models and structures aimed at public organisations from different locations, such as:

1 the need to align IT and business strategies

2 the relevance of adopting structural, procedural and relational practices

3 the importance of considering the regulatory issues required by the government.

Table 5 ITG models proposed in the bibliographic portfolio

Reference	*Organisation*	*Country*	*Structure/description*
Ajayi and Hussin (2016)	University	Malaysia	• *ITG effectiveness model:* This model consists of aspects that have been categorised into three capacities: structure, processes, and relations between IT and business. According to the authors, when there is a relationship between these capacities in the organisation, it is possible to achieve the desired behaviour and effective IT governance, in addition to improving the organisation's performance.
Bianchi and Sousa (2015)	University	Brazil	• *Structure for the development of an individual ITG model:* A set of steps has been proposed to assist organisations in developing their own IT governance structure, taking into account the specific data of the organisational environment.
Amali et al. (2014)	Gorontalo Province organisations	Indonesia	• *ITG framework:* This framework is composed of six specific blocks, and its structure focuses on the management of IT processes. It aims to ensure that the use of IT is by the organisational objectives and the strategic alignment. In addition, the framework considers the management of resources and risks associated with IT.
Olesen et al. (2013)	University	Australia	• *ITG model:* This model is more process-oriented, providing useful guidance to support universities in developing their responsive and responsible governance structures. In other words, institutions must analyse their needs and develop governance practices that help them to understand and better use their IT.
Marzullo and Souza (2009)	Government organisations	Brazil	• *ITG framework:* The proposed model considers aspects of public administration, such as political views, investments, and the interest of the population. This structure aims to identify the strategic actions necessary to implement an efficient ITG. In other words, it seeks through the alignment of business and IT goals to obtain the best results in the areas of decision-making, IT projects, information security, and investment management. In the same study, the *ITG competence dimensional model* was proposed, which identified and suggested ten aspects of necessary skills for its implementation.
Parfitt and Tryfonas (2009)	Government of the Assembly for Wales	UK	• *ITG capacity assessment model:* The model was called PAINLESS and aims to evaluate and provide a means of measuring the continuous improvement of ITG. It presents an assessment of the IT governance procedures that operate within a public sector organisation.

In addition, it can be seen that the structures proposed in the analysed studies sought to develop models that would enable government public organisations to make use of technology – in the most appropriate way possible – through an effective ITG, seeking by the end to improve organisational performance.

5.4 ITG focus areas

Regarding the fourth most addressed research theme in the bibliographic portfolio, ITG focus areas, the research was found to be predominantly concentrated in four subareas: IT value (two articles), accountability (one article), IT risk management (one article), and IT strategic alignment (one article). Among the main contributions identified in the research related to each of these domains, the following stand out:

- *IT value:* Sunthonwutinun and Chooprayoon (2017) pointed out that ITG influences the achievement of several benefits for public organisations, through the skills of their employees, the performance of internal processes, and in the stability of finances. Another important point about this focus area is the role played by the ITG representative in the organisation because through his/her actions he/she can contribute to increasing the efficiency in the return on spending on technology and consequently improving government performance (Pang, 2014).
- *Accountability:* Arshad et al. (2014) presented a support structure for decision-making on ITG (involving the definition of responsibilities) aimed at universities, comprising 33 practices distributed as follows: 12 structural practices, 11 procedural practices, and ten relational practices.
- *IT risk management:* Mascarenhas Sirqueira et al. (2018) pointed out some benefits of this focus area for organisations, such as:
  1 helping to reduce technology costs
  2 improving the organisation's performance
  3 reducing the impacts caused by service interruptions
  4 providing IT services with quality and skillfulness.

  The authors also suggested the adoption of ITIL practices by organisations to assist in the management of incidents in these organisations.
- *IT strategic alignment:* Ahriz et al. (2018a) proposed a model focused on the strategic alignment between IT and business areas to assist public organisations to achieve greater organisational efficiency.

The next section presents a brief discussion of the results obtained in the systematic mapping of this study.

6 Discussion

Initially, considering the characteristics of research on ITG in the government public sector, it was observed – through the year of publications of the articles – that although the issues related to ITG have been discussed among researchers for several years, the research of ITG in the public sector is still scarce and focuses mainly on the last decade.

This result supports other studies that also suggest a lack of empirical research on ITG in public organisations (Bianchi and Sousa, 2015; Pang, 2014).

Observing the authors' country of origin, it was verified the interest of Brazilian researchers in investigating the theme of ITG in the public sector. This fact can be justified by the increased use of IT in public administration to provide better services to society (Marzullo and Souza, 2009; Tonelli et al., 2017), as well as by the need to ensure greater transparency and efficiency in the investments made in IT by the Brazilian public organisations (Tonelli et al., 2017). As for the other countries highlighted in the analysis, some aspects can justify the interest in this topic:

1 in Malaysia, the high investments in IT made by the government to make the services provided more efficient (Veerankutty et al., 2018)

2 in some developing countries, for example, Colombia, the government has determined several guidelines to disseminate the use of IT and the implementation of ITG in public institutions (Valencia et al., 2018).

Also in this context, the low number of contributions from the US contained in the bibliographic portfolio of this study was noteworthy. A probable explanation for this result may be related to the keywords used by the authors in the database search strategy. In other words, the terms employed may not be the same used by researchers in the US when dealing with the theme of ITG in the public sector. The term government may be a probable suggestion of a descriptor used by the authors in the US when investigating this topic.

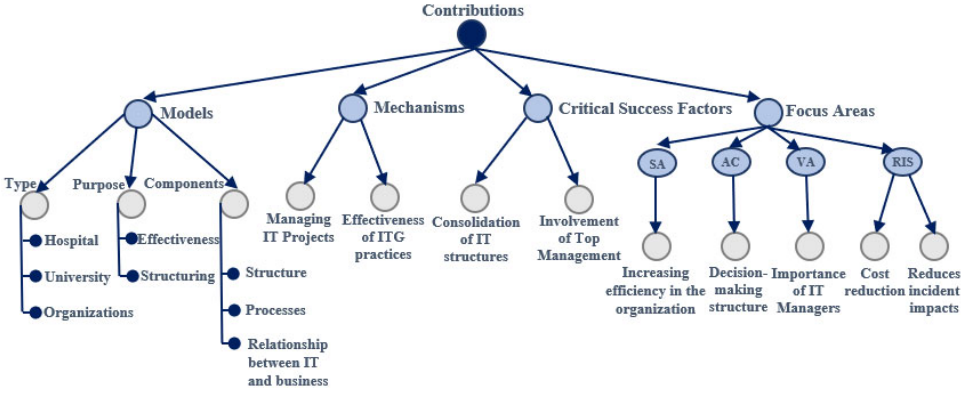
Regarding the main channels of communication, we observed a diversity of journals interested in publishing articles on the theme of ITG in the public sector, without the specific predominance of one or another journal. This fact is also reflected in the different areas in which the articles in the portfolio were published. A broad multidisciplinary was identified in the publications since the articles were classified into several areas of knowledge, the most prominent being computer science (including 60.4% of the articles), business, management, and accounting (with 31.2% of the articles), and decision sciences (with 25%). The sum of articles exceeds 100% because some journals are classified in more than one knowledge area.

Another relevant aspect of this mapping refers to the 15 publications in the portfolio that most influence ITG research in the public sector, which were ranked based on the number of citations per publication. The most cited article was published in 2011 and, therefore, has the highest annual citation among the analysed documents, making the paper 'The effect of critical success factors on IT governance performance', the most influential publication on the topic analysed in the systematic mapping of this study.

Finally, after analysing the main topics covered in the article portfolio, a structure was developed consolidating the main contributions identified from the results obtained in the content analysis (Figure 6). Among these contributions, we highlight the interest in studying mechanisms aimed at managing IT projects, as well as empirical research observing the impact of different ITG mechanisms on IT performance and organisation performance. The main critical success factors emphasised in the observed studies, on the other hand, are those related to the structural part of ITG, seeking to consolidate the IT structure and involve the top management. As for the ITG's focus areas, four areas stood out: IT strategic alignment, accountability, IT value, and IT risk management. The studies suggested several benefits for organisations that have these well-developed areas, such as

increasing efficiency in the organisation's performance, reducing costs, and reducing incidents.

Figure 6 Main contributions on the four most discussed topics in the portfolio (see online version for colours)



Notes: SA = strategic alignment; AC = accountability; VA = IT value; RIS = risk management.

In addition, there was an interest in the development and proposal of different ITG models to assist public organisations in their process of implementing ITG. The following models stand out: the ITG competence dimensional model, the effectiveness model, and the ITG capacity assessment model. Some specific aspects of ITG models were identified, such as:

1 The models were developed for specific types of organisations, such as hospitals, universities, and government organisations.

2 The models proposed in the studies presented two streams, the first was directed to the effectiveness of ITG – in other words, the models seek to evaluate, conduct, and monitor the alignment between IT and organisational objectives, on the other hand, the second focused on the structuring line, the proposed models aim to obtain an effective ITG through the best use of IT in organisations.

3 The components pointed out in the models are related to the structure of the organisations, to the processes and the relationship between IT and the business area.

It is perceived through these components, the importance of the identification and implementation of the ITG mechanisms that best meet the organisation's needs.

7 Conclusions

The high investments in technology made by governments to provide better services to society ratify the importance of ITG in the public sector, as a way to ensure transparency and the appropriate investments in the technological area of these institutions. In this context, from this systematic literature mapping, it was possible to present an overview of the studies involving the theme of ITG in the public sector, showing it as an area of

research in development and with opportunities for application in different organisations linked to the public or government area.

The research found that this topic has gained relevance and importance, especially in recent years, as the presence and dissemination of technologies in government public organisations have been advancing. The theme, although studied in different continents, has attracted great interest from Brazilian researchers, being the country with the largest amount of research identified in the portfolio. There is no predominance of one journal over another regarding the publication of articles on this topic, and these are published in journals aimed at different audiences, with emphasis on the areas of computing, business, management and accounting, and decision sciences.

Some specific aspects were observed in the studies of this portfolio about the use of basic theories and the analysis techniques, in which the agency theory and the technique of structural equation modelling (based on partial least squares) were pointed out as descriptors by their authors. As for the main themes addressed in the published studies, it was found that the adoption and implementation of different ITG mechanisms in public organisations was the theme that stood out, with the main mechanisms identified in these studies being IT strategic planning, IT project portfolio, information security policy, and IT steering committee. The other themes involved studies on critical success factors, the proposal of ITG models specific to public organisations, and ITG's focus areas. Although studies addressing ITG models have stood out in the portfolio, there was a low incidence of studies exploring the maturity of ITG in the public sector, as well as the suggestion of opportunities and challenges to be investigated, which shows a certain lack of scientific studies related to these themes.

Our findings are similar to those of other studies, that research on ITG in public administration is still incipient and recent within the academic universe, given the large number of articles published on ITG in the private sector. In addition, the particularities of public sector organisations, such as aspects related to transparency, efficiency, and the focus on improving public services make this thematic area an interesting field of research that requires a further deepening of the academic knowledge base.

In this context, considering that ITG in the public sector remains a field still in development, future research could deepen studies on the themes identified in this research in different public administration bodies and areas of activity. More specifically, there is a need to develop more studies:

1 involving different focus areas of ITG, with special attention to 'performance measures' and 'IT resource management' – study areas missing from the analysis

2 also, due to the vast set of ITG mechanisms present in the literature, research that analyses the relationship between ITG mechanisms – especially the least studied ones – in the effectiveness of ITG and organisational performance could be done

3 the identification of indicators to monitor the effectiveness of ITG in the public sector, a theme not identified in the analysed portfolio

4 the analysis of investments made in IT and its relationship with the performance of the public sector

5 as well as further research on emerging topics, such as ambidexterity in public organisations.

Additionally, some gaps in the studied research theme were identified in the bibliographic portfolio, which can also serve as suggestions for new research, such as:

1 the need to study bureaucracy in the management of ITG (Pang, 2014)

2 the identification of problems and obstacles in the ITG processes (Sunthonwutinun and Chooprayoon, 2017)

3 the classification of critical success factors as internal or external to the organisation, in addition to their classification by purpose (Reis and Neto, 2019)

4 a deeper investigation on the contribution of ITG mechanisms to the dynamic balancing and enactment of ambidexterity in public sector organisations (Magnusson et al., 2020).

Regarding the contributions of the study, the results presented here are expected to guide a future research agenda on ITG in the public sector, thus expanding the existing body of knowledge, especially those less investigated research themes, and topics. We also expected to contribute to other researchers, academics, and managers interested in the topic, providing information and research suggestions that can assist in the improvement and evolution of ITG processes in public organisations. As limitations of the study:

1 It should be noted that the selected sample was composed only of articles published in journals indexed in only two investigated databases, which certainly excluded other productions from the analysis, such as conference articles, reports, and books.

2 The keywords used for the term 'ITG' may have excluded studies from countries that use different terms to refer to the ITG process in public organisations. Nevertheless, we believe that the analysed portfolio represents the vast majority of research carried out and presented during the period of analysis.

References

Ahriz, S., Benmoussa, N., El Yamami, A., Mansouri, K. and Qbadou, M. (2018a) 'An elaboration of a strategic alignment model of university information systems based on SAM model', *Engineering, Technology & Applied Science Research*, Vol. 8, No. 1, pp.2471–2476.

Ahriz, S., El Yamami, A., Mansouri, K. and Qbadou, M. (2018b) 'COBIT5-based approach for IT project portfolio management: application to a Moroccan university', *International Journal of Advanced Computer Science and Applications*, Vol. 9, No. 4, pp.88–95.

Ajayi, B. and Hussin, H. (2016) 'IT governance from practitioners' perspective: sharing the experience of a Malaysian university', *Journal of Theoretical & Applied Information Technology*, Vol. 88, No. 2, pp.219–230.

Al-Farsi, K. and Haddadeh, R.E. (2015) 'Framing information technology governance in the public sector: opportunities and challenges', *International Journal of Electronic Government Research*, Vol. 11, No. 4, pp.89–101.

Ali, S. and Green, P. (2007) 'IT governance mechanisms in public sector organisations: an Australian context', *Journal of Global Information Management*, Vol. 15, No. 4, pp.41–63.

Almeida, R.S. and Souza, W.A. (2019) 'Implementation of mechanisms of information technology governance in a public university', *NAVUS-Revista de Gestão e Tecnologia*, Vol. 9, No. 1, pp.136–149.

Alreemy, Z., Chang, V., Walters, R. and Wills, G. (2016) 'Critical success factors (CSFs) for information technology governance (ITG)', *International Journal of Information Management*, Vol. 36, No. 6, pp.907–916.

Amali, L.N. and Katili, M.R. (2018) 'Identification of influential factors in implementing IT governance: a survey study of Indonesian companies in the public sector', *Interdisciplinary Journal of Information, Knowledge & Management*, Vol. 13, pp.61–77.

Amali, L.N., Mahmuddin, M. and Ahmad, M. (2014) 'Information technology governance framework in the public sector organizations', *Telkomnika*, Vol. 12, No. 2, p.429.

Arshad, Y., Ahlan, A.R. and Ajayi, B.A. (2014) 'Intelligent IT governance decision-making support framework for a developing country's public university', *Intelligent Decision Technologies*, Vol. 8, No. 2, pp.131–146.

Bardin, L. (2016) *Análise de Conteúdo*, Edições 70, São Paulo.

Bianchi, I.S. and Sousa, R.D. (2015) 'IT governance for public universities: proposal for a framework using design science research', *Espacios*, Vol. 36, No. 21, p.E-3.

Brereton, P., Kitchenham, B.A., Budgen, D., Turner, M. and Khalil, M. (2007) 'Lessons from applying the systematic literature review process within the software engineering domain', *Journal of Systems and Software*, Vol. 80, No. 4, pp.571–583.

Campbell, J., McDonald, C. and Sethibe, T. (2010) 'Public and private sector IT governance: identifying contextual differences', *Australasian Journal of Information Systems*, Vol. 16, No. 2, pp.5–18.

Cochrane (2020) *Homepage* [online] https://www.cochrane.org/pt/evidence (accessed 21 January 2020).

Dawson, G.S., Denford, J.S. and Desouza, K.C. (2016a) 'Governing innovation in US state government: an ecosystem perspective', *The Journal of Strategic Information Systems*, Vol. 25, No. 4, pp.299–318.

Dawson, G.S., Denford, J.S., Williams, C.K., Preston, D. and Desouza, K.C. (2016b) 'An examination of effective IT governance in the public sector using the legal view of agency theory', *Journal of Management Information Systems*, Vol. 33, No. 4, pp.1180–1208.

Denyer, D. and Tranfield, D. (2009) 'Producing a systematic review', *The Sage Handbook of Organizational Research Methods*, pp.671–689, Sage Publications Ltd., London.

Dwivedi, Y.K., Ismagilova, E., Rana, N.P. and Raman, R. (2021) 'Social media adoption, usage and impact in business-to-business (B2B) context: a state-of-the-art literature review', *Information Systems Frontiers*, pp.1–23.

Frogeri, R.F., Pardini, D.J. and Cunha, G.R. (2020) 'Information technology governance in a higher education institution: an it professionals' perception analysis', *International Journal of Human Capital and Information Technology Professionals*, Vol. 11, No. 1, pp.31–46.

Ismail, N.A. (2008) 'Information technology governance, funding and structure: a case analysis of a public university in Malaysia', *Campus-Wide Information Systems*, Vol. 25, No. 3, pp.145–160.

Juiz, C., Guerrero, C. and Lera, I. (2014) 'Implementing good governance principles for the public sector in information technology governance frameworks', *Open Journal of Accounting*, Vol. 3, No. 3, pp.9–27.

Kappelman, L., Torres, R., McLean, E., Maurer, C., Johnson, V. and Kim, K. (2019) 'The 2018 SIM IT issues and trends study', *MIS Quarterly Executive*, Vol. 18, No. 1, pp.51–84.

Kurti, I., Barolli, E. and Sevrani, K. (2014) 'Effective IT governance in the Albanian public sector – a critical success factors approach', *The Electronic Journal of Information Systems in Developing Countries*, Vol. 63, No. 1, pp.1–22.

Laita, A. and Belaissaoui, M. (2017) 'Information technology governance in public sector organizations', *Europe and MENA Cooperation Advances in Information and Communication Technologies*, Vol. 520, pp.103–112, Springer, Cham.

Luciano, E. and Macadar, M. (2016) 'Governança de TIC em organizações públicas', in Barbosa, A. (Ed.): *TIC Governo Eletrônico 2015*, 1st ed., Vol. 1, pp.55–63, Comitê Gestor da Internet no Brasil, São Paulo.

Lunardi, G.L., Dolci, P.C., Maçada, A.C.G. and Becker, J.L. (2014) 'Análise dos mecanismos de governança de TI mais difundidos entre as empresas brasileiras', *Revista Alcance*, Vol. 21, No. 1, pp.46–76.

Lunardi, G.L., Maçada, A.C.G., Becker, J.L. and Van Grembergen, W. (2017) 'Antecedents of IT governance effectiveness: an empirical examination in Brazilian firms', *Journal of Information Systems*, Vol. 31, No. 1, pp.41–57.

Magnusson, J., Koutsikouri, D. and Päivärinta, T. (2020) 'Efficiency creep and shadow innovation: enacting ambidextrous IT governance in the public sector', *European Journal of Information Systems*, Vol. 29, No. 4, pp.329–349.

Marzullo, F. and Souza, J. (2009) 'New directions for IT governance in the Brazilian Government', *International Journal of Electronic Government Research*, Vol. 5, No. 4, pp.57–69.

Mascarenhas Sirqueira, C.A., Campos, A.D.R. and Castro, D.T. (2018) 'Proactive it incident lifting: case study in the state university of Tocantins-Unitins, back to framework incident management, ITIL', *Humanidades & Inovação*, Vol. 5, No. 11, pp.18–30.

Medeiros, B.C., Danjour, M.F. and Sousa Neto, M.V. (2017) 'Project management: contributions for IT governance in Brazilian public sector', *Revista Gestão e Tecnologia*, Vol. 17, No. 1, pp.54–78.

Meirelles, F. (2019) *30ª Pesquisa Anual do Uso de TI Nas Empresas*, Centro e Tecnologia de Informação Aplicada da EAESP, FGVcia.

Mendes-Da-Silva, W. (2019) 'Contribuições e limitações de revisões narrativas e sistemáticas na área de negócios', *Revista de Administração Contemporânea*, Vol. 23, No. 2, pp.1–11.

Mendonça, C.M.C., Guerra, L.C.B., Souza Neto, M.V. and Araújo, A.G. (2013) 'Governança de tecnologia da informação: um estudo do processo decisório em organizações públicas e privadas', *Revista de Administração Pública*, Vol. 47, No. 2, pp.443–468.

Nfuka, E.N. and Rusu, L. (2011) 'The effect of critical success factors on IT governance performance', *Industrial Management & Data Systems*, Vol. 111, No. 9, pp.1418–1448.

Nfuka, E.N. and Rusu, L. (2013) 'Critical success framework for implementing effective IT governance in Tanzanian public sector organizations', *Journal of Global Information Technology Management*, Vol. 16, No. 3, pp.53–77.

Olesen, K., Narayan, A.K. and Ramachandra, S. (2013) 'The challenges of information technology (IT) governance in public universities over time', *Corporate Ownership Control*, Vol. 10, No. 2, pp.258–266.

Oñate-Andino, A. and Mauricio, D. (2019) 'The advances of information technology governance in universities: a systematic review', *Journal of Theoretical and Applied Information Technology*, Vol. 97, No. 21, pp.3084–3109.

Pang, M.S. (2014) 'IT governance and business value in the public sector organizations: the role of elected representatives in IT governance and its impact on IT value in US state governments', *Decision Support Systems*, Vol. 59, No. 1, pp.274–285.

Parfitt, M. and Tryfonas, T. (2009) 'Painless: a model for IT governance assessment in the UK public sector', *EDPACS: The EDP Audit, Control, and Security Newsletter*, Vol. 39, No. 23, pp.1–25.

Pérez, F.M., Martinez, J.V.B. and Fonseca, I.L. (2021) 'Strategic IT alignment projects, towards good governance', *Computer Standards & Interfaces*, Vol. 76, No. 4, p.103514.

Reis, A.L.N. and Neto, J.S. (2019) 'Critical success factors in implementing information technology governance in federal public administration', *Revista do Serviço Público*, Vol. 70, No. 4, pp.608–629.

Sunthonwutinun, W. and Chooprayoon, V. (2017) 'A causal relationship model of the influence of information technology governance processes on the benefits received by Thai public companies', *The Electronic Journal of Information Systems in Developing Countries*, Vol. 80, No. 1, pp.1–24.

Tonelli, A.O., Souza Bermejo, P.H., Dos Santos, P.A., Zuppo, L. and Zambalde, A.L. (2017) 'IT governance in the public sector: a conceptual model', *Information Systems Frontiers*, Vol. 19, No. 3, pp.593–610.

Tranfield, D., Denyer, D. and Smart, P. (2003) 'Towards a methodology for developing evidence-informed management knowledge by means of systematic review', *British Journal of Management*, Vol. 14, No. 3, pp.207–222.

Valencia, F., Marulanda, C. and López, M. (2018) 'Gobierno de las tecnologías de la información. Uso y prácticas en las entidades públicas del triángulo del café, Colombia', *Información Tecnológica*, Vol. 29, No. 3, pp.249–256.

Veerankutty, F., Ramayah, T. and Ali, N.A. (2018) 'Information technology governance on audit technology performance among Malaysian public sector auditors', *Social Sciences*, Vol. 7, No. 8, p.124.

Wiedenhöft, G.C., Luciano, E.M. and Pereira, G.V. (2020) 'Information technology governance institutionalization and the behavior of individuals in the context of public organizations', *Information Systems Frontiers*, Vol. 22, No. 6, pp.1487–1504.