

The Evolution of Shadow IT Literature: A Bibliometric Analysis.

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THE EVOLUTION OF SHADOW IT LITERATURE: A BIBLIOMETRIC ANALYSIS.

1. INTRODUCTION

The usage of unauthorized technology, called shadow IT, is increasing within the organizations, calling the attention of managers and researchers. Shadow IT is defined as any IT solution (e.g., hardware, software, peripherals) that has not received formal approval or support from the company's IT department that employees use to perform their work tasks (Rentrop & Zimmermann, 2012; Györy et al., 2012; Walters, 2013; Silic & Back, 2014). Mobile technologies, such as smartphones and cloud apps, are widely available to employees nowadays, which has facilitated the adoption and use of unauthorized technology in the workplace (Meulensteen, 2014).

Previously, some others studies (e.g. De Bakker, Groenewegen & Den Hond, 2005; Koseoglu et al., 2015) have been performed using the bibliometric method with the objective of examining the patterns and the evolution of a topic within the academic literature. In this study, the bibliometric method was used to get an overview of shadow IT papers over the past years up to now. We attempt to research the patterns and trends of the shadow IT literature to investigate the evolution that the topic of shadow IT has had in the IS literature.

Considering the above, the overall aim of this study is to perform a bibliometric analysis of the shadow IT literature considering the following criteria (e.g., De Bellis, 2009) 1) the trends of research literature production (number of articles, the places of publication, and the most cited papers); 2) the most prolific authors and countries; 3) the theories and methods used in the papers; and 4) a thematic analysis related to the most frequent terms in the paper's title, abstract and keywords.

The motivation for this paper came from the following reason: no bibliometric study was performed related to shadow IT literature since this topic can be considered in its infancy. Although shadow IT is not a new phenomenon and is increasingly gaining attention, this topic is relatively unexplored and current knowledge is still limited and scarce (e.g., Silic & Back, 2014; Silic, Barlow & Back, 2017). A bibliometric study may contribute to advance a scientific topic or discipline since it provides an overview about the literature published so far and, consequently, research gaps may arise to develop new studies. In that sense, this study aid to explore the shadow IT topic using a bibliometric approach.

The remainder of this paper is organized as follows. Firstly, an overview on shadow IT literature is given. Secondly, the method are presented. In the next session, the results in line with the objective of the study are discussed. Finally, the final considerations are presented.

2. SHADOW IT: AN OVERVIEW ABOUT THE PHENOMENON

Rentrop and Zimmermann (2012) define shadow IT as systems developed by business departments without support of the official IT department that are generally not known, accepted and supported by the official IT department. Shadow IT represents all hardware, software, or any other solutions used by employees inside of the organizational ecosystem which have not received any formal IT department approval (Silic & Back, 2014). Thus, a shadow technology can emerge from one individual or from a group of them, such as a team or a department. In addition, shadow IT are resources adopted and used without the approval of the IT department (Haag & Eckhardt, 2015), that is, the employees do not only adopt the shadow IT but use it frequently to perform work tasks, becoming the post-adoption level essential to that phenomenon.

Accordingly, this paper defines shadow IT as any IT solution used by employees to perform work tasks with no approval or support from the company's IT department (Györy et al. 2012; Rentrop & Zimmermann 2012; Silic & Back 2014; Walters, 2013). The phenomenon named IT Consumerization and the growth of cloud computing resources have facilitated the adoption and use of technologies by users without the need of IT department support, boosting the emergence of shadow technologies.

Huber et al (2016) point out that shadow systems are decentralized solutions with a low enterprise integration such as a locally installed application, a spreadsheet, database solution, cloud service, but also an end or peripheral device, a combined solution or a legacy system that is no longer part of the IT service management. Then, Shadow IT usage encompass a variety of possibilities. Being so, we looked into shadow IT literature in an effort to clarify how individuals can use shadow technologies at work. Table 1 summarizes four instances of shadow IT usage based on a review of the literature.

Shadow IT	Description	Authors
Cloud Services	Use of Internet-based Software and Software as a Service (SaaS), such as communication and content sharing software to communicate and share work information with co-workers, clients, and partners, among others cloud services that are not authorized or is unknown by IT department. These systems are also called as Mobile Shadow IT once it can be accessed outside the workplace. Examples of these systems are WhatsApp, Facebook, Skype, Dropbox, Google Apps, etc.	Rentrop and Zimmermann (2012); Gyory et al. (2012); Fürstenau and Rothe (2014); Silic and Back (2014); Haag and Eckhardt (2014); Zimmermann, Retrop and Felden (2014); Gozman and Willcocks (2015); Huber et al. (2016); Kopper and Westner (2016); Walters (2013); Meulensteen (2014).
Self-made solutions	Use of Solutions developed by employees on the company's computers to perform their work tasks. For example, an Excel spreadsheet or an application develop by employees.	Jones et al. (2004); Rentrop and Zimmermann (2012); Fürstenau and Rothe (2014); Zimmermann, Retrop and Felden (2014); Huber et al. (2016), Kopper and Westner (2016).
Self-installed applications	Use of Software installed by employees to perform their work tasks, on the company's computers. For example, a free downloaded software.	Jones et al. (2004); Rentrop and Zimmermann (2012); Fürstenau and Rothe (2014); Zimmermann, Retrop and Felden (2014); Silic and Back (2014), Huber et al. (2016).
Self-acquired devices	Use of mobile devices (smartphones and tablets), notebooks, servers, routers, printers or other peripherals purchased by employees. These devices are purchased directly from retail rather than being ordered through the official catalog of the IT department. It includes the use of applications in the employee's personal devices at the workplace. For instance, smartphones, notebooks, tablets, etc.	Rentrop and Zimmermann (2012); Silic and Back, (2014); Zimmermann, Retrop and Felden (2014); Gozman and Willcocks (2015), Huber et al. (2016).

Table 1. Instances of Shadow IT usage according to the literature.

Another discussion concerning shadow IT is related to its outcomes to individuals and organizations. Raden (2005) point out that shadow IT is inherently inefficient and brittle and poses a real threat to an organization's agility. In a similar vein, Zimmermann, Rentrop & Felden (2016) argue that risks and inefficiencies are associated with this phenomenon, challenging organizations. However, Behrens (2009) point out that shadow systems may be bad to the core in some cases, but in others, they can be just what an organization needs: a powerful source of creativity and innovation. Rather than a threat, a research performed by Haag, Eckhardt, Bozoyan (2015), for instance, shows that shadow system usage could be very valuable for the firm by advancing the corporate IS in innovative ways and increasing employees' job performance. As can be seen, the current literature either acknowledge shadow IT as a driver of innovation and gain in productivity or defame as a risk to information security and control.

3. METHOD

We divided the research within two stages to achieve the objective of the study. Firstly, the papers were selected from several databases, considering the criteria of inclusion and exclusion, which are explained below. Secondly, the data collection and the bibliometric analysis were performed.

According to Hawkins (2001), bibliometric can be defined as "the quantitative analysis of the bibliographic features of a body of literature". De Bellis (2009) argue that the objective of a bibliometric study is to analyze the literature so as to identify patterns in the literature, such as the most prolific authors, institutions, countries, and journals within a scientific discipline, the trends of literary production over time, collaboration networks and similar.

We searched for papers on "shadow IT" and "shadow systems" in the IS domain. We included papers that the terms "shadow IT" and "shadow systems" appear in the title, abstract or keywords. We excluded the terms "feral systems/practices" and "workarounds" from the analysis because these concepts differ from shadow IT definition (see Kooper & Westner, 2016 for a taxonomy). Moreover, it is important to differentiate shadow IT from the terms "end user computing" (Rentrop & Zimmermann, 2012) and "bring your own device" (BYOD) (e.g. French, Guo & Shim, 2014; Dang-Pham & Pittayachawan, 2015) once they have different definitions. Thus, these last terms were not considered in the search. The search was conducted from May to June 2017.

As suggested by Webster and Watson (2002), we searched first within the Association for Information Systems (AIS) "basket" of eight top IS journals, namely: European Journal of Information Systems, Information Systems Journal, Information Systems Research, Journal of the Association for Information Systems, Journal of Information Technology, Journal of Management Information Systems, Journal of Strategic Information Systems, and MIS Quarterly. Following this, we searched for papers within Web of Science, Science Direct, Google Scholar and Ebsco Host databases. Additionally, we reviewed AIS net to find out conference paper about the topic. We expanded the search beyond the top journals because academic research about shadow IT is not abundant and the vast majority of the papers are from conferences.

The analysis follows the bibliometric study's objectives suggested by De Bellis (2009). We analyzed 1) the trends of research literature production, considering the number of articles, the places of publication and, the most cited papers; 2) the most prolific authors and countries; 3) the theories and methods used in the papers; and 4) a thematic analysis related to the most frequent terms in the paper's title, abstract and keywords.

Two software were used to analyzed the data. Excel was used to tabulate data and generate tables and charts. In addition, VOSviewer, which is a software tool for constructing

and visualizing bibliometric networks, was used to count the most prominent words and visualize these words through a figure (a network visualization).

4. RESULTS AND DISCUSSIONS

4.1 Papers on Shadow IT: numbers, places of publication and citation

Table 2 shows the number of papers selected about the topic, as well as its places of publication. In total, 40 papers were found that contain the term “shadow IT” or “shadow systems” in the title, abstract or keywords. As can be seen, the majority of papers (77,5 percent) about the topic were published in conferences, such as the American Conference on Information Systems (AMCIS) and the International Conference on Information Systems (ICIS). Solely 7 papers (22,5 percent) were published in journals.

	Places of Publication	Number
Journals	Network Security	2
	Computer & Security	1
	Computer Fraud & Security	1
	Information & Management	1
	Journal of Enterprise Information Management	1
	Journal of Information Systems	1
	Outros (e.g., Complex Systems Informatics and Modeling Quarterly; Systems	2
	Total	9
Conference	AMCIS	6
	ECIS	5
	ICIS	5
	PACIS	4
	Others (ACIS, ICDS, BLED, Wirtschaftsinformatik Proceedings, ECKM, Conf-irm, etc.)	11
	Total	31
	Total of Papers	

Table 2. Papers on shadow IT.

Figure 1 presents the trend of number of papers over the years, which enable to analyze the evolution in terms of numbers of papers published on shadow IT. The graphic shows that the number of papers published about the topic is increasing over the years. The oldest papers found are dated from 2004 when two papers were published about shadow IT in the Pacific Asia Conference on Information Systems (PACIS) and in the Australasian Conference on Information Systems (ACIS).

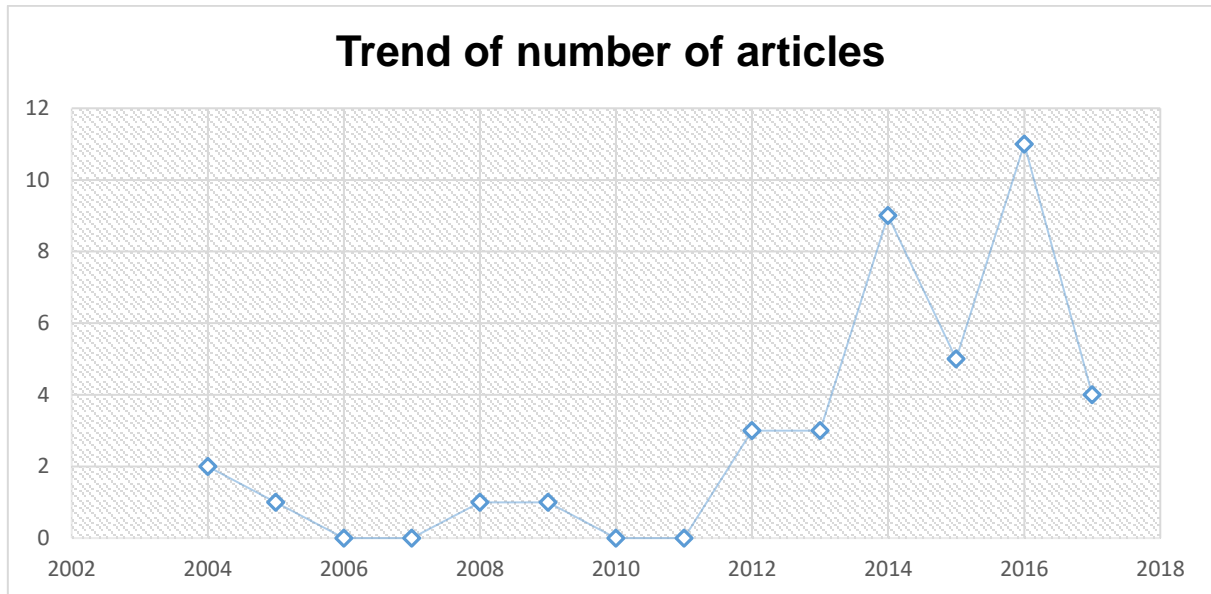


Figure 1: Trend of number of articles.

In 2012, the number of papers on shadow IT started to increase and the growth was exponentially in 2014. The largest production dated from 2016 when 11 papers were published. Moreover, it can be observed that more than 72 percent of the publications date from the last four years (2014, 2015, 2016 and 2017). It can be noted, then, that the majority of the studies on shadow IT are recent and the topic can be still considered poorly explored, although it is also gaining notoriety in the academia over the years.

The ten most-cited papers, according to Google Scholar, published about shadow IT and identified within our study are as follows:

1. **Behrens, S. (2009)**. Shadow systems: The good, the bad and the ugly. *Communications of the ACM*, 52(2), 124-129; 99 citations.
2. **Györy, A. A. B., Cleven, A., Uebernickel, F., & Brenner, W. (2012)**. Exploring the shadows: IT governance approaches to user-driven innovation. *ECIS 2012 Proceedings*. Paper 222; 87 citations.
3. **Behrens, S., & Sedera, W. (2004)**. Why do shadow systems exist after an ERP implementation? Lessons from a case study. *Proceedings of the PACIS 2004*, 136; 63 citations.
4. **Jones, D., Behrens, S., Jamieson, K., & Tansley, E. (2004)**. The rise and fall of a shadow system: Lessons for enterprise system implementation. *ACIS 2004 Proceedings*, 96; 51 citations.
5. **Silic, M., & Back, A. (2014)**. Shadow IT—A view from behind the curtain. *Computers & Security*, 45, 274-283. 47 citations.
6. **Raden, N. (2005)**. Shedding light on shadow IT: Is Excel running your business. *DSSResources.com*, 26; 34 citations.
7. **Fürstenau, D., & Rothe, H. (2014)**. Shadow IT systems: Discerning the good and the evil. *Proceedings of the Twenty-Second European Conference on Information Systems*, Tel Aviv. 29 citations.
8. **Zimmermann, S., & Rentrop, C. (2014)**. On the Emergence of Shadow IT-A Transaction Cost-Based Approach. *Proceedings of the Twenty-Second European Conference on Information Systems*, Tel Aviv. 27 citations.
9. **Rentrop, C., & Zimmermann, S. (2012)**. Shadow IT Evaluation Model. *Proceeding of The ICDS 2012: The Sixth International Conference on Digital Society*. 21 citations.

10. **Zimmermann, S., Rentrop, C., & Felden, C. (2014).** Managing Shadow IT Instances– A Method to Control Autonomous IT Solutions in the Business Departments. Proceedings of the Twentieth Americas Conference on Information Systems, Savannah. 17 citations.

4.2 Authors and Countries

Table 3 shows the most prolific authors. Among the authors, Zimmermann and Rentrop are the most successful with five published papers, followed by Haag and Eckhardt also with five published papers.

Authors	Number of publication	Percentage
Zimmermann and Rentrop	5	0,13
Haag and Eckhardt	5	0,13
Fürstenau et al.	3	0,08
Silic M. et al.	3	0,08
Mallmann and Maçada	3	0,08
Behrens	2	0,05
Others	19	0,48
Total	40	1

Table 3. The most prolific authors.

The first paper on shadow IT published by Zimmermann and Rentrop on Shadow IT dated from 2012, while the first paper of Haag and Eckhardt dated from 2014. Thus, Zimmermann and Rentrop are the most relevant authors about shadow IT up to now considering the criteria of the number of publications and time researching the topic. However, it is important to highlight that this pairs of authors have a different focus when studying shadow IT: Zimmermann and Rentrop focus on organizational level of shadow IT (e.g., IT governance to cope with shadow IT), while Haag and Eckhardt have a focus on individual level of analysis (e.g., user behavior related to shadow IT usage). Furthermore, it can be observed in Table 3 that the authorship of shadow IT papers is sprayed, being almost 50 percent of the papers from different authors.

Figure 2 shows the scientific production on shadow IT per country. The most prolific country on the topic is Germany that is responsible for half (50 percent) of the all publication on shadow IT. Australia and Switzerland are the second most prolific countries with 10 percent of the scientific production on shadow IT, followed by Brazil and UK, both with 7 percent.

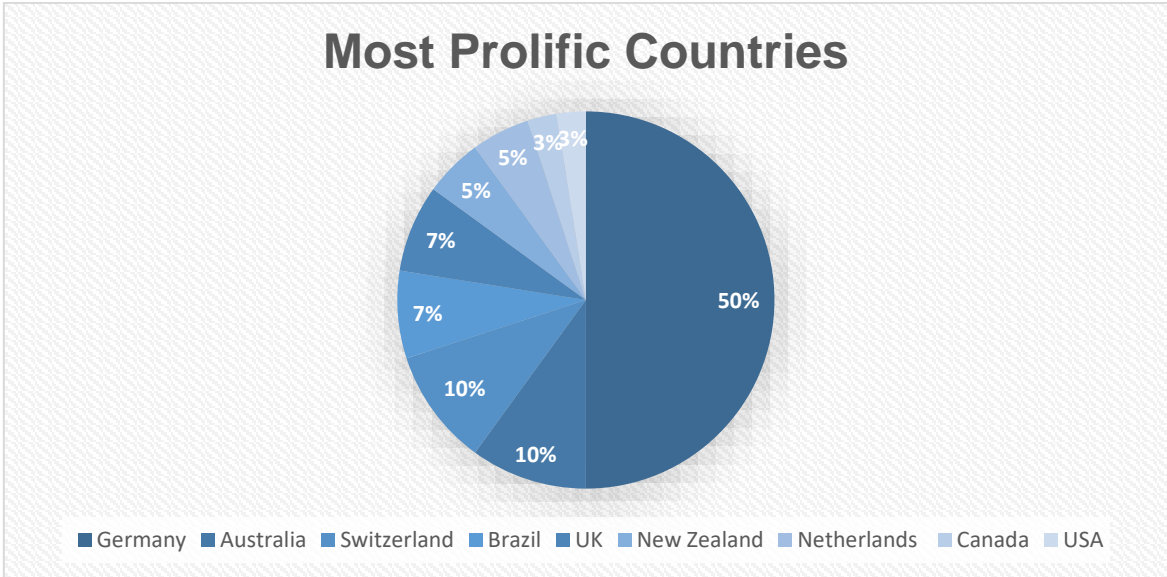


Figure 2: Most prolific countries.

4.3 Theories and Methods

Table 4 presents a relation of the theories used in the papers about shadow IT and the authors. As can be seen, the Transaction Cost Theory is the most used so far to address shadow IT, followed by the Neutralization Theory.

Theory	Authors
Transaction Cost Theory	Zimmermann, Retrop and Felden (2014); Zimmermann and Rentrop (2014); Huber et al. (2016); Zimmermann, Rentrop and Felden (2016); Lüker, Winkler, & Kude (2016).
Neutralization theory	Haag and Eckhardt (2015); Born and Krönung (2016); Silic, Barlow & Back (2017)
Social Learning Theory	Haag and Eckhardt (2014)
Motivation Theory	Haag and Eckhardt (2014b)
Social Information Processing Theory	Haag and Eckhardt (2014b)
Theory of Reasoned Action	Haag (2015)
Workaround Theory	Zimmermann, Rentrop & Felden (2017)
Procedural Justice Theory	Lüker, Winkler, & Kude (2016)
Social Presence Theory	Mallmann & Maçada (2017)
Deterrence Theory	Silic, Barlow & Back (2017)

Table 4. Theories used by authors.

We also identified the methods used in the shadow IT studies, which were divided into empirical and non-empirical studies. We adopted the categories proposed by Alavi and Carlson (1992) and Hoppen and Meirelles (2005). Table 5 presents the relations of methods by authors.

Empirical Studies	Authors	Total
Case study	Behrens & Sedera (2004); Jones et al., (2004); Zimmermann & Rentrop (2014); Singh (2015); Fürstenu et al. (2016); Huber et al. (2016); Born & Krönung (2016);	9

	Lüker et al. (2016); Zimmermann, Rentrop & Felden (2017)	
Survey	Silvius & Dols (2012); Haag (2015); Mallmann & Maçada (2016); Mallmann & Maçada (2017); Silic, Barlow & Back (2017)	5
Interviews	Chua, Storey & Chen (2014); Gozman & Willcocks (2015); Fürstenau, Sandner & Anapliotis (2016); Mallmann, Maçada & Oliveira (2016)	4
Mixed-Method	Haag & Eckhardt (2014b); Haag & Eckhardt (2015); Walterbusch, Fietz & Teuteberg (2017)	3
Multimethod	Silic & Back (2014); Silic, Silic & Oblakovic (2016); Györy et al. (2012)	3
Experiment	Haag & Eckhardt (2014a); Haag, Eckhardt & Bozoyan (2015)	2
Design science research	Zimmermann, Rentrop & Felden (2014); Fürstenau & Rothe (2014)	2
Action Design Research	Zimmermann, Rentrop & Felden (2016)	1
	Total	29
Non-empirical Studies	Authors	Total
Conceptual	Shumarova & Swatman (2008); Rentrop & Zimmermann (2012); Beimborn & Palitza (2013); Pirani & Meister (2014); Kopper & Westener (2016a); Kopper & Westner (2016b)	6
Illustrative	Raden (2005); Behrens (2009); Walters (2013); Johnson (2013); Meulensteen (2014)	5
	Total	11

Table 5. Methods used by authors.

As shown in the table above, the majority of the studies on shadow IT are empirical, totalizing 29 empirical studies. Among the methods, the case study (9 studies) was the most used, followed by survey (5 studies) and interviews (4 studies), respectively. It can also be highlighted the studies that use more than one method such as mixed-method and multi method approach. Mixed methods and multi method are two different methods conceptually because mixed-methods research requires a combination of qualitative and quantitative procedures, whereas multi method research requires a combination of qualitative or quantitative procedures (Venkatesh et al., 2013). Considering this definition, we identified 3 studies using mixed-method approach and 3 studies using multi method, totalizing 6 studies.

Regarding the non-empirical studies, 6 studies were classified as conceptual, which means that they develop, through a literature review, frameworks (e.g., Beimborn & Palitza, 2013), theoretical or conceptual model (e.g., Pirani & Meister, 2014) or a taxonomy (Kopper & Westner (2016a) to aid explaining the phenomenon. Finally, 5 studies were classified as Illustrative, that is, the papers provide discussion and recommendations toward practice.

4.4 Thematic Analysis

We also analyzed the frequency of the terms occurring in articles' title, abstract, and keywords, which are relevant because they represent the main concepts that authors intend to communicate to readers and to the scientific community. The analysis of the most prolific terms

provides an idea of what has been discussed considering the large topic of shadow IT. Figure 3 provides a visualization of the most prolific terms based on the paper's title, abstract and keywords divided into clusters.

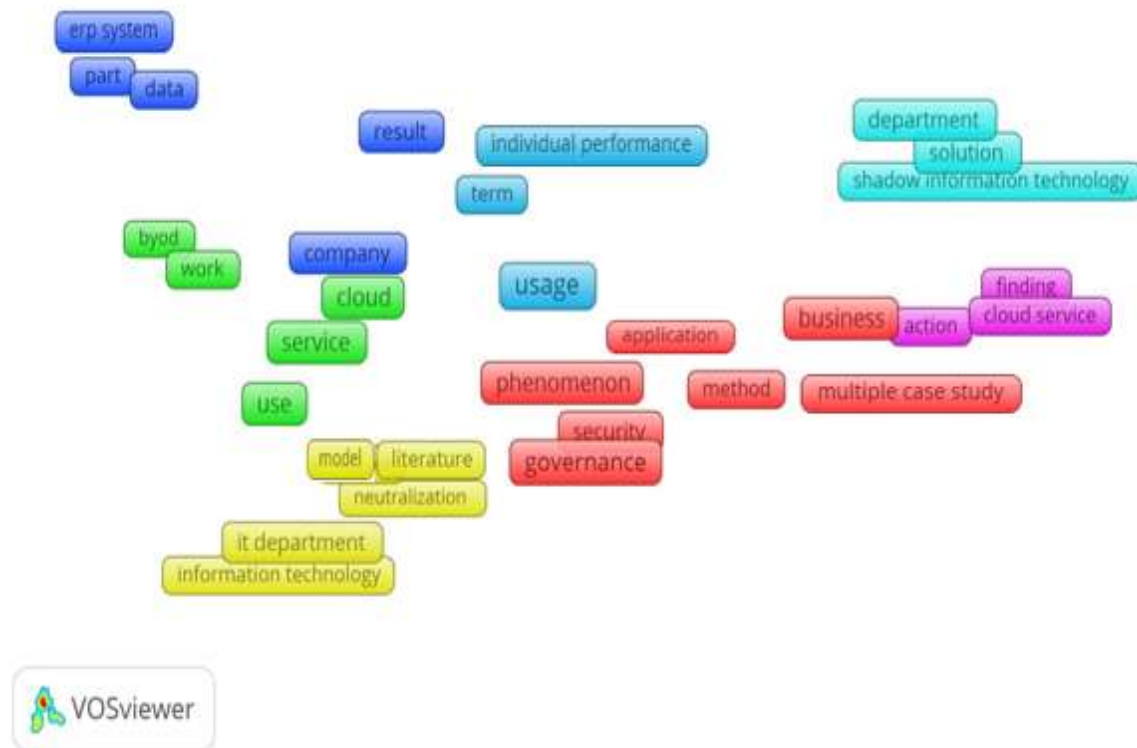


Figure 3: Visualization map of the most prolific terms based on the paper's title, abstract and keywords.

The term “ERP” appears in the dark blue cluster. Most of the articles prior to 2012 address the emergence of SIT after the adoption of ERPs (e.g. Jones et al., 2004; Behrens & Sedara, 2004; Raden, 2005). These studies discuss the emergence of shadow IT relating the use of Excel's spreadsheets, instead of the official ERP systems, to perform the work tasks. From 2012, several papers (e.g. Györy et al., 2012; Silvius & Dols, 2012) address shadow IT considering the governance approaches to control or minimize the unauthorized usage of technologies, mainly with relation to security issues. The red cluster in Figure 3 shows the term “governance” very close to the term “security”, evidencing the relationship of these terms in these studies. In addition, these studies has focus on the organizational level as can be perceived considering the terms “business” and “company” in both clusters.

The yellow cluster shows how the neutralization theory has been used to develop a literature discussion and theoretical model to address the use of unauthorized technology. This result supports the findings of the previous sections about the most used theories in the shadow IT studies. Similarly, the method “case study” appears in the figure (red cluster), also supporting the result of the most used method.

The light blue and green clusters change the focus to the individual. The most recent studies on shadow IT change the focus of analysis to the individual, what represents a complementary view of the phenomenon. Authors such as Haag and Eckhardt address this phenomenon based on a behavioral approach, which contributed to better understand and explore the origin of shadow IT. The light blue cluster provides a general idea about these

studies because several of them investigate the influence of shadow IT usage in the individual performance (e.g., Haag, Eckhardt & Bozoyan, 2015; Mallmann & Maçada, 2016, 2017).

The green cluster shows the use of cloud services to perform work tasks, which also appears in the purple cluster, as well as the use of BYOD. The shadow IT literature shows that cloud services frequently are used as an unauthorized technology inside companies (e.g., Silic & Back, 2014; Mallmann & Maçada, 2017). However, it is important to highlight that BYOD is an IT policy that permits the use of personal devices inside organization (e.g., Dang-Pham & Pittayachawan, 2015), then, BYOD is not shadow IT. The relation between these two concepts is that when a company permits the use of personal devices through a BYOD policy, it indirectly permits the use of several applications with these devices. In that sense, BYOD facilitates the use of unauthorized technologies.

To complement the analysis, Figure 4 shows a chart with the number of occurrence of the most prolific terms in the literature of shadow IT.

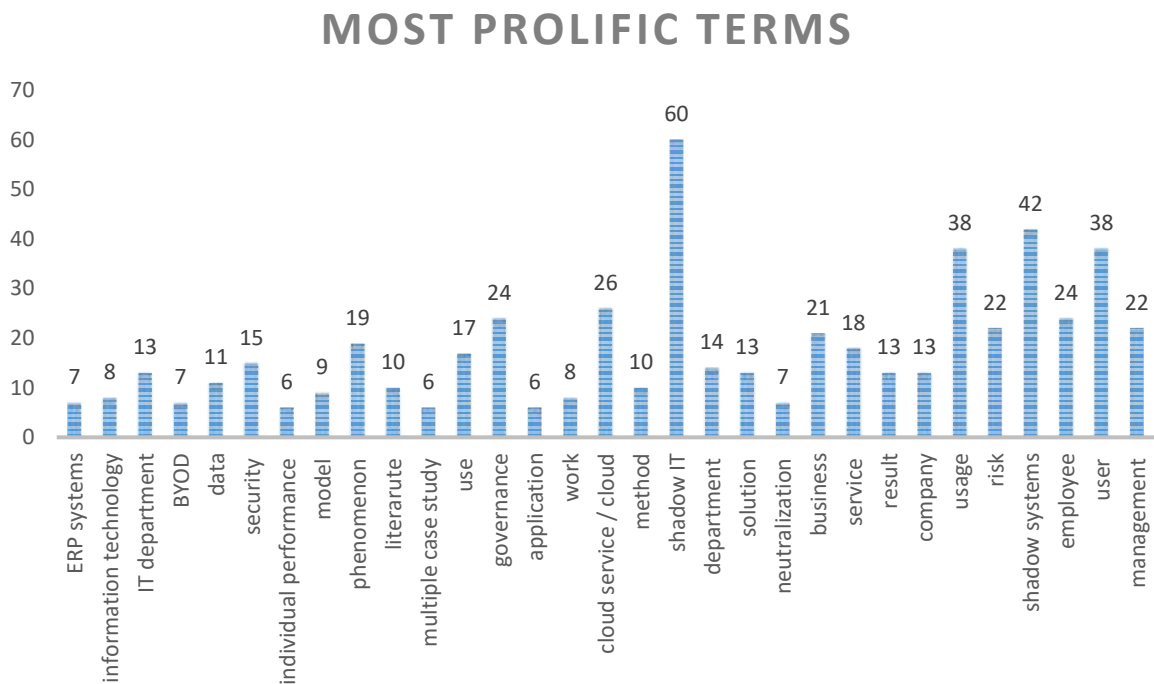


Figure 4: Chart of the most prolific terms based on the paper’s title, abstract and keywords.

As can be seen in Figure 4, the term “usage” frequent appears in papers. Related to that term, the terms “user”, “use” and “employee” also are significant in terms of occurrence. Those terms have a high occurrence in the papers that focus on the individual level and analyze the phenomenon with a behavioral approach (e.g., Haag & Eckhardt, 2014; Haag, Eckhardt & Bozoyan, 2015; Haag, 2015; Mallmann & Maçada, 2016). Examples of these occurrences are “IT usage behavior”, “IS usage” and “shadow IT usage”. The importance of those terms is due to the origin of shadow IT, which is created by employees to use in their daily work activities.

The terms “governance”, “security” and “risk” are also frequent terms used in the paper’s title, abstract, and keywords. Several papers (e.g., Györy et al., 2012; Silvius & Dols, 2012; Zimmermann & Rentrop, 2014; Furstenu et al., 2016) focus on IT governance approaches to control or minimize shadow IT usage and, consequently, ensure the security of organizational information, which is the most relevant concern regarding shadow IT. Examples of these occurrences are “IT Governance”, “information security”, “IS Security” and “IT Risk”.

The term “management” may be also highlighted in Figure 4. Keywords such as “Risk Management” (e.g., Zimmermann, Rentrop & Felden, 2014), “IT Service Management” (e.g. Rentrop & Zimmermann, 2012), “IT Management” (e.g., Mallmann, Maçada & Oliveira, 2016) and “portfolio management” (Singh, 2015) are examples of how the term “management” is used in the papers. In addition, the term “cloud” or “cloud services” are also significant in terms of occurrence. Cloud solutions are widely available nowadays, most of the time free of charge to users. Thus, cloud services frequently are used by employees as shadow IT, as already discussed above.

Finally, Figure 5 provides a big picture of the evolution in the shadow IT literature from the bibliometric analysis. As can be seen, the articles were classified into three large thematic groups, which shows the evolution of the literature over time.

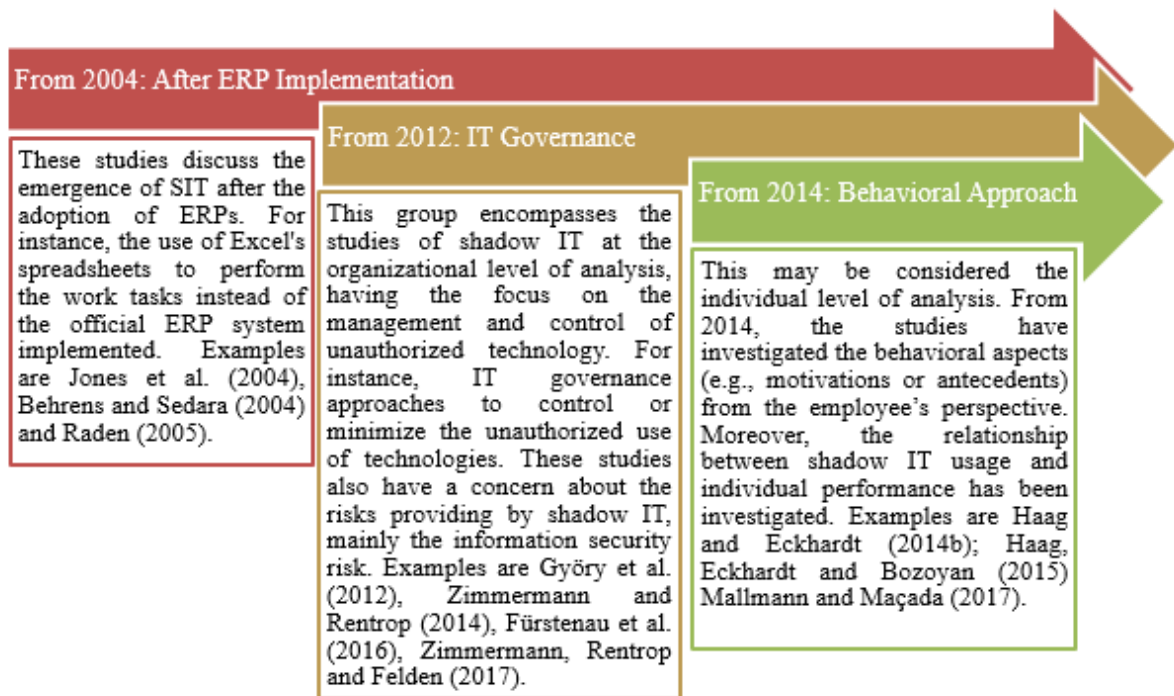


Figure 5: The evolution of Shadow IT literature.

It is important to highlight that the three groups are not isolated, they are interrelated and provides a complementary view of the phenomenon. In that sense, the thematic groups complement each other in some way to increase the understanding of shadow IT and continues evolving this emergent topic.

5. CONCLUSIONS

This paper sought to research the patterns and trends of the shadow IT literature to investigate the evolution of that topic in the IS literature. Our purpose was to perform a bibliometric analysis of the scientific publication on shadow IT considering the following criteria: 1) the trends of the literature production (number of articles, the places of publication and, the most cited papers); 2) the most prolific authors and countries; 3) the theories and methods used in the papers; and 4) a thematic analysis related to the most frequent terms in the paper's title, abstract and keywords.

Based on the analysis exposed above, the following can be concluded:

1) The study reveals that the trend of scientific literature production is positive once the number of publications is increasing. The literature about the topic is sparse, particularly in

journals, and more than 70 percent of the publications date from the last four years (2014, 2015, 2016 and 2017). Therefore, shadow IT can be still considered an unexplored topic, although it is gaining notoriety in the academia;

2) The most productive country is Germany that is responsible for half of the articles published on shadow IT. Moreover, Zimmermann and Rentrop and Haag and Eckhardt are the most prolific authors on shadow IT, being the first pair focus at organizational level of analysis (e.g., IT governance) and the second one at the individual level (e.g., behavioral approach);

3) Most of the studies on shadow IT are empirical, with the case study being the most widely used method, followed by survey. Regarding theories, the study found that Transaction Cost Theory is the most used to address shadow IT, followed by the Neutralization Theory;

4) Related to the thematic analysis, we found that the thematic of shadow IT studies is changing over time, which was classified into three large thematic groups. The first thematic was the raising of shadow IT after ERP implementation. Second, IT governance to cope with shadow IT and minimize security risk. Third, the focus on the individual to analyze the behavioral aspects of shadow IT usage. Moreover, cloud services is a very prolific term in shadow IT literature, supporting the relationship of these solution and unauthorized technologies.

This study has some limitations. The thematic analysis was based on the title, abstract and keywords only. Thus, it is possible that the results could have been different if the whole paper had been analyzed. In addition, the interpretation of the clusters in the visualization map was qualitative and, consequently, has a subjective bias. The limited number of papers in journals also can be considered a limitation.

This study contributes in the sense that analyzes characteristics patterns and trends of the shadow IT literature, exploring how the topic has evolved over the years. Another strength of this study is that the knowledge provided by this bibliometric analysis such as the evolution of terms and thematic analyze has not yet been used in the analysis of literature production of shadow IT up to now.

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