WE ARE SOCIAL: A SOCIAL INFLUENCE PERSPECTIVE TO INVESTIGATE SHADOW IT USAGE.

Research paper

Mallmann, Gabriela L., School of Management, Federal University of Rio Grande do Sul, Brazil, gabilmallmann@gmail.com

Maçada, Antônio C. G., School of Management, Federal University of Rio Grande do Sul, Brazil, acgmacada@ea.ufrgs.br

Eckhardt, Andreas, German Graduate School of Management and Law, Germany, andreas.eckhardt@ggs.de

Abstract

Shadow IT can be used by one individual or a group of employees, which suggest two levels of use: an individual and collective use of shadow IT. The study takes a social influence perspective to investigate the mechanisms that underlie the dissemination process of shadow IT among users and uncover the reasons why they use shadow IT. We performed a survey among employees of four companies. The results show that the social influence varies depending on the group of reference in question (peer, superior, mass influence). We found that employees are strongly influenced by their peers and by a mass of people to use a shadow IT, such as co-workers, professional workmates, and employees from other departments, suggesting a broader range of social influence that can affect the use of shadow IT. We aid to clarify some reasons why employee uses shadow IT and how the dissemination process occurs among users. Also, as social influence is based on communication and social interactions, organizations may pay attention in creating initiatives and taking actions to engaged users in the information security policies, which is one of the primary concern related to shadow IT.

Keywords: Shadow IT, Social Influence, deviant work behaviour, IT management.

1   Introduction

"No man is an island entire of itself; every man is a piece of the continent, a part of the main," said the 17th-century British poet John Donne. Over the years, science has been proving that he was right, indeed. Individuals exist within society; they are influenced by society and influence the society (Stets and Burke, 2000). The fact is that human's brain is designed to be influenced by others because they are built to ensure that we will hold the beliefs and values of people around us (Lieberman, 2013). In few words, we are social, and that can be influencing our behaviour regarding the technological choices as well.

The pervasiveness of technology is causing relevant changes to individuals, organizations, and society. In addition to the greater availability of technology, it is also notable the increasing knowledge and ability of users regarding the use of technology (e.g., Eckhardt, Laumer and Nguyen, 2010; Carter and Gruver, 2015). These two factors together are bringing several challenges to manage technology within organizations. People are finding ways to use consumer technologies from their personal lives in the workplace (e.g., Harris, Ives and Junglas, 2012). As a consequence, the traditional IT adoption logics have been completely reversed in the last years because, instead of IT departments deciding which solution their employees should use, employees autonomously adopt and use solution that meets their needs at work (Stryker and Burke, 2000; Haag and Eckhardt, 2017).

Within the context exposed above, emerges the use of unauthorized technology in the workplace called shadow IT usage. The literature posits that this phenomenon emerges at the individual level (e.g., Györy et al., 2012; Haag, Eckhardt, and Bozoyan, 2015). Shadow IT is a form of decentralized computing implemented by individuals, workgroups or whole business units (e.g., Zimmermann and Rentrop, 2014; Furstenau, Rothe, and Sandner, 2017), which suggest the adoption and use of shadow IT may disseminate among employees within a company.

Although people frequently think of themselves as "independent-minded and immune of some kinds of social influence", others are daily influencing us in many ways (Lieberman, 2013). Considering the individual as a member of a group that is influenced and influences others, we ask:

RQ: What factors drive the use of shadow IT among individuals?

We take a social influence perspective to investigate the mechanisms that underlie this process and uncover the reasons why employee uses shadow IT, as well as why shadow IT usage disseminates from one individual to another, spreading to a whole group of people. In that sense, we use the social influence perspective to capture the cumulative individual effect of these influences on individual behaviour (e.g., Karahanna, Straub and Chervany, 1999). The findings suggest that employees are strongly influenced by their peers and by a mass of people, in general, to use a shadow IT, such as co-workers, professional work-mates, and employees from other departments, suggesting a broader range of social influence that can affect the individual.

Understanding the effect of social influence on IS usage it is not a recent concern. Since more than a quarter century, social influence is considered as a focal determinant for individual's behavioural intention and, consequently, profoundly affects user behaviour (e.g., Li, 2013; Wang, Meister and Gray, 2013; Hsu and Lu, 2004). Previous studies have identified that the social structure and user's environment are also determinants for the proliferation of IT use and its benefits from individual to organizational level (e.g., DeLone and McLean, 2003; Eckhardt, Laumer and Nguyen, 2010). In addition, social influence has greater importance for the use of work systems since the use of these systems has a more tangible and extrinsic value (Eckhardt, Laumer and Nguyen, 2010). Thus, we use the social influence perspective to investigate the use and dissemination of shadow IT among employees in the workplace.

Although shadow IT is not a new phenomenon, it demands further studies from new perspectives in order to reveal, explain, and control its challenges, as well as to exploit its opportunities (Haag and Eckhardt, 2017; Silic, Barlow and Back, 2017). Furthermore, investigating individual behaviour related to the use of technology is central to manage shadow IT since it emerges from the employee's level (Györy et al., 2012; Haag, Eckhardt, and Bozoyan, 2015; Furstenau, Rothe, and Sandner, 2017). Regarding the theoretical lens, managers and research need to understand how social influence occurs and affects the potential IS user to prevent malicious IS use (Eckhardt, Laumer and Nguyen, 2010).

The paper advances as follow. The following section provides the theoretical background of shadow IT and social influence. Next, we developed the hypotheses of our research mode. The following methodology section describes the applied research method. The result section presents the statistical analysis. Next section discusses the results and implications for theory and practice, as well as the limitations and further research.

2 Theoretical Background

2.1 Shadow IT

Shadow IT can be any hardware, software, or services built, introduced, and/or used to work without explicit approval or even knowledge of the organization (e.g., Silic and Back, 2014; Haag and Eckhardt, 2017). The term shadow IT refers, then, to the unauthorized information technology and its usage has been referred as shadow IT usage. This paper follows the definition of shadow IT usage provided by Haag and Eckhardt (2014), which states that shadow IT usage is "the voluntary usage of

any IT resource violating injunctive IT norms at the workplace as reaction to perceived situational constraints with the intent to enhance the work performance, but not to harm the organization".

Shadow IT is a form of decentralized computing implemented by individuals, workgroups or whole business units (e.g., Zimmermann and Rentrop, 2014; Furstenau, Rothe, and Sandner, 2017). Depending on their business needs, different units and individuals implement a wide range of solutions, using a variety of unauthorized technologies (e.g., Huber et al., 2017). Thus, employees can use shadow IT in a variety of ways: shadow IT can be a hardware, software, or any other solution, such as a ready-made spreadsheet, cloud services, or a self-developed application (e.g., Silic and Back, 2014; Zimmermann, Rentrop and Felden, 2017).

We reviewed the shadow IT literature in an effort to clarify how individuals use shadow IT at work. Four types of shadow IT emerged. The first, called unauthorized cloud services, represents the software accessed through the internet (e.g. Furstenau and Rothe, 2014; Haag, 2015; Walterbusch, Fietz and Teuteberg, 2017) and, thereby, to be used, it does not need to be installed in any device. The second, self-developed solutions are solutions developed and used by employees on the company's computers to perform their work tasks (e.g. Zimmermann, Rentrop and Felden, 2014; Zimmermann, Rentrop and Felden, 2017), which may vary from a simple excel spreadsheet to a more complex application developed by employees to be used by a whole business unit. The third are self-installed software applications are those installed and used by employees on the company's devices (e.g. computers, smartphones or tablets provided by the company) (e.g. Jones et al. 2004; Silic and Back, 2014). This type of shadow IT usage involves solutions that are often freely available on the web and need to be downloaded and installed prior to use, instead of accessed via internet. Finally and fourth, self-acquired devices represent the hardware layer of shadow IT since it represents the devices purchased and owned by the employees instead of the company's devices, including the use of applications in the employee's personal devices at the workplace (e.g. Rentrop and Zimmermann, 2012; Zimmermann, Rentrop and Felden, 2017). Table 1 summarizes the findings from the literature.

Shadow IT Usage Types	Description	Authors
Unapproved cloud services	Use of Internet-based Software and Software as a Service (SaaS) that are not approved or unknown by IT department. These systems are also called as Mobile Shadow IT once it can be accessed outside the workplace (e.g., WhatsApp, Facebook, Skype for Web, 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); Huber et al. (2016); Walters (2013); Walterbusch, Fietz and Teuteberg (2017).
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 developed by employees.	Jones et al. (2004); Rentrop and Zimmermann (2012); Fürstenau and Rothe (2014); Zimmermann et al. (2014); Huber et al. (2016), Kopper and Westner (2016b).
Self-installed applications	Use of software installed by employees to perform their work tasks, on the company's computers. For example, downloading and installing software available free of charge on the internet.	Jones et al. (2004); Rentrop and Zimmermann (2012); Fürstenau and Rothe (2014); Zimmermann et al. (2014); Silic and Back (2014).
Self-acquired devices	Use of devices owned by employees. These devices are purchased directly from retail rather than being ordered through the official catalogue of the IT department. It includes the use of applications in the employee's personal devices at the workplace (smartphones, tablets, notebooks, etc.).	Rentrop and Zimmermann (2012); Silic and Back, (2014); Zimmermann et al. (2014); Gozman and Willcocks (2015), Huber et al. (2016).

Table 1.   Types of shadow IT usage.

Previous studies suggest that shadow IT emerges at the employee's level (e.g., Györy et al., 2012; Furstenau, Rothe, and Sandner, 2017) and can be used by one individual or a group of individuals, that is, an individual and/or collective use of shadow IT. Figure 1 shows the dissemination paths of shadow IT usage among employees.
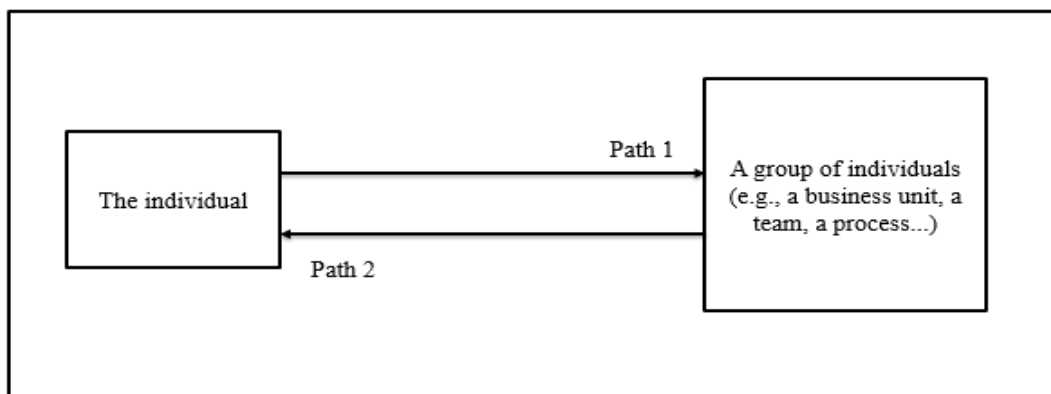

Figure 1.   Dissemination paths of Shadow IT usage

Path 1 represents the situations when an individual uses a shadow IT to perform his/her work tasks and, after some time, others employees adopt and use the same shadow IT. In turn, Path 2 represents the situation when a group of individual (e.g., team or department) adopts and use the shadow IT as their work solution and, as new individuals join this group, they consequently adopt and use the same shadow IT as others in the group. Therefore, there are social mechanisms that underlie the adoption and dissemination process of use shadow IT among employees.

2.1.1   What is not Shadow IT? Related concepts

To a better definition of shadow IT, it is crucial to define what is and what is not shadow IT. Haag and Eckhardt (2017) highlight that shadow IT distinguishes from closely related concepts such as workaround, bring-your-own (BYO), and IT consumerization. Although those concepts carry some similarities, there are crucial differences that "characterize and justify shadow IT as a unique and relevant concept worthy of future investigation" (Haag and Eckhardt, 2017).

Workarounds are, in a broader way, conscious adaptations of work activities that are not expected or specified to be changed in this manner (Laumer et al. 2017). They are implemented to address constraints related to target IT, personal IT, and/or the IT policies perceived by employees as challenging for their work (e.g., task performance) (Alter, 2014). Therefore, employees create other means to solve those restrictions and help them to perform their work task.

Haag and Eckhardt, 2017 point out three instances of workarounds: 1) non-IT-based workarounds without using any IT, for example, using paper to collect and process information; adapt the mandatory IT and/or approved personal IT and use it in different and unexpected ways, for example, by using MS Word to convert and re-edit contents of PDF documents; and 3) shadow IT, which is bringing unapproved IT and/or change approved IT in unapproved ways, for example, by creating MS Excel macros without approval to automate repetitive work tasks. Considering the definition of shadow IT presented previously, shadow IT can be a workaround, although it is not necessarily a workaround because it is related to the technology, while workaround can also be related to non-IT-devices. In that sense, workaround is a broader concept that encompasses other instances, including shadow IT and both terms can be classified as deviant work behaviour.

Others concepts frequently linked to shadow IT and workarounds are IT consumerization and BYOD. Although these concepts as related to workarounds and shadow IT, they are not a deviant behaviour itself. BYOD can facilitate or drive shadow IT usage because employees can use their device in an inappropriate way. However, BYOD cannot be considered a deviant behaviour once it is a policy that allows employees to bring and use personal devices at work (e.g., French et al. 2014). Finally, IT con-

sumerization is the adoption of consumer devices and applications by employees (Harris, Ives, and Junglas, 2012). That is a broader concept related to all the prior ones (e.g., Haag and Eckhardt, 2017) because consumer IT can be related to the IT-supported solution, to the personal IT (e.g., BYOD) or to the unapproved consumer IT (e.g., shadow IT or workaround).

2.2   Social Influence and IS Usage

Social influence is defined as a change in thoughts, feelings, attitudes or behaviour of an individual that results from the communication and interaction with another person or with a group (Eckhardt, Laumer and Nguyen, 2010; Ogara, Koh and Prybutok, 2014). In a general way, the background of social influence has its roots in the nature of changes that are caused by a particular communication or type of communication among individuals (Kelman, 1958).

Social influence has been considered as a major determinant for individual's behavioural intention and, consequently, profoundly affects user behaviour (e.g., Venkatesh and Davis, 2000; Hsu and Lu, 2004; Li, 2013; Wang, Meister and Gray, 2013). That is because people are more likely to perform a behaviour when they believe that referents think they should perform the behaviour (e.g., use new technology) and they are encouraged to satisfy the expectations of these referents (Venkatesh et al. 2003; Jiang et al., 2016).

Subjective Norm (SN) is the dominant conceptualization of social influence (Lee, Lee and Lee, 2006; Wang, Meister and Gray, 2013). In IS research, the investigation of social influence is linked mostly to the perception of subjective norm and its effect on the adoption and use of technology by individuals (Eckhardt, Laumer and Nguyen, 2010). In line with previous research (e.g., Venkatesh and Morris, 2000; Venkatesh and Davis, 2000; Venkatesh et al. 2003), we used subjective norms to analyse and measure social influence in our study.

Performing a literature review on social influence, Eckhardt and his colleagues found that the point of adoption (pre-adoption vs post adoption) and the degree of free decision-making (mandatory vs voluntary) do not affect the impact of social influence (Eckhardt, Laumer, and Weitzel, 2009; Eckhardt, Laumer and Nguyen, 2010). Therefore, these aspects are not a concern in our study.

Top managers, supervisors, subordinates, colleges, organization's IT department, local computer technology experts, and friends can be possible salient referents for the social influence component regarding individuals' adoption and usage of IT in organizations (e.g., Karahanna, Straub and Chervany, 1999; Wang, Meister and Gray, 2013). Regarding this aspect, Eckhardt, Laumer, and Weitzel (2009) suggest that social influence is more significant with an individualized measurement than with the basic collective measurement (e.g., "important others"), because individual measures specify the groups of people that exert the influence (e.g., friends, co-workers, superiors). Taking all these aspects in mind, we contextualize the choices regarding the research model in the next section.

3   Research Model and Hypotheses Development

As discussed in the literature review, changes in behaviour due to interaction with others, especially people considered important or close, can influence individual's behaviour and choices (e.g., Ogara, Koh and Prybutok, 2014). Social influence is critical to understand user behaviour because they could play an essential role in determining how users make their decisions about adopting and using new technologies (Venkatesh and Morris, 2000).

The usage context here is the use of unauthorized information technology to perform work tasks inside organizations, therefore, shadow IT is the target technology for this study (Hong et al. 2013). Previous studies suggest that shadow IT can be used by one individual or a group of individuals, which means that the use of shadow IT disseminates among employees (e.g., Györy et al., 2012; Furstenau, Rothe, and Sandner, 2017). Moreover, the current IS literature suggests that IT department is losing the influence on the choice of technology used by employees to perform their work (e.g., Stryker and Burke, 2000; Eckhardt, Laumer and Nguyen, 2010). This influence, then, may be coming from people like co-workers, friends, professionals, or even from the head of the business unit. Within this context, the

social influence perspective was used as a theoretical lens to investigate the use of shadow IT among employees. We decided to use the social influence perspective, which is an established construct of IS field, to investigate the use of technology among individuals in the context of shadow IT as a manner to capture the cumulative individual effect of these influences on individual behaviour (e.g., Karahanna, Straub and Chervany, 1999). That is, we suggest that social influence may be an antecedent of shadow IT usage among employees.

An individualized measurement was used to specify the groups of people (Eckhardt, Laumer and Nguyen, 2010). We identified three groups that may exert social influence in the shadow IT context within organizations, based on prior research in social influence: peer, superior and mass influence (e.g., Hsu and Lu, 2004; Lee, Lee and Lee, 2006; Wang, Meister and Gray, 2013). Although there are several possible referents (e.g., Karahanna, Straub and Chervany, 1999), we selected the salient ones considering the research context. The influence from subordinates and IT department were not considered because 1) most of IT users that use shadow IT do not have subordinates in the hierarchy and 2) shadow IT is regarding the use of unauthorised technology, then it is a deviant work behaviour and not related to the IT department influence. Thereby, we theorized that, in the shadow IT context, employees may be influenced by immediate referents (peers and superiors) toward the use of shadow IT, and, in a broader sense, they can be influenced by a larger and more distant group of people (mass influence), which can be employees form others departments or company's units and colleagues of the same profession.

We focus first on hypothesizing the social influence effects of an individual's immediate referents in the workplace, that is, peer and superior influence. Peers are defined as people (e.g., colleagues, workmates) who work in the same business unit, team or department and, consequently, they have some work task in common, while superiors are defined as all people (e.g., managers, supervisors) in an individual's business unit, team or department who hold higher-level positions (e.g., Wang, Meister and Gray, 2013).

Peer pressure and superiors' influence are well recognized as determinants in technology usage contexts (e.g., Malhotra and Galleta, 2005; Wang, Meister and Gray, 2013). Influence from peers and superiors can play an essential role in determining user behaviour since individuals focus their perceptions to general and abstract criteria that includes complying with the ideas of peers and superiors (Venkatesh and Morris, 2000). This influence can be stronger if the individual perceives the peer or superior as a computer technology expert (e.g., Karahanna, Straub and Chervany, 1999; Weiß and Leimeister, 2012). For instance, if a workmate suggests that a particular technology may be useful to perform work tasks, the person considers this suggestion and are influenced by it and, consequently, starts to use that technology at work (Venkatesh and Davis, 2000).

Extant research points out that the business units are in a better position now to create new digital streams for themselves and engaging with digital tools more intensely than ever (e.g., Furstenau and Rothe, 2014). Consequently, it is becoming increasingly difficult for IT managers to govern the growing variety of IT systems within companies. Moreover, business units are gaining their budget to implement IT solution without the traditional process of consulting the IT department, which is causing individual impacts to employee's work consequently. In this context, digital companies are being driven by a new generation of business managers and employees who do not need technology to be contextualized by an IT department. For example, the head of a team or department can influence his employees to use a certain technology because he considers this technology as more efficient than the mandatory technology. Thus, the employee's choice regarding the technology to perform the work tasks may be influenced by workmates or by the business unit leader that may indicate a solution outside the official scope of the IT department. Consistent with the above arguments, we hypothesised:

H1: Peers influence is positively related to shadow IT usage.
H2: Superiors influence is positively related to shadow IT usage.

Mass influence refers to the fact that a broader range of people can influence the individual. The network externalities is the underlying theoretical concept, which states that the value of a network increases with the square of its number of users (Hsu and Lu, 2004). The more people adopt a particular technology, the stronger the influence of others, and the higher perceived value of the technology (Sun, 2013). Wang, Meister and Gray (2013) examined the influence of individual's extended professional population within the organization, which they define as employees that perform the same kind of work, but do not work in the same location. In the digital and globalized companies nowadays, technology is the primary way of interactions. For instance, employees, frequently, have to communicate and interact with workmates partners and clients geographically distributed, which represent a broader range of social influences. To give a more concrete example, an employee can find out a solution to perform the tasks faster than using the mandatory solution and share that new finding with colleagues of other units and departments. Thus, it is necessary to extend the influence beyond immediate colleagues, providing an additional source of social influence (Wang, Meister and Gray, 2013).

Several factors may explain why individuals tend to converge on the same technology. For instance, mass influence can be related to a concept called IT fashion. An IT fashion is a collective transient belief that information technology is cutting-edge regarding innovation, efficiency and practicality (Wang, 2010). In that sense, the belief that the technology is making it known and "fashion" among users, may influence other employees behaviour toward this technology. Similarly, it can lead to a phenomenon called herd behaviour, when people converge on the same form of technology by imitating each other's choices (e.g., Sun, 2013). Thus, we hypothesized:

H3: Mass influence is positively related to shadow IT usage.

Finally, we theorized that an individual's hierarchical level has a moderating effect on the relationship between social influence constructs and shadow IT usage. Previous studies suggest that the need to use shadow IT is more prominent among the new generation of technology users and top managers of the organizations (Weiß and Leimeister, 2012; Harris, Ives, and Junglas, 2012; Silic and Back, 2014; Zimmermann, Rentrop and Felden, 2014). It is suitable to infer that, on average, there is a relation between age and hierarchical level since young people tend to occupy lower-level positions (e.g., interns and assistants), while higher-level positions tend to be occupied by more seniors people (e.g., managers, supervisors and presidents).

Compared to junior positions, employees in senior positions are more visible and are more likely to influence others due to their status and expertise. Therefore, high-level senior leaders are less likely to be influenced in general, while low-level junior employees more likely to be influenced by others (Wang, Meister and Gray, 2013). Our last hypothesis says:

H4: Hierarchical level moderates the relationship between a) peers influence; b) superiors influence; c) mass influence, and shadow IT usage in a way that, people who have a higher hierarchical level in the organization are less likely to be influenced by other employees.

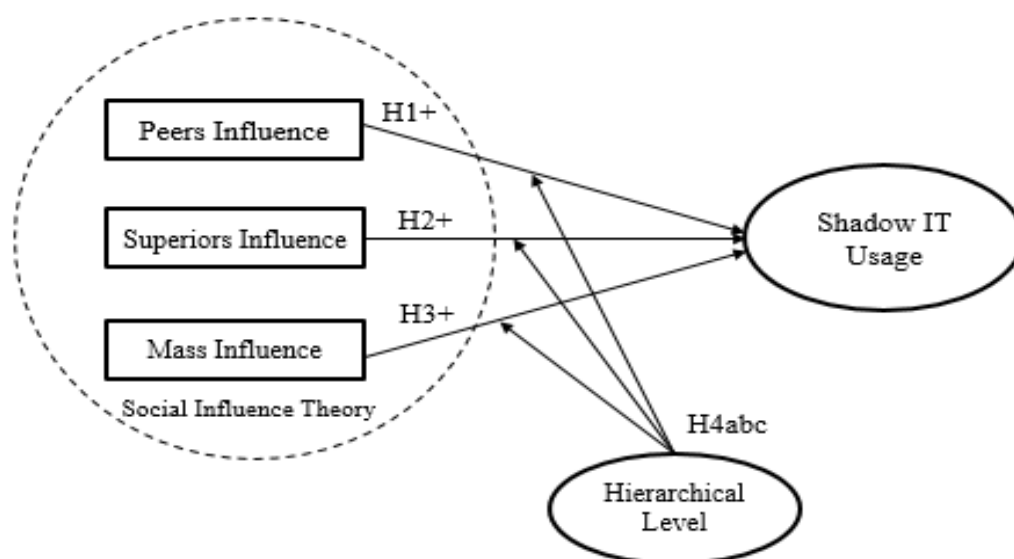The study, thus, set up the research model as appearing in Figure 2.

Figure 2.   Research Model

4   Method

We conducted a field survey to test our model and hypotheses. First, a questionnaire was designed based on the existing IS literature to collect data. Two further steps were incorporated to ensure the validity and reliability of the measures. First, two postgraduate students from IS field were consulted to proofread and validate the questionnaire. Second, a pilot study with 34 respondents from a large media company was conducted to test the research model and the questionnaire items.

The sample consisted exclusively of IT users from administrative departments. By administrative departments, we mean employees who work in departments such as marketing, human resources, financial, commercial and sales. We do not include IT employees in the sample because their context is significantly different from employees from others business areas. The questionnaire was distributed by e-mail using a link. An initial email was sent in September 2017 to IT managers of five organizations. Four organizations from different sectors engaged in the study (retail, education, financial and communication). We ensured confidentiality to the respondents and companies. A total sample of 148 respondents from four organizations completed the survey. The software GPower 3.1 was used to calculate the minimum sample size, considering the number of predictors (3), statistical power (80%), probability of error (0,05), and the effect size f2 (0,15), according to Hair et al. (2014). The result showed that the sample size provides actual power to detect significant effects.

Regarding the measurement item, all items of the variables were measured on a 7-point Likert scale, on which '1=strongly disagree' and '7 = strongly agree'. The study measured each dimension of social influence by using existing research and scales. More specifically, the constructs of peer influence (four items) and superiors influence (three items) was operationalized from previous studies such as Venkatesh et al. (2003), Wang, Meister and Gray (2013), and Ogara, Kuch and Prybutok (2014) (i.e., "My workmates use shadow IT to perform their work tasks." and "The boss of my team/department told us about the usefulness of shadow IT."). Mass influence (three items) was based on the studies of Hsu and Lu (2004) and Wang, Meister and Gray (2013) (i.e., "Colleagues from other business units use shadow IT to perform their work." and "Many people in my company use shadow IT to accomplish their work tasks.").

The dependent variable Shadow IT Usage was based on previous studies about shadow IT such as Haag and Eckhardt (2014), Silic and Back (2014) and Silic et al. (2017). The items of shadow IT usage were designed based on the four types of shadow IT from the literature (see Table 1) and it was

assessed based on subjective measures, which is in line with previous studies on shadow IT at individual level (e.g., Haag and Eckhardt 2014; Haag, Eckhardt, and Bozoyan 2015; Silic et al. 2017). Finally, the moderator variable hierarchical level was measured on a 2-point scale (yes, if the respondent occupies a management position, or no if he/she does not).

5 Analysis and Results

The dataset was analysed using Partial Least Squares SEM (PLS-SEM) structural equation modelling (Hair et al., 2014). PLS- SEM is an appropriate method if the research objective is prediction and theory development and has become a good alternative to Covariance-based SEM (CB-SEM) for estimating theoretically justified cause-effect relationship models especially when the sample size is small (Hair, Ringle, and Sarstedt, 2011). The software SmartPLS 3.0 was used for model calculation and testing. Following the PLS-SEM guidelines (e.g., Hair et al., 2014), the study performed a two-stage approach to evaluation: (1) assessment of measurement model and (2) estimation of structural model and hypothesis tests.

5.1 Assessment of the measurement model

All constructs drew on a reflective measurement model in this study (Hair et al., 2014). First, the reliability and validity of constructs were assessed with several statistical tests. The analysis of internal consistency and the scale reliability were checked with Composite Reliability (CR), which is a more appropriate criterion to measure internal consistency reliability according to Hair et al. (2014). Values of CR between 0.60 to 0.70 are "acceptable" in exploratory research, whereas values higher than 0.70 are "satisfactory to good" (Hair et al., 2014). All CR values are above the minimum threshold of 0.6, demonstrating that all the constructs have high levels of internal consistency reliability.

The outer loadings of the indicators and the average variance extracted (AVE) are considered to establish convergent validity. The outer loadings values ranged from 0.604 to 0.964, being two values below the threshold of 0.70 (Hair et al., 2014). Following Hair et al. (2014) guidelines, we decided to retain these reflective indicators because their deletion does not lead to a considerable increase in the AVE and the composite reliability values. Next, convergent validity of the variables was calculated using Average Variance Extracted (AVE), that should be higher than 0.50 (Hair et al., 2011). With a minimum of 0.50, all AVE values are higher than the acceptable threshold of 0.5, demonstrating convergent validity for all constructs. Table 2 report the results of the Composite Reliability, AVE and Correlation matrix of constructs.

Constructs	CR	AVE	Mass Influence	Peer Influence	Shadow IT Usage	Superior Influence
Mass Influence	0.969	0.911	**0.955**			
Peer Influence	0.941	0.801	0.889	**0.895**		
Shadow IT usage	0.814	0.526	0.733	0.729	**0.725**	
Superior Influence	0.957	0.881	0.655	0.719	0.586	**0.939**

Table 2.   Composite Reliability (CR), AVE and Correlation matrix of constructs.

Discriminant validity determines the extent to which a construct is empirically distinct from other constructs in the path model. Following Fornell and Larcker criterion, the square root of AVE in each latent variable must be higher than the correlation values with all other latent variables (Hair et al., 2014). The correlation matrix in Table 2 shows that discriminant validity was, thus, established for all constructs in this study.

5.2 Estimation of the structural model

After establishing reliability and validity of the construct measures, the study assessed the structural model, which involves examining the model's predictive capabilities and the relationships between the constructs (Hair et al., 2014). The results are based on the application of the bootstrapping procedure provided by SmartPLS. We follow Hair, Ringle and Sarstedt (2011) guidelines for a minimum number of 5,000 bootstrap samples.

Table 3 shows the hypothesis testing for relationships among constructs. The path coefficients represent the hypothesized relationships among the constructs (Hair et al., 2014). As can be seen, two out of three paths are significant on the $p < 0.05$-level (sig. level =5%) and $p < 0.01$-level (sig. level =1%). Mass influence had the strongest effect on shadow IT usage ($\beta = 0.394$, $p < 0.01$), followed by peer influence ($\beta = 0.296$, $p < 0.05$). Therefore, H1 and H3 were supported. The relationship between superior influence and shadow IT usage was not statistically significant ($\beta = 0.115$, $p > 0.1$), then, H2 was not supported.

Hypothesis	Path	Path coefficient	Standard error	t-Statistic (a)	Valour P	Decision
H1	Peer ➜ SITU	0.296	0.140	2.110**	0.035	Supported
H2	Superior ➜ SITU	0.115	0.094	1.23	0.221	Not Supported
H3	Mass ➜ SITU	0.394	0.126	3.124***	0.002	Supported

*Table 3.   Hypothesis testing for relationships among constructs. (a) t-values for two-tailed test: ** 1.96 (sig. level =5%); *** t-value 2.57 (sig. level =1%) (Hair et al., 2011).*

The R^2 value of each endogenous construct is a measure of the variance explained in each endogenous construct and the model's predictive accuracy (Hair et al., 2014). To social and behavioural sciences, Cohen (1988) suggests assessing the R^2 values for endogenous latent variables as follows: 26% as a substantial effect, 13% as moderate, and 2% as weak. The R^2 value of the endogenous variable shadow IT usage is 0.572, suggesting that the antecedents (social influence groups) explained 57.2% of the variance in the dependent variable shadow IT usage. Thus, R^2 value is considerably high.

Stone–Geisser's Q^2 measure was calculated to assess the model predictive relevance. Q^2 values must be larger than zero, indicating that the exogenous constructs have predictive relevance for the endogenous construct under consideration (Hair, Ringle and Sarstedt, 2011). Running the blindfolding procedure with an omission distance of seven yielded, the cross-validated redundancy values for the endogenous variable shadow IT usage: 0.283 were above zero, supporting the model's predictive relevance. Finally, the study assessed the standardized root mean square residual (SRMR) as an appropriate measure of model fit. Assuming a cut-off value of 0.08 as the more adequate for PLS path models (Henseler, Hubona and Ray, 2016), the SRMR value resulted was 0.06. Thus, the model shows an acceptable fit. Figure 3 shows the research model with the results from the bootstrapping procedure (path coefficients, the significance of the paths, and the amount of variance explained).
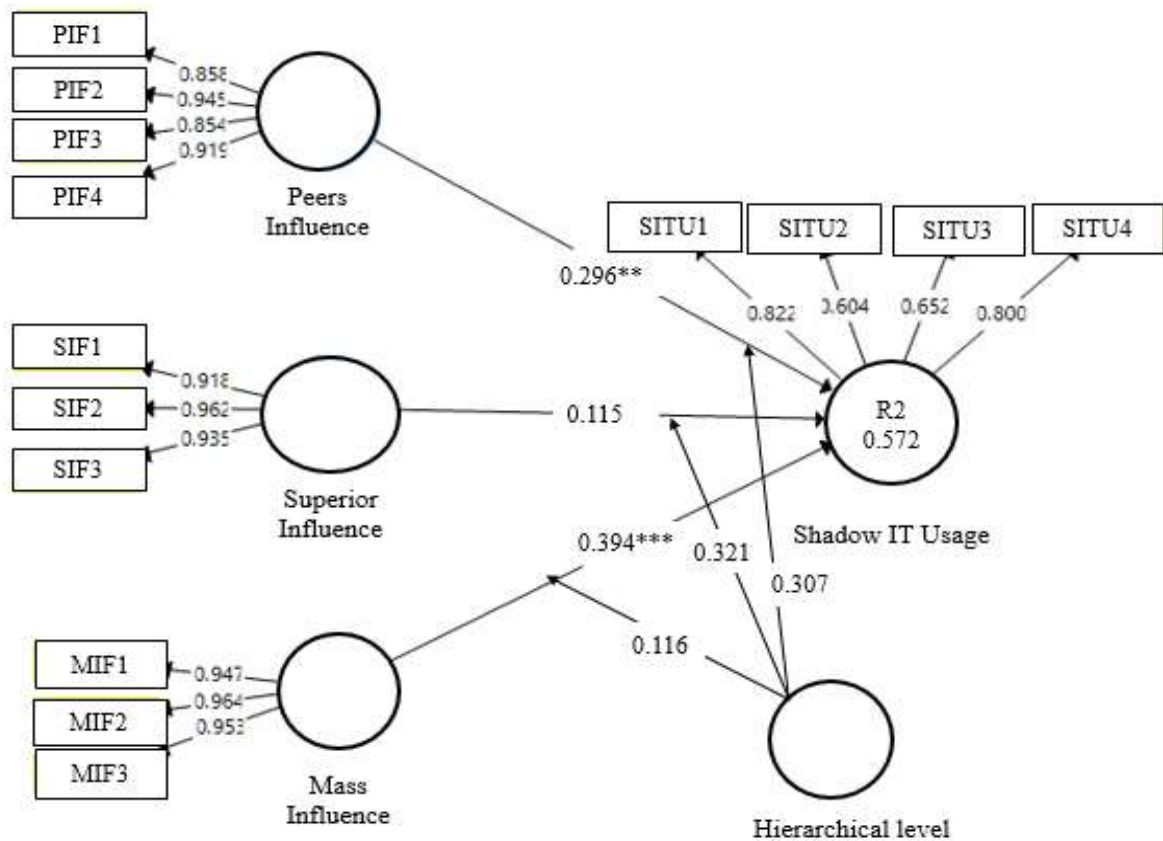
Figure 3.   Structural Model with Results of PLS Analysis (*** p<0.01 and ** p<0.05)

Related to the moderator analysis, we investigate if the categorical variable hierarchical level has a moderator effect, that is if hierarchical level changes the strength or the direction of the relationship between social influence groups and shadow IT usage. When a moderator effect is categorical, the variable serves as a grouping variable that divides the data into subsamples, being suitable to perform a multi-group analysis in this case (Sarstedt, Henseler and Ringle, 2011; Hair et al., 2014). The results here suggest no significant difference between employees who occupy a high-level senior position and those that occupy a low-level junior position.

6   Discussions

The study takes a social influence perspective to investigate the mechanisms that underlie the dissemination process among users and uncover the reasons why employee uses shadow IT in the workplace. In summary, the findings show differences in social influence on shadow IT usage behaviour depending on the group of reference in question (peer, superior, mass influence). The results suggest that employees are strongly influenced by their peers and by a mass of people, in general, to use a shadow IT. The influences toward the use of shadow IT are exerted from co-workers, professional workmates and employees from other departments, suggesting a broader range of social influence that can affect the individual. These results also reinforce the blurred barriers between personal, professional, and social lives of users in contemporary society. Below, we discuss the findings from this research, implications for theory and practice, as well as the study's limitations and suggestions for further research.

6.1   Findings and Implications

6.1.1   Social influence drives to the use of shadow IT among individuals

Previous studies about shadow IT posit that it can be used by one individual or a group of individuals, suggesting an individual and/or collective use of shadow IT. We took that as a motivation to investigate the use of shadow IT through a social influence perspective to find out what drives the use of shadow IT among individuals. As Kelman (1958) suggest, we have interests in the nature of changes related to use patterns within organizations that are being caused by a particular communication or type of communication among users. The results indicate that the effects of social influence on shadow IT usage differ significantly across groups in an organizational context. Our findings show that peer influence and mass influence effect employees toward the use of shadow IT.

The results indicate that shadow IT users are influenced by observing and interacting with others, adjusting their behaviour according to those social cues. Mass influence shows to have the strongest relationship with shadow IT usage, following by peer influence. Although previous studies suggest that some degree of proximity may be necessary for social influence to occur (e.g., Wang, Meister and Gray, 2013), the findings here suggest that users are not only influenced by those that are closer to them. The study shows that users are influenced by the fact that many people use shadow IT in their companies, including from other teams and departments.

It is essential to take into account the current context of several large organizations. A geographically distributed environment is a reality of digital and cross-country companies, which demands a high level of communications and interactions mediated by technology. Employees frequently interact with co-works from other units, external partner and clients. Then, it is suitable to infer that users are exposed nowadays to a broader range of social influences that they were some years ago.

An increasing number of interactions in individual's professional life, which is not limited to geographical space, is not the only cause for a broader range of social influence. People are experiencing consumer technology in their personal lives and finding ways to use them in the workplace (Harris, Ives and Junglas, 2012; Carter and Gruver, 2015). Therefore, the social cues and personal experiencing from individuals personal lives are also increasing the number of sources of social influence that may influence user behaviour in the workplace. These results also reinforce the blurred barriers among professional, personal and social lives of individuals (e.g., Carter and Gruver, 2015).

Consistent with Wang, Meister and Gray (2013) findings, our results suggest that superior influence did not appear to be a source of social influence on individual's shadow IT usage. The superior's expectancy is that the employee efficiently performs his/her work tasks and maintain a satisfactory individual performance. In the communications and social interactions between the superior and user, the sublunary message understood by the user may be: "keep high performance whatever the technology you use". From this perception, employees may not be worried about punishments of not using the mandatory system (e.g., Kelman 1958; Venkatesh and Davis, 2000), but their concern can be related to the reward and punishments of achieving or not the performance expectancy. In that sense, superiors can influence users toward shadow IT usage, however, in an indirect way.

Regarding the moderator variable, the results here suggest no significant difference between employees who occupy a high-level senior position and those that occupy a low-level junior position. As discussed in the literature review, age may have a relationship with hierarchical level since young people tend to occupy lower-level positions and vice-versa. Thus, testing a moderator effect of age on the relationship between social influence and shadow IT usage could be a way to investigate possible differences.

6.1.2   Theoretical implications

The study here provides theoretical implications to the emerging body of knowledge regarding shadow IT usage. Shadow IT is not a recent phenomenon. However, it is still under-studied in the IS literature. This study contributes in that sense expanding theoretical knowledge on shadow IT usage at the indi-

vidual level by performing an empirical investigation on the antecedents of shadow IT usage from a perspective of a widely used construct of IS field. The paper also provides conceptual contribution by defining what is and what is not shadow IT, discussing the similarities and differences from related concepts.

As discussed in the paper, shadow IT may be used by one individual or a group of individuals, emerging an individual and collective level of use of shadow IT. However, this multi-level perspective needs further investigation, including a group-level approach in addition to the individual level to understand how workgroups collectively support shadow IT usage and what are the negative and positive consequences for the group (Haag and Eckhardt, 2017). Taking this gap as motivation, this research contributes to understanding how individual shadow IT usage spreads across the employees within organization. Based on an individual-based social influence analysis, we enlighten some reasons why employee uses shadow IT in the workplace, as well as the mechanisms that underlie the dissemination process among users, driving to the use of shadow IT in work groups, teams, and in others departments inside organizations.

The study here also provides implications for adoption and post-adoption research. Paying attention to the definition, shadow IT is defined as any resource adopted and used without the approval of the IT department (e.g., Haag & Eckhardt, 2015). Thereby, employees do not only adopt shadow IT but also use it frequently to perform work tasks. In addition, the diffusion level of shadow IT usage is also relevant to understand the phenomenon since it spreads from one individual to a whole group of employees. The post-adoption level, thus, becomes essential to study the phenomenon. In that sense, this study contributes to adoption and post-adoption research investigating the employee's reason to adopt and use shadow IT, as well as how occurs the diffusion process of shadow IT usage among employees. To the best of our knowledge, this study was the first to investigate shadow IT from social influence perspective. Social influence is well recognized as a predictor to user behaviour and, for that reason, it has been widely used in the IS field to investigate user behaviour toward adoption and use of technology (e.g., Hsu and Lu, 2004; Li, 2013; Wang, Meister and Gray, 2013). The findings from the study here are consistent with the evidence provided by the social influence literature, validating the results of previous research that social influence has positive effects regarding IT user behaviour, including in the shadow IT context.

6.1.3   Practical Implications

The study here also provides practical implications. First, organizations must be aware that shadow IT is a behavioural phenomenon that emerges from the employee's level. Keeping that in mind, managers should better understand employee's behaviour related the use of technology in order to cope with shadow IT. Thus, insights into what drives individuals toward shadow IT usage can aid managers to develop IT strategies and security policies to manage shadow IT.

Second, managers must pay attention to the fact that the main reason for the emergence of shadow IT is the complete or partial absence of adequate IT solutions that meet the employees' requirements (Walterbusch, Fietz and Teuteberg, 2017). Therefore, knowing the antecedents of shadow IT usage is also a good opportunity to IT managers understand users expectations and their needs related to technology in order to prevent shadow IT, providing the suitable technology to perform their tasks.

Third, the literature on shadow IT discuss a wide range of consequences, from performance improvements and innovative solution to security risks and compliance. In that sense, balancing the positive and negatives outcomes of shadow IT is another challenge of IT managers. Investigate users behaviour and their motives to use shadow IT is a manner to find out a solution to that complex issue. Taking into account the results here, managers can realize that shadow IT usage is being valuable among employees, and they are sharing the benefits of shadow IT with each other, which help to understand why a whole team or unit uses shadow IT. Thus, better than avoid the use of shadow IT, organizations could find ways to mitigate the risks while recognizing the opportunities for improvements provided by it.

Forth and last, it is also crucial for organizations to understand how social influence occurs and affects the behaviour of IT user related to shadow IT (Eckhardt, Laumer and Weitzel, 2009). Frequently, the

problems regarding deviant work behaviour like shadow IT are caused by a deficient communication of IT policies among employees, who are not aware of the recommended information security practices. As social influence relies on communication and social interactions, organizations must pay attention in create initiatives and take actions to engaged and active users in the information security policies, which is one of the primary concern related to shadow IT usage.

6.2   Limitations and Future Research

This paper is part of a broader project that aims to investigate shadow IT usage at the employee's level. As Haag and Eckhardt (2017) suggest, it would be valuable to include group-level investigations of shadow IT usage and its consequences for the group through a multi-level perspective, e.g., individual and collective usage. Thereby, future studies can include group-level investigations to understand shadow IT usage at the collective level of analysis.

Taking a social constructivist perspective, we aim to investigate why employees use shadow IT, as well as what drives the dissemination of shadow IT usage among individuals inside organizations. As several studies suggest, the focus only on social norms can be somewhat limited, because users' values and personal norms play a crucial role in affecting individual usage behaviours (e.g., Malhotra and Galleta, 2005; Lee, Lee and Lee, 2006). Thus, it can be considered as a limitation of this study and an opportunity for future research. We suggest addressing social influence with other theoretical lens (e.g., social identity theory) that permits greater understanding of personal aspects (e.g., individual values, beliefs and goals) and, consequently, capture the nuances of the social environment (Stets and Burke, 2000; Stryker and Burke, 2000; Boudreau, Serrano, and Larson, 2014; Carter and Grover, 2015). Moreover, it would also be interesting to discuss the social influence on each of the four types of shadow IT to see the differences among them.

The literature also provides pieces of evidence to a relationship between the use of shadow IT and age. The dependence on technology to interact with people is increasing, especially among digital natives (Turkle, 2011), which is changing the way we socially interact and bringing several consequences related to those changes. Previous studies suggest the use of consumer technologies are more prominent among younger generations, called tech-savvy, millennial or Y generations (Weiß and Leimeister, 2012; Harris, Ives, and Junglas, 2012; Turner, 2015). Thereby, age can be a potential factor to understand the role of social influence regarding the use of new technologies. In a broader sense, a study regarding generations and the use of shadow IT may add valuable insights into individual behaviour in a post-modernity society.

References

Alter, S. (2014) 'Theory of workarounds'. *Communications of the Association for Information Systems*. 34 (55), 1041-1066.

Boudreau, M. C., Serrano, C., and Larson, K. (2014) 'IT-driven identity work: Creating a group identity in a digital environment'. *Information and Organization*, 24(1), 1-24.

Carter, M., and Grover, V. (2015) 'Me, my self, and I (T): conceptualizing information technology identity and its implications'. *MIS Quarterly*, 39(4).

Cohen, J. (1988) *Statistical Power Analysis for the Behavioral Sciences*. 2nd ed. New York: Psychology Press.

Delone, W. H., and McLean, E. R. (2003) 'The DeLone and McLean model of information systems success: a ten-year update'. *Journal of management information systems*, 19(4), 9-30.

Eckhardt, A., Laumer, S., & Weitzel, T. (2009) 'Who influences whom? Analyzing workplace referents' social influence on IT adoption and non-adoption'. *Journal of Information Technology*, 24(1), 11-24.

Eckhardt, A., Laumer, S., and Nguyen, N. T. (2010) Social Influence in Technology Adoption Research–A Scientometric Study over two Decades Behavior. In *Proceedings of the Diffusion Interest Group in Information Technology (DIGIT) Workshop,* St. Louis, USA.

Furstenau, D., and Rothe, H. (2014) Shadow IT systems: Discerning the good and the evil. In *Proceedings of the Twenty-Second European Conference on Information Systems*, Tel Aviv, Israel.

Furstenau, D., Rothe, H., and Sandner, M. (2017) 'Shadow Systems, Risk, and Shifting Power Relations in Organizations'. *Communications of the Association for Information Systems*, 41(1), 3.

French, A. M., Guo, C., and Shim, J. P. (2014) 'Current Status, Issues, and Future of Bring Your Own Device (BYOD)'. *Communications of the Association for Information Systems*, 35 (10), 191-197.

Györy, A. A. B., Cleven, A., Uebernickel, F., and Brenner, W. (2012) 'Exploring the shadows: IT governance approaches to user-driven innovation'. In Proceedings of the *European Conference on Information Systems*, Paper 222, Barcelona, Spain.

Haag, S., and Eckhardt, A. (2014) 'Normalizing the Shadows–The Role of Symbolic Models for Individuals' Shadow IT Usage'. Proceedings of the *Thirty-Fifth International Conference on Information Systems (ICIS)*, Auckland.

Haag, S. (2015) 'Appearance of Dark Clouds?-An Empirical Analysis of Users' Shadow Sourcing of Cloud Services'. In *Wirtschaftsinformatik* (pp. 1438-1452).

Haag, S., Eckhardt, A., and Bozoyan, C. (2015) 'Are Shadow System Users the Better IS Users?– Insights of a Lab Experiment'. In *Proceedings of the Thirty-Sixth International Conference on Information Systems* (ICIS), Fort Worth.

Haag, S., and Eckhardt, A. (2017) 'Shadow IT'. *Business & Information Systems Engineering*, 1-5.

Hair, J. F., Ringle, C. M., and Sarstedt, M. (2011) 'PLS-SEM: Indeed a silver bullet'. *Journal of Marketing Theory and Practice*, 19(2), 139-152.

Hair Jr, J. F., Hult, G. T. M., Ringle, C., and Sarstedt, M. (2014) *A primer on partial least squares structural equation modeling (PLS-SEM)*. Sage Publications.

Harris, J., Ives, B., and Junglas, I. (2012) 'IT Consumerization: When Gadgets Turn Into Enterprise IT Tools'. *MIS Quarterly Executive*, 11(3).

Henseler, J., Hubona, G., and Ray, P. A. (2016) 'Using PLS path modeling in new technology research: updated guidelines'. *Industrial management & data systems*, 116(1), 2-20.

Hong, W., Chan, F. K., Thong, J. Y., Chasalow, L. C., and Dhillon, G. (2013) 'A framework and guidelines for context-specific theorizing in information systems research'. *Information Systems Research*, 25(1), 111-136.

Hsu, C. L., and Lu, H. P. (2004) 'Why do people play on-line games? An extended TAM with social influences and flow experience'. *Information & Management*, 41(7), 853-868.

Huber, M.; Zimmermann, S.; Rentrop, C.; and Felden, C. (2017) 'Integration of Shadow IT Systems with Enterprise Systems - A Literature Review'. In *Proceedings of the Twenty-First Pacific Asia Conference on Information Systems*, Langkawi.

Jiang, C., Zhao, W., Sun, X., Zhang, K., Zheng, R., and Qu, W. (2016) 'The effects of the self and social identity on the intention to microblog: An extension of the theory of planned behavior'. *Computers in Human Behavior*, 64, 754-759.

Jones, D., Behrens, S., Jamieson, K., and Tansley, E. (2004) 'The rise and fall of a shadow system: Lessons for enterprise system implementation'. In *Proceedings of the ACIS (Australasian)*.

Karahanna, E., Straub, D. W., and Chervany, N. L. (1999). 'Information technology adoption across time: a cross-sectional comparison of pre-adoption and post-adoption beliefs'. *MIS Quarterly*, 23 (2), 183-213.

Kelman, H. C. (1958) 'Compliance, identification, and internalization three processes of attitude change'. *Journal of conflict resolution*, 2(1), 51-60.

Laumer, S., Maier, C., and Weitzel, T. (2017) 'Information quality, user satisfaction, and the manifestation of workarounds: a qualitative and quantitative study of enterprise content management system users'. *European Journal of Information Systems*, 26 (4), 333-360.

Lee, Y., Lee, J., and Lee, Z. (2006) 'Social influence on technology acceptance behavior: self-identity theory perspective'. *ACM SIGMIS* Database, 37(2-3), 60-75.

Li, C. Y. (2013) 'Persuasive messages on information system acceptance: A theoretical extension of elaboration likelihood model and social influence theory'. *Computers in Human Behavior*, 29(1), 264-275.

Lieberman, M. D. (2013) *Social: Why our brains are wired to connect*. OUP Oxford.

Malhotra, Y., and Galletta, D. (2005) 'A multidimensional commitment model of volitional systems adoption and usage behavior'. *Journal of Management Information Systems,* 22(1), 117-151.

Ogara, S. O., Koh, C. E., and Prybutok, V. R. (2014) 'Investigating factors affecting social presence and user satisfaction with mobile instant messaging'. *Computers in Human Behavior*, 36, 453-459.

Rentrop, C., and Zimmermann, S. (2012) 'Shadow IT. Management and Control of Unofficial IT'. In *Proceedings of the Sixth International Conference on Digital Society*, 98-102.

Sarstedt, M., Henseler, J., and Ringle, C. M. (2011) 'Multigroup analysis in partial least squares (PLS) path modeling: Alternative methods and empirical results'. *Measurement and research methods in international marketing* (pp. 195-218).

Silic, M., and Back, A. (2014) 'Shadow IT–A view from behind the curtain'. *Computers & Security*, 45, 274-283.

Silic, M., Barlow, J. B., and Back, A. (2017) 'A new perspective on neutralization and deterrence: Predicting shadow IT usage'. *Information & management.* (in press), 1-15.

Stets, J. E., and Burke, P. J. (2000) 'Identity theory and social identity theory'. *Social psychology quarterly*, 224-237.

Stryker, S., and Burke, P. J. (2000) 'The past, present, and future of an identity theory'. *Social psychology quarterly*, 284-297.

Sun, H. (2013) 'A longitudinal study of herd behavior in the adoption and continued use of technology'. *MIS Quarterly*, 37(4).

Turner, A. (2015) 'Generation Z: Technology and social interest'. *The Journal of Individual Psychology*, 71(2), 103-113.

Turkle, S. (2011) *Alone together: Why we expect more from technology and less from each other*. Basic Books, New York.

Venkatesh, V., and Davis, F. D. (2000) 'A theoretical extension of the technology acceptance model: Four longitudinal field studies'. *Management Science*, 46(2), 186-204.

Venkatesh, V., and Morris, M. G. (2000) 'Why don't men ever stop to ask for directions? Gender, social influence, and their role in technology acceptance and usage behavior'. *MIS Quarterly*, 115-139

Venkatesh, V., Morris, M. G., Davis, G. B., and Davis, F. D. (2003) 'User Acceptance of Information Technology: Toward a Unified View'. *MIS Quarterly*, vol 27, n° 3, pp. 425–478.

Walterbusch, M., Fietz, A., and Teuteberg, F. (2017) 'Missing cloud security awareness: investigating risk exposure in shadow IT'. *Journal of Enterprise Information Management*, 30(4), 644-665.

Wang, P. (2010) 'Chasing the hottest IT: effects of information technology fashion on organizations'. *MIS Quarterly*, 34(1), 63-85.

Wang, Y., Meister, D. B., and Gray, P. H. (2013) 'Social influence and knowledge management systems use: Evidence from panel data'. *Mis Quarterly*, 37(1).

Weiß, D. W. I. F., and Leimeister, J. M. (2012) 'Consumerization: IT Innovations from the Consumer Market as a Challenge for Corporate IT'. *Business & Information Systems Engineering*, 4(6), 363-366.

Zimmermann, S., and Rentrop, C. (2014) 'On the Emergence of Shadow IT-A Transaction Cost-Based Approach'. *Proceedings of the European Conference on Information Systems (ECIS)*, Tel Aviv, Israel.

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

Zimmermann, S., Rentrop, C., and Felden, C. (2017) 'A Multiple Case Study on the Nature and Management of Shadow Information Technology'. *Journal of Information Systems*, 31 (1), 79-101.