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Understanding Shadow IT usage: The interplay of IT accessibility, work overload, and employee strain

Entendendo o uso do Shadow IT: A interação da acessibilidade de TI, sobrecarga de trabalho e tensão do funcionário

Ogedengbe Fowokemi Alaba, Yurita Yakimin Abdul Talib and Fariza Hanim Rusly

Universiti Utara Malaysia, Sintok, Kedah, Malaysia

Authors' notes

Ogedengbe Fowokemi Alaba is a PDRF at the College of Business and Economics, University of Johannesburg, having completed her PhD at the Tunku Puteri Intan Safinaz School of Accountancy, Universiti Utara Malaysia; Yurita Yakimin Abdul Talib and Fariza Hanim Rusly are currently Senior Lecturers at Tunku Puteri Intan Safinaz School of Accountancy, Universiti Utara Malaysia.

Correspondence regarding this article should be directed to any of the co-authors: Ogedengbe Fowokemi Alaba, University of Johannesburg, South Africa; Yurita Yakimin Abdul Talib, or Fariza Hanim Rusly, Universiti Utara Malaysia, Sintok, Kedah, Malaysia, ZIP code 06010. Email: fogedengbe @uj.ac.za, yurita@uum.edu.my, hanim@uum.edu.my

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Abstract

Purpose: This study aimed to analyze the impact of information technology (IT) accessibility, work overload, and the mediating impact of employee strain on employee Shadow IT usage.

Originality/value: This study innovates by extending the strain theory model in an employee's Shadow IT usage context and empirically testing it. Structural factors (IT accessibility and work overload) and psychological factors of employee strain were included in the extended model. This study bridges a gap in the literature by exploring Shadow IT (SIT) usage in developing economies, focusing on Nigeria, which has been underrepresented in prior research primarily centered on developed and Western countries. Implementation of sound IT systems and structures that reduce work overload will positively impact reducing interaction with Shadow IT, which will assist in maintaining robust organization information systems and reduce security risks.

Design/methodology/approach: The study was conducted using a quantitative research design, with a sample of 345 IT-inclined employees in Nigeria. SmartPLS software was used for analysis, which employed structural equation modeling (SEM) to test the hypotheses.

Findings: The results revealed that structural imbalances (IT accessibility and work overload) significantly relate to employee strain and Shadow IT usage. Furthermore, the mediating impact of employee strain reflects strain as an intermediary between IT accessibility, work overload, and Shadow IT usage. This study provides insight for organizations into the need for appropriate structural measures and equitable and accessible IT structure.

Keywords: Shadow IT, information systems, strain theory, IT accessibility, work overload, employee strain

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Resumo

Objetivo: Este estudo visou analisar o impacto da acessibilidade da tecnologia da informação (TI), da sobrecarga de trabalho e do impacto mediador da tensão dos funcionários no uso do Shadow IT pelos funcionários.

Originalidade/valor: Este estudo inova ao estender o modelo da teoria da tensão no contexto de uso do Shadow IT do funcionário e testá-lo empiricamente. Fatores estruturais (acessibilidade de TI e sobrecarga de trabalho) e fatores psicológicos de desgaste dos funcionários foram incluídos no modelo estendido. Este estudo preenche uma lacuna na literatura ao explorar a utilização de Shadow IT (SIT) nas economias em desenvolvimento, com foco na Nigéria, que tem sido sub-representada em pesquisas anteriores centradas principalmente em países desenvolvidos e ocidentais. A implementação de sistemas e estruturas de TI sólidos que reduzam a sobrecarga de trabalho terá um impacto positivo na redução da interação com Shadow IT, o que ajudará na manutenção de sistemas de informação organizacionais robustos e na redução dos riscos de segurança.

Design/metodologia/abordagem: O estudo foi conduzido utilizando um design de pesquisa quantitativa, com uma amostra de 345 funcionários com inclinação para TI na Nigéria. Para análise foi utilizado o software SmartPLS, que empregou modelagem de equações estruturais (SEM) para testar as hipóteses.

Resultados: Os resultados revelaram que os desequilíbrios estruturais (acessibilidade de TI e sobrecarga de trabalho) estão significativamente relacionados com a tensão dos funcionários e a utilização de Shadow IT. Além disso, o impacto mediador da tensão dos funcionários reflete a tensão que fortalece a relação entre a acessibilidade das TI, a sobrecarga de trabalho e a utilização do Shadow IT. Este estudo fornece informações às organizações sobre a necessidade de medidas estruturais adequadas e de uma estrutura de TI equitativa e acessível.

Palavras-chave: Shadow IT, sistemas de informação, teoria da tensão, acessibilidade de TI, sobrecarga de trabalho, tensão do funcionário

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INTRODUCTION

Recent reports indicate a significant increase in Shadow information technology (SIT) (Bianchi et al., 2022; de Vargas Pinto et al., 2022). This is evidenced in employees accessing organizational information systems through personal devices, using private cloud services for official tasks, and non-compliance with administrative information technology (IT) security policies (Horton, 2020; Đorđević et al., 2023). Empirical studies have revealed various motivating factors for SIT usage. While these motivating factors include perceived benefits of SIT (Klotz, Kopper, et al., 2019; Ostermann, 2018), social pressure (Mallmann & Maçada, 2019). Organizational IT system failures, obsolete IT systems, limitations in existing IT systems, and other IT-related employee strains (Klotz, Kopper, et al., 2019; Klotz, Westner, et al., 2019).

Other studies described SIT usage as a deviant behavior exhibited by employees, which has been explained using neutralization theory (Hatashima & Sakamoto, 2017; Richter et al., 2019).

Although some extant studies have explored the positive aspects of SIT as it offers numerous IT benefits to organizations and individuals (de Vargas Pinto et al., 2022; Ogedengbe et al., 2024a), other studies have raised the alarm about its negative impact on the organization and cautioned that management should control SIT (Keskin et al., 2021; Remondi et al., 2022). Moreover, studies have shown that SIT usage has led to various security concerns (Alsmadi & Prybutok, 2018; Khan & Al-Yasiri, 2018; Peng et al., 2019; Lv & Zhou, 2014). Businesses using SIT are susceptible to increased cyber-attacks, data breaches, system security compromises, spam, phishing, and malware trends resulting from access to compromised cloud documents, applications, emails, and data (Abbas & Alghail, 2021; Willison et al., 2018; Czakert et al., 2021; Chen et al., 2021). For example, Vevo lost over 3TB of data due to phishing scams caused by employees' cloud interaction (Storey, 2017).

In addition, using SIT creates gaps within the organization as the IT department loses the knowledge and organizational information reality (Bianchi et al., 2022). Aside from this, studies have linked SIT usage with data inconsistencies, loss of synergy in the organization, increased inefficiencies, decentralization of information systems (IS), autonomy performance, and loss of control of organization activities, data, and information, leading to gaps in transparency development (Abbas & Alghail, 2021; de Vargas Pinto et al., 2022; Huber et al., 2018; Suer, 2017). Other adverse effects of SIT are its lack of continuity, documentation, and risk of system outages (Gozman & Willcocks, 2015).

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For effective management and control of employee's interaction with SIT and to determine the risk associated with its usage, it is imperative to understand the factors that drive SIT usage. There are currently limited empirical articles on Shadow IT (SIT), presenting a gap in the existing literature (Bianchi et al., 2022). Moreover, previous articles used data from developed economies, while studies on developing economies are limited (Ogedengbe et al., 2024b). Moreover, most available studies used data from Western countries, and limited studies relate to the African context (Gozman & Willcocks, 2018; Haag et al., 2018; Ines et al., 2017; Kopper et al., 2018). Hence, this study examined SIT as it relates to developing economies using data from Nigeria, which is the biggest economy in Africa. This research contributes to IS literature by empirically investigating the factors influencing employees' interactions with SIT due to the negative effect of SIT usage on IS security. Theoretically, this study contributes to theory by replicating the strain theory in the IS context. In addition, the strain theory model was modified by including factors such as IT accessibility and work overload. Hence, this study empirically tested the modified strain theory model to investigate how the organization's structural factors (IT accessibility and work overload) and employee strain influence Shadow IT usage.

Research questions:

1. Do IT accessibility and work overload influence employee strain?
2. Do IT accessibility and work overload influence employee Shadow IT usage?
3. Does employee strain mediate the relationship between IT accessibility, work overload, and employee Shadow IT usage?

LITERATURE REVIEW

Shadow IT (SIT)

SIT is a deviant behavior exhibited by people who use and interact with information technology (Haag & Eckhardt, 2015). SIT refers to all information technology systems that neither originate from the organization's IT department nor receive explicit authorization for official usage. This includes all technologies not officially authorized to be used or provided by the IT department, which people within the organization use to carry out official duties and meet their information technology needs (Mallmann et al., 2019). Although some studies have shown that SIT has some beneficial

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impacts, such as innovation and increased employee performance (Gozman & Willcocks, 2018; de Vargas Pinto et al., 2022), other studies have explained it in line with its negative effects, such as the negative relationship with knowledge protection (Abbas & Alghail, 2021), and have suggested ways to discontinue SIT usage, which include phasing its usage out, replacing SIT with organizational approved ITY mechanisms and continuing using SIT as a business managed system (Fürstenau et al., 2021).

Table 1

Description of Shadow IT

Authors	Description of Shadow IT
Bianchi et al. (2022)	"The use of devices, software, systems, and applications without the information technology (IT) department's approval."
Fürstenau et al. (2021)	Information systems are hidden from managers and official IT units
Chua et al. (2014)	Rogue IT outside the centralized IT-approved systems
Bour et al. (2019)	Democratic information systems in organizations
Richter et al. (2019)	Employees' voluntary use of private devices without formal approval from the IT department is called Shadow IT
Silic et al. (2016)	Black IT and non-compliance with organization IT policies
Haag et al. (2018)	Deviant IT behavior
Klotz, Kopper, et al. (2019) and Klotz, Westner, et al. (2019)	The autonomous deployment/management of IT instances by business units
Šedivcová (Nesvedová) and Potančok (2019)	Software, hardware, or any other solution used by employees within organizations that have not received formal IT department approval for use

IT accessibility

The accessibility of information technology (IT) is crucial for the success and survival of organizations. An organization's IT provision encompasses the investment in appropriate and relevant technologies and providing employees with the needed IT structure. Organizations with superior and updated technology have a stronger competitive advantage in their industry (Chae et al., 2014). IT also has a significant impact on the improvement of organizational performance (Dantsoho et al., 2021). By harnessing the potential of IT, organizations can enhance their overall performance, generate

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higher revenues, and increase profits (Ali & Bharadwaj, 2010; Raghavan et al., 2020; Kamboj et al., 2022).

Work overload

Work overload is a prevalent and consequential form of work-related stress experienced by employees in the workplace. It occurs when the workload assigned to employees exceeds capacity, leading to an excessive workload (Dewangan & Verghese, 2018; Adeoti et al., 2017; Spector, 2012). Work overload is determined by various factors, including the number of tasks to be completed, the availability of skilled workers, the timeframe to complete those tasks, and the availability of necessary IT systems to carry out tasks effectively.

THEORETICAL BACKGROUND AND HYPOTHESIS DEVELOPMENT

Strain theory

This study is based on the strain theory. Merton developed strain theory in the late 1930s, which has since been modified and expanded by various researchers (Bao et al., 2004; Baron, 2007; Broidy & Agnew, 1997; Agnew et al., 1996; Piquero & Sealock, 2010; Hoffmann, 2019). It has primarily been used in criminology to explain how environmental imbalances can lead to deviant behavior such as victimization, cyberbullying, social incompetencies, and illegal income streams (Glassner & Cho, 2018; Walters, 2020). The strain theory posits that individuals experience psychological and emotional stress when confronted with challenges and employee strains impeding their goals of cyberbullying (Patchin & Hinduja, 2011; McGrath et al., 2012; Lin et al., 2011). Similar to its application in criminology and societal explanation for deviant behaviors, this study believed strain theory could be applied in the organizational context by providing a modified strain theory model to understand how organizational imbalances can influence employee SIT behavior.

This stress can trigger deviant behavior as a coping mechanism. Within this study, work overload and IT accessibility challenges present organizational imbalances that employees navigate. Thus, it is hypothesized that employees may resort to Shadow IT to address work overload and challenges related to IT inaccessibility.

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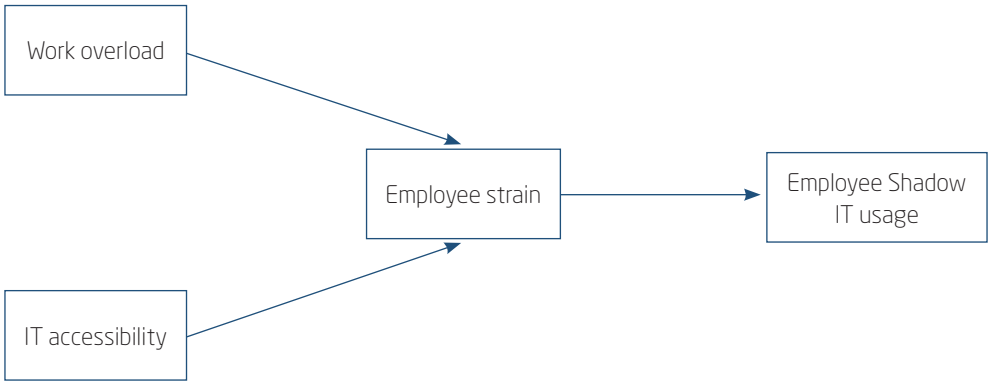
Research model

This study proposes a research model that explores the direct effects of workload and IT inaccessibility on Shadow IT usage and the mediating role of employee strain.

Figure 1

Research framework



Hypothesis development

IT accessibility and Shadow IT

The first theoretical linkage, H1, proposes that IT accessibility negatively influences SIT. IT is currently the significant backbone of an IS success. It shapes workers' behavior and catalysis for their development (Arnold et al., 2018; Liu et al., 2005; Beehr & Bhagat, 1985; Shah, 2018; Spielberger & Reheiser, 1994). Inaccessibility to needed technologies creates work difficulties for employees, reduces their participation in organization activities, slows their performances, and influences their non-compliance to IS policies and other unethical behavior (Setor & Joseph, 2015; Ragu-Nathan et al., 2008; Ge et al., 2019). Employees may resort to Shadow IT due to limited access to robust IT mechanisms. This is particularly true for employees who possess IT skills and operate in an environment with IT system failures, obsolete IT systems, or inadequate IT investments. Employees may seek alternative systems to perform their tasks and activities (Magunduni & Chigona, 2018; Huber et al., 2017; Kopper & Westner, 2016; Kopper et al., 2018). This study, therefore, hypothesizes that equitable and adequate IT

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structures will negatively influence employees' Shadow IT usage. This is the motivation for Hypothesis 1.

- **H1**: IT Accessibility negatively influences SIT usage.

IT accessibility and employee's strain

The second theoretical linkage H2 in the research model posits that IT inaccessibility is negatively related to employee strain. The importance of IT accessibility has been established as a cognitive tool that enhances task performance and boosts cognitive capacity. In contrast, IT inaccessibility has been linked with technostress in organizations, which can lead to mental strain for workers (Ragu-Nathan et al., 2008).

- **H2**: IT accessibility negatively influences employee strain.

Work overload and SIT usage

The research model's third linkage, H3, posits a direct relationship between work overload and SIT. Past research has shown that work overload within an organization can result in employees exhibiting deviant behaviors (Adeoti et al., 2017; Lim et al., 2008). This study posits that employees may interact with Shadow IT systems due to high job demands. This assumption is based on extant literature that has explained the tendency of employees to act contrary to policies when facing high job demands (Arnold et al., 2018; Shah, 2018; Adeoti et al., 2017). Technical activities without the necessary IT structures may prompt individuals to seek alternative IT systems to ease their tasks, such as Shadow IT. Such contrary actions may include non-compliant or unethical behavior that does not align with the organization's vision and goals (Arnold et al., 2018; Liu et al., 2005; Beehr & Bhagat, 1985; Shah, 2018; Spielberger & Reheiser, 1994).

- **H3**: Work overload positively influences Shadow IT usage.

Work overload and employee strain

The job-stress model posits that high workload demands can lead to psychological strain (Spector, 2012; Liu et al., 2005). Beehr and Bhagat (1985) and Bhagat et al. (2010) have empirically demonstrated that work overload results in psychological stress. Hamizah et al. (2018) and Omar et al. (2011) revealed that work stress leads to decreased self-regulation and

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non-affective responses such as dissatisfaction, reduced concentration, anxiety, and work tension. Cousins et al. (2004) have explained the relationship between high workload demands and stress, while Mirsim (2014) has described the influence of work overload on dissatisfaction.

Since previous studies have theoretically and empirically linked work overload to psychological strain, reduced self-regulation, and non-affective responses such as dissatisfaction, decreased concentration, anxiety, and work tension, these studies provide a strong justification for examining the relationship between employee strain and work overload, as they suggest that work overload can have significant negative impacts on employees' cognitive functioning and psychological well-being. By exploring the relationship between employee strain and work overload, researchers can better understand the mechanisms underlying these negative effects and develop interventions to help mitigate them.

- **H4**: Work overload positively influences employee strain.

The mediating influence of employee strain

Hypothesis 5 posits that employee strain has a positive relationship with SIT usage. Based on strain theory, employees engage in deviant behavior when employees experience employee strain (Setor & Joseph, 2015; Ragu-Nathan et al., 2008).

Previous research has shown that work overload within an organization can result in employees engaging in deviant behaviors, including non-compliant and unethical actions (Arnold et al., 2018; Shah, 2018; Adeoti et al., 2017). This study argues that employees can interact with Shadow IT systems due to high job demands, which may lead to employee strain. This justification motivates the seventh and eighth theoretical linkages, H6 and H7.

- **H5**: Employee strain positively influences SIT usage.
- **H6**: Employee strain mediates the relationship between IT accessibility and SIT usage.
- **H7**: Employee strain mediates the relationship between work overload and SIT usage.

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Table 2

Summary of hypotheses

Hypothesis	Description
Direct hypotheses	
H1	IT accessibility negatively influences SIT usage.
H2	IT accessibility negatively influences employee strain.
H3	Work overload positively influences Shadow IT usage.
H4	Work overload positively influences employee strain.
H5	Employee strain positively influences SIT usage.
Mediating hypotheses	
H6	Employee strain mediates the relationship between IT accessibility and SIT usage.
H7	Employee strain mediates the relationship between work overload and SIT usage.

RESEARCH METHODOLOGY

This study followed a positivist approach and adopted a quantitative research design. The respondents were drawn from employees in Nigeria. Prior studies have explained the adoption of IT in Nigerians (Ogedengbe & Abdul-Talib, 2020; Vinters, 2020). In addition, this study also utilizes a cross-sectional survey approach, and data was collected using the survey method. The study used both SPSS and SmartPLS for the data analysis. Structural Equation Modelling (SEM) was used to test the proposed hypotheses.

Sampling and data collection

The study population comprises employees in Nigeria, irrespective of their industry. An exclusion criteria question was, "do you use IT systems to carry out official tasks?". Only those who use IT mechanisms were used for the research. The sample size was determined using the Krejcie and Morgan table, and a sample of 385 respondents was selected using a stratified random sampling technique. Nigeria was divided into strata based on the six geopolitical zones: the South-South, South-East, South-West, North-Central, North-East, and North-West. Inside each state, a convenience

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sampling technique was used for data collection. Data was collected using a structured questionnaire distributed online and physically, consisting of five Likert scale questions ranging from 1 (strongly disagree) to 5 (strongly agree).

Measurement items

Items were adapted from previously validated scales to measure each construct effectively.

Shadow IT usage was assessed using a 5-item scale from Mallmann and Maçada (2019) and nine items from Hatashima and Sakamoto (2017), covering potential Shadow IT practices. An example item is: "I installed software that was unauthorized by the IT department to perform my work tasks."

Employee strain was measured using six items adapted from Hadzibajramovic et al. (2015), including statements like: "I feel stressed due to the need to complete tasks using IT."

IT accessibility used a six-item scale adapted from Barlett et al. (2018), such as: "My organization has easily accessible wireless connectivity."

Work overload was measured with a five-item scale adapted from Cousins et al. (2004): "I rely on IT to manage the demands of extended work hours."

The table below displays only two items per construct out of 30 for brevity in the presentation. Some constructs included reverse-scored items, which were rescaled for analysis (Weijters et al., 2013).

Table 3

Construct items

Items	Adapted references
Exclusion criteria question	
To what extent do you use IT services at work?	
Shadow IT usage	Mallmann and Maçada (2019); Hatashima and Sakamoto (2017)
I use cloud-based services that are unauthorized by the IT department.	
I store organization data on personal devices, e.g., my mobile phone and laptop.	

(continues)

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Table 3 (conclusion)

Construct items

Items	Adapted references
Strain	Hadzibajramovic et al. (2015)
I feel stressed due to the need to complete tasks using IT.	
I feel tense about the tasks that must be carried out using IT systems.	
IT accessibility	Barlett et al. (2018)
My organization has easily accessible wireless connectivity.	
My organization is considered to be technologically advanced.	
Work overload	Cousins et al. (2004)
I experience the pressure of working long hours.	
I need IT to meet unachievable work deadlines.	

RESULTS

The respondents include 51% male and 49% female. More than 75% of the respondents fall between 25 and 65 years old. This is typically the working age for most workers. 15.1% are under 25, and 9.6% are older than 65. Regarding education qualification, most respondents (68.6%) have a B.Sc., equivalent to the minimum education qualification. This shows that the respondents are educated and can answer questions regarding their Shadow IT usage at work. Regarding the geographical regions, the three southern regions have a combined response rate of slightly below 65%, while the three northern areas account for about 35% of the total respondents. These demographic details are presented in Table 4.

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Table 4

Respondent's demography

Demographic item		Frequency	Percent
Gender	M	173	51.0
	F	171	49.0
	Total	**345**	**100.0**
Age	<25	52	15.1
	25-40	139	40.3
	41-55	74	21.4
	55-65	47	13.6
	>65	33	9.6
	Total	**345**	**100.0**
Academics	High school	88	25.5
	Diploma / Associate Degree	19	5.5
	First-degree and equivalent	168	48.7
	Masters	65	18.8
	Doctoral	5	1.4
	Total	**345**	**100.0**
Geopolitical Zone	South-South	44	12.8
	South-East	69	20.0
	South -West	110	31.9
	North-Central	40	11.6
	North-East	43	12.5
	North-West	39	11.3
	Total	**345**	**100.0**

Measurement model

Reliability and convergent reliability

The measurement model underwent a rigorous assessment to ensure validity and reliability. Convergent validity analysis demonstrated that all

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items were significantly loaded onto their respective constructs, with factor loadings ranging from 0.81 to 0.87. Composite reliability (CR) and average variance extracted (AVE) values surpassed the recommended thresholds of 0.70 and 0.50, respectively, affirming good reliability and convergent validity (Hair et al., 2014; Kock & Hadaya, 2018).

Convergent validity

A factor weight of 0.7 or more indicates a strong level of validation for explaining the latent construct variable (Ab Hamid et al., 2017). In this study, the loading factor size for each construct is > 0.7, indicating a satisfactory level of reliability. Additionally, all variable indicators have a loading factor value above 0.5, fulfilling the convergent validity requirements (Hair et al., 2012). The AVE value of each construct variable is also greater than 0.5. The composite reliability and AVE values for the research model can be found in Table 5.

Table 5

Construct validity

	Cronbach's alpha	Composite reliability	The average variance extracted (AVE)
SIT	0.839	0.841	0.557
ES	0.792	0.794	0.549
IT	0.845	0.922	0.671
WL	0.781	0.732	0.650

Discriminant validity

Discriminant validity analysis verified that constructs are distinct and measure distinct concepts. The square root of the AVE for each construct exceeded cross-correlations between constructs, establishing appropriate discriminant validity. Cross-loadings, gauging item relationships with intended constructs, demonstrated all cross-loading values above 0.5, affirming the effectiveness of item measurement. Using the VIF calculation, collinearity analysis revealed no issues, as all items exhibited VIF scores below the acceptable threshold of 5.

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The structural model

The structural model assessment focused on evaluating relationships between variables. Cohen's (1965) f-square matrix indicated effect strengths, with work overload (WL) demonstrating a significant effect on employee strain (f-square = 0.207) and a minor contribution to Shadow IT usage (SIT) (f-square = 0.076). Conversely, ES significantly impacted SIT (f-square = 0.404). IT accessibility (IT) exhibited negligible effects on ES (f-square = 0.02) and a minor effect on SIT (f-square = 0.013). The Q^2 values signified the model's medium predictive relevance for SIT (Q^2 = 0.197) and minor predictive relevance for ES (Q^2 = 0.164).

Hypothesis testing

Hypothesis testing, employing bootstrapping techniques, assessed the significance of direct and indirect effects. Findings confirmed support for hypotheses related to direct effects. Work overload and IT accessibility directly and significantly impacted Shadow IT usage (β = 0.225, t = 3.102, p = 0.001; β = -0.087, t = 1.799, p = 0.036).

The direct effects of work overload and IT accessibility on employee strain were positive and significant (β = 0.225, t = 3.102, p = 0.001; β = -0.127, t = 2.127, p = 0.017). Moreover, the direct effect of employee strain on Shadow IT usage was substantial (β = 0.410, t = 4.526, p = 0.000).

Table 6

Summary of direct relationships

Hypotheses	Path	β	t-value	p-value	Result
H1	IT accessibility and Shadow IT usage	-0.087	1.799	0.036	Supported
H2	IT accessibility and employee strain	-0.127	2.127	0.017	Supported
H3	Work overload and Shadow IT usage	0.225	3.102	0.001	Supported
H4	Work overload and employee strain	0.410	3.12	0.000	Supported
H5	Employee strain and Shadow IT usage	0.410	4.526	0.000	Supported

Mediation analysis revealed that employee strain significantly mediated the relationships between work overload and Shadow IT usage (β = 0.235, t = 3.887, p = 0.000), as well as between IT accessibility and Shadow IT usage (β = -0.072, t = 2.103, p = 0.018).

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Table 7

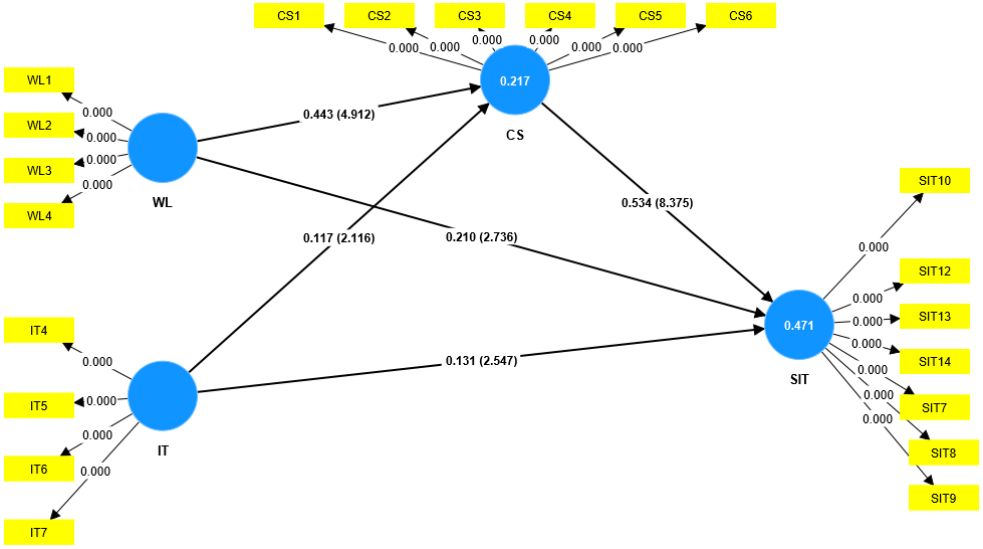
Summary of mediation relationship

Mediation	Beta	t-value	p-value	Significance
Work overload -> Employee strain -> Shadow IT usage	0.215	3.695	0.00	Significant
IT accessibility -> Employee strain -> Shadow IT usage	-0.072	2.103	0.018	Significant

The analysis elucidated significant relationships between the variables, with direct and mediating effects confirmed through comprehensive assessment techniques. These findings contribute to a deeper understanding of the interplay between work overload, IT accessibility, employee strain, and Shadow IT usage in Nigeria employees' context.

Figure 2

Structural equation modeling result



DISCUSSION OF FINDINGS

This study investigated the impact of IT accessibility, work overload, and employee strain on SIT usage and the mediating role of employee strain. The results of this study suggest that all hypotheses are significant.

Moreover, the finding that IT accessibility has a significant negative impact on SIT usage supports previous research that has suggested that IT

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inaccessibility encourages the use of Shadow IT (Magunduni & Chigona, 2018; Huber et al. 2017; Kopper & Westner, 2016; Kopper et al., 2018). This result highlights the importance of providing employees with access to appropriate IT tools and resources to minimize the use of Shadow IT.

The results of this study are consistent with previous reports indicating an increase in employee's use of SIT. The findings show that IT accessibility negatively relates to employees' use of SIT, confirming H2 and addressing the research question. Additionally, the study supports previous literature suggesting that employees increasingly use personal services and cloud devices for official purposes, including unapproved devices and cloud solutions to access critical organizational data and other forms of organizational IS. This behavior aligns with previous studies that indicate that IT-oriented employees lacking legal access to reliable IT systems tend to seek alternative methods for their official tasks and activities (Setor & Joseph, 2015; Klotz, Kopper, et al., 2019). Moreover, studies reveal that IT access influences employees' performance (Alfredo et al., 2020). Hence, if organizations fail to provide these IT structures, employees may use alternative sources, influencing their SIT usage. Poor IT structures, such as a lack of access to organizational computers, influence employees to use personal computers and mobile phones to complete managerial tasks.

Furthermore, the lack of an organization's subscriptions to applications and databases influences employees to use alternative sources to access these IT mechanisms. Also, the lack of formal organizational emails can influence employees to use personal emails and communication mechanisms in transmitting organizational documents (Klotz, 2019; Preimesberger, 2018). Hence, this study confirms that IT inaccessibility is a motivating factor that attracts SIT usage.

The result of this study also reveals that IT accessibility has a negative influence on ES. Poor IT infrastructure, such as internet connectivity, affects employees' job stress. This result is consistent with studies that revealed structural imbalances influence people's strain (Mallmann et al., 2018; Haag et al., 2018), and employees experienced increased emotional affection when provided access to IT (Lee et al., 2021).

This study reveals that work overload motivates employees to strain and that employees Shadow IT (SIT) usage. With high work demands and inadequate IT structures, employees may resort to innovating alternative IT mechanisms to complete their tasks. The motivation behind their SIT usage can be attributed to this factor. The findings of this study are consistent with prior research, which explained that work overload leads to psychological

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stress (Bhagat et al., 2010; Rubington, 2014; Buttigieg, 2007; Setor & Joseph, 2015; Korunka et al., 2010; Dabbish & Kraut, 2006). Although no previous study has specifically examined the influence of work overload on SIT usage, work overload has been found to influence non-affective responses from employees. These include dissatisfaction, poor job concentration, and high work tension (Omar et al., 2011; Radzali et al., 2013; Hamizah et al., 2018).

Therefore, organizations should improve the employees' working environment to reduce work overload and prevent employees from becoming mentally strained. When the organization is understaffed, employees may interact with SIT to complete tasks faster, which may not always align with the organization's objectives. Thus, it is essential to reduce work overload and ensure adequate staffing levels to prevent the negative impact of Shadow IT usage on the organization.

The finding that employee strain significantly impacts Shadow IT usage is consistent with previous research, explaining that strain affects deviant behavior (Arnold et al., 2016). Prior studies have predicted the influence of stress and strain on people in various capacities. This includes underperformance, dissatisfaction, and other deviant behaviors (Tabei et al., 2012; Wagstaff et al., 2012). This finding is consistent with strain theory, which posits that strained people tend to act defiantly (Agnew & White, 1992; Agnew, 2015; Cloward & Ohlin, 1960; Cohen, 1965). Hence, when employees are strained due to structural imbalances regarding IT inaccessibility, they relate more to Shadow IT mechanisms.

Similarly, the mediating effect of employee strain on the relationship between IT inaccessibility and Shadow IT usage was also significant. This finding suggests that the relationship between IT inaccessibility and Shadow IT usage is partially explained by the effect of IT inaccessibility on the employees' strain, increasing the likelihood of using Shadow IT.

Implication of study

Theoretical implication

Prior research has examined factors influencing deviant employee behavior toward organization information systems (IS). However, few empirical studies have focused on employee Shadow IT usage. Therefore, the present study contributes to the existing literature on this topic.

The study's first contribution is applying strain theory to IS, a relatively new approach. Previous studies have mainly utilized strain theory in

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psychology, medicine, and criminology. This study confirms its applicability to the field by applying strain theory to IS and expands our understanding of the theory. The study adds to strain theory's theoretical understanding by including IT inaccessibility and work overload antecedents. These additions improve the model's explanatory power and offer more significant insights into employees' Shadow IT usage.

In addition, the available studies on Shadow IT in developing economies are lacking. Hence, this study contributes to the literature by empirically examining Shadow IT in developing economies, focusing on Nigeria. The relationship between IT accessibility, work overload, and Shadow IT usage suggests that organizations must ensure employees have access to IT resources and support to perform their jobs effectively. This can be achieved by providing adequate IT infrastructure, equipment, and support and improving IT policies and procedures. The significant mediating effect of employee strain on the relationship between IT accessibility, work overload, and Shadow IT usage highlights the importance of addressing the sources of employee strain in the workplace.

Organizations can adopt various strategies to reduce employee strain, such as improving working conditions, providing social support, and implementing stress management programs. The accessibility and affordability of internet capacity in developed countries are relatively easier for organizations. However, in developing countries like Nigeria, the government's implementation of such developments is slow. Thus, the government needs to intervene in implementing policies that support the affordable IT provision of Internet packages at workplaces. Policymakers must communicate with the business sectors about their cloud IT intentions, policies, and programs to which businesses can subscribe. This would help reduce employees' strain and their IT deviant behavior.

Limitations and suggestions for future research

One limitation of this study is that the sample was limited to employees in Nigeria, which may limit the generalizability of the findings to other countries. Future research could expand the sample to different sectors and countries to enhance the generalizability of the findings. Future research could also explore other potential mediators or moderators of the relationship between IT inaccessibility, work overload, and Shadow IT usage, such as job satisfaction, organizational commitment, and perceived control.

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CONCLUSIONS

In conclusion, this study provides evidence of the impact of IT accessibility and work overload on Shadow IT usage in Nigeria. The findings suggest that organizations must provide adequate IT resources and support to employees to manage work demands, reduce the need for Shadow IT usage, and ensure that employees have access to the necessary IT resources and support to perform their jobs effectively. Moreover, the findings highlight the importance of addressing the sources of employee strain in the workplace to reduce the likelihood of using Shadow IT.

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