

The copyright © of this thesis belongs to its rightful author and/or other copyright owner. Copies can be accessed and downloaded for non-commercial or learning purposes without any charge and permission. The thesis cannot be reproduced or quoted as a whole without the permission from its rightful owner. No alteration or changes in format is allowed without permission from its rightful owner.



**THE RELATIONSHIP BETWEEN ORGANISATIONAL
STRUCTURAL FACTORS AND STRAIN TOWARDS
SHADOW INFORMATION TECHNOLOGY USAGE
AMONG NIGERIAN EMPLOYEES**



FOWOKEMI OGEDENGBE

**DOCTOR OF PHILOSOPHY
UNIVERSITI UTARA MALAYSIA
SEPTEMBER 2024**

**THE RELATIONSHIP BETWEEN ORGANISATIONAL STRUCTURAL
FACTORS AND STRAIN TOWARDS SHADOW INFORMATION
TECHNOLOGY USAGE AMONG NIGERIAN EMPLOYEES**

By

FOWOKEMI OGEDENGBE



UUM
Universiti Utara Malaysia

**Thesis Submitted to
College of Business
Universiti Utara Malaysia,
in Fulfillment of the Requirement for the Degree of Doctor of Philosophy**



Kolej Perniagaan
(College of Business)
Universiti Utara Malaysia

PERAKUAN KERJA TESIS / DISERTASI
(Certification of thesis / dissertation)

Kami, yang bertandatangan, memperakukan bahawa
(We, the undersigned, certify that)

OGEDENGBE FOWOKEMI ALABA

calon untuk Ijazah **DOCTOR OF PHILOSOPHY**
(candidate for the degree of)

telah mengemukakan tesis / disertasi yang bertajuk:
(has presented his/her thesis / dissertation of the following title):

**THE RELATIONSHIP BETWEEN ORGANISATIONAL STRUCTURAL FACTORS AND STRAIN
TOWARDS SHADOW INFORMATION TECHNOLOGY USAGE AMONG NIGERIAN EMPLOYEES**

seperti yang tercatat di muka surat tajuk dan kulit tesis / disertasi.
(as it appears on the title page and front cover of the thesis / dissertation).

Bahawa tesis/disertasi tersebut boleh diterima dari segi bentuk serta kandungan dan meliputi bidang ilmu dengan memuaskan, sebagaimana yang ditunjukkan oleh calon dalam ujian lisan yang diadakan pada:

19 Mac 2024.

(That the said thesis/dissertation is acceptable in form and content and displays a satisfactory knowledge of the field of study as demonstrated by the candidate through an oral examination held on:

19 March 2024).

Pengerusi Viva :
(Chairman for Viva)

Assoc. Prof. Dr. Hafizah Mohamad Hsollah

Tandatangan
(Signature)

Pemeriksa Luar :
(External Examiner)

**Assoc. Prof. Ts. Dr. Muhamad Saufi Che
Rusuli (UMK)**

Tandatangan
(Signature)

Pemeriksa Dalam :
(Internal Examiner)

Assoc. Prof. Dr. Haslinda Hassan

Tandatangan
(Signature)

Tarikh: **19 March 2024**
(Date)

Nama Pelajar
(Name of Student)

: **Ogedengbe Fowokemi Alaba**

Tajuk Tesis / Disertasi
(Title of the Thesis / Dissertation)

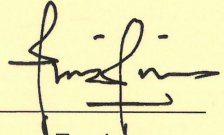
: **The Relationship Between Organisational Structural Factors and Strain Towards Shadow Information Technology Usage Among Nigerian Employees**

Program Pengajian
(Programme of Study)

: **Doctor of Philosophy (Accounting)**

Nama Penyelia/Penyelia-penyelia
(Name of Supervisor/Supervisors)

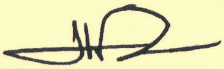
: **Dr. Yurita Yakimin Abdul Talib**



Tandatangan

Nama Penyelia/Penyelia-penyelia
(Name of Supervisor/Supervisors)

: **Dr. Fariza Hanim Rusly**



Tandatangan

PERMISSION TO USE

In presenting this thesis, fulfilling the requirements for a postgraduate degree from the Universiti Utara Malaysia (UUM), I agree that the university library may make it freely available for inspection. I further agree that permission for copying this thesis in any manner, in whole or in part, for scholarly purposes may be granted by my supervisor(s) or, in their absence, by the Director of Postgraduate Studies Unit, College of Business, where I did my thesis. It is understood that any copying, publication, or use of this thesis or parts of it for financial gain shall not be allowed without my written permission. It is also understood that due recognition shall be given to me and the UUM in any scholarly use that may be made of any material in my thesis.

Request for permission to copy or to make other use of materials in this thesis in whole or in part should be addressed to:

Director of Postgraduate Studies Unit, College of Business

Universiti Utara Malaysia

06010 UUM Sintok

Kedah Darul Aman



Abstrak

Penggunaan teknologi maklumat bayangan (*Shadow IT*) adalah tingkah laku yang menyimpang dalam penggunaan sistem maklumat (IS), iaitu pekerja menggunakan mekanisme teknologi maklumat (IT) yang tidak dibenarkan dalam tugas rasmi mereka. Tingkah laku ini dikaitkan dengan pelbagai kebimbangan keselamatan IS, termasuk pencerobohan, pelanggaran keselamatan, dan salah jajaran dengan matlamat organisasi. Kajian ini secara empirikal mengkaji penggunaan *Shadow IT* dalam kalangan pekerja melalui teori ketegangan, yang menerangkan bagaimana ketidakseimbangan struktur dalam organisasi mempengaruhi ketegangan dan tingkah laku menyimpang. Kajian ini mengadaptasi teori ketegangan dalam konteks IS dengan meneliti hubungan antara faktor struktur organisasi, ketegangan dan penggunaan *Shadow IT*. Kajian ini membangunkan dan menguji model teori ketegangan yang diperluaskan dengan empat faktor struktur: akses kepada IT, pendidikan keselamatan, latihan dan kesedaran (*SETA*), tekanan dan beban kerja. Tiga belas hipotesis telah diusulkan berdasarkan pendekatan kuantitatif, dengan data yang dikumpul daripada 345 pekerja di Nigeria melalui soal selidik. Pemodelan persamaan struktur menggunakan *SmartPLS4* digunakan untuk menganalisis data. Hasil analisis menunjukkan bahawa akses kepada IT, beban dan tekanan kerja secara signifikan mempengaruhi penggunaan *Shadow IT*, manakala akses kepada IT dan *SETA* memberi kesan langsung kepada ketegangan. Seterusnya, ketegangan menjadi pengantara perhubungan antara kebolehcapaian IT, *SETA* dan penggunaan *Shadow IT*. Kajian ini menyumbang kepada literatur dalam IT dengan menggabungkan teori ketegangan dalam kerangka teori. Hasil kajian mencadangkan bahawa organisasi perlu memberi tumpuan kepada pengukuhan faktor struktur untuk mewujudkan persekitaran kerja yang kondusif dan mengurangkan ketegangan berkaitan kerja. Ini termasuk menyediakan struktur IT yang kukuh, melaksanakan amalan perkongsian pengetahuan yang berkesan, menubuhkan struktur pemudah cara sistem maklumat yang teguh dan memupuk hubungan kerja yang sihat dalam organisasi. Langkah-langkah ini dapat mengautomatiskan sebahagian tugas kerja dan menyediakan sokongan kognitif kepada pekerja, seterusnya mengurangkan ketegangan pekerja dan kecenderungan mereka terhadap penggunaan *Shadow IT*.

Kata Kunci: Teknologi Maklumat Bayangan, Teori Tekanan, Akses Teknologi Maklumat, SETA, Tekanan Kerja.

Abstract

Shadow information technology (Shadow IT) usage is a deviant behaviour within information systems (IS) where employees use unauthorised information technology (IT) tools in their official activities. This behaviour is linked to various IS security concerns, including infiltration, breaches, and misalignment with organisational goals. This research empirically examines employee Shadow IT usage through strain theory, which explains how organisational disparities influence strain and deviant behaviours. The study explores the relationship between organisational structural factors, strain, and Shadow IT usage by applying strain theory to IS. This objective was achieved by developing an extended strain theory model incorporating four key structural factors: IT accessibility, security education, training and awareness (SETA), work pressure, and work overload. These factors are assessed as precursors to both strain and Shadow IT usage. Thirteen hypotheses were formulated based on the developed model and tested quantitatively, with data collected from 345 employees in Nigeria. Structural Equation Modelling (SEM) using SmartPLS4 software was employed for the analysis. The results reveal that IT accessibility, work overload, and work pressure significantly influence Shadow IT usage, while IT accessibility and SETA also directly impact strain. Furthermore, strain mediates the relationships between IT accessibility, SETA, and Shadow IT usage. This research contributes to IS literature by incorporating strain theory as a theoretical framework. The findings suggest that organisations should enhance structural factors to foster a supportive work environment and reduce work-related strain. The recommendations include upgrading IT systems, implementing effective knowledge-sharing practices, establishing robust IS frameworks, and nurturing positive workplace relationships. Such measures may help streamline tasks, provide cognitive support, and reduce employee strain and the inclination toward Shadow IT usage.

Keywords: Shadow IT, Strain Theory, IT Accessibility, SETA, Work Pressure.

DECLARATION

I certify that except where due acknowledgement has been made, the work is that of the author alone; the work has not been submitted previously, in whole or in part, to qualify for any other academic award; the content of the thesis is the result of work which has been carried out since the official commencement date of the approved research program; and any editorial work, paid or unpaid, carried out by a third party is acknowledged.



Acknowledgment

I would like to extend my heartfelt gratitude to God Almighty for His unwavering guidance and blessings, from my conception to eternity. I am profoundly thankful to my supervisors, Dr. Yurita Yakimin Abdul-Talib and Dr. Fariza Hanim Rusly, for their invaluable guidance and support throughout this PhD program. Your encouragement, dedication, and motherly care have been pivotal to my perseverance and success. Thank you for the lunches, walks, hikes, dinners, and numerous invitations. I deeply appreciate these acts of kindness as they provided much-needed emotional support throughout this journey. I will always cherish your contributions to both my academic and personal growth. May God bless you and your families always. I also express my sincere appreciation to my examiners, Prof. Madya Muhamad Saufi Che Rusuli and Prof. Madya Dr. Haslinda Hassan, for their thorough examination and insightful comments on my thesis. Your feedback has been instrumental in refining my work, and I am immensely grateful for your contributions. Thanks to Mr Azlan for making all official processes related to the academic journey seamless and easy.

My deepest thanks go to my wonderful family, especially my parents, Pastor Otamayomi Godwin Ogedengbe and Mrs. Olayinka Ogedengbe. Your unconditional love, prayers, and sacrifices have been the foundation of my success. I pray that God rewards you abundantly. May my siblings and I continue to make you proud and may you live long in good health to enjoy the dividends of your labour of love. To my wonderful siblings: the FMTs “Folakemi, Funke, Busayo (Fayokemi), Mayokun, Mayowa, Marvelous, and My Twins (Taiwo and Kenny), your unwavering support has transcended financial and emotional assistance. God has blessed me with a big family, and I pray that His love continues to bind us together. May you be blessed in all areas by the creator and the universe.

I am also grateful to the government of Malaysia, as well as the management, teaching, and non-teaching staff of UUM, for making my stay in Malaysia both peaceful and memorable. Special thanks to the staff of TISSA for the structures and support that have enriched my postgraduate experience.

Lastly, I extend my gratitude to my friends, friends turned families, church members of RCCG, DLBC, and FGCC, my academic colleagues, my dormitory friends, and everyone who came into contact with me during the PhD phase. I have several names to mention, but, the space allotted to this will fail me, so, I will not mention any name, but, I can assure you that you occupy a space in my heart, deep gratitude to you. Thank you so much and may we continue to create beautiful moments in our brief sojourn on this earth. I love you all. To those who supported this journey but I may never see again on earth (due to physical location barrier), on the final day, may we all meet at the feet of Christ.

Table of Content

PERMISSION TO USE.....	ii
ABSTRAK	iii
ABSTRACT	iv
DECLARATION.....	v
ACKNOWLEDGMENT	vi
LIST OF TABLES	xi
LIST OF FIGURES	xii
 CHAPTER ONE: INTRODUCTION	 1
1.1 Background of the Study.....	1
1.2 Problem Statement	6
1.3 Research Question.....	8
1.4 Research Objective.....	9
1.5 Scope of Research.....	9
1.6 Significance of Research.....	10
1.6.1 Theoretical Contribution	10
1.6.2 Practical Contribution	11
1.7 Definition of Research Terms	12
1.7.1 Employee Deviant Behaviours.....	12
1.7.2 Shadow IT	13
1.7.3 Strain	14
1.7.4 IT Accessibility	15
1.7.5 SETA.....	15
1.7.6 Work Overload.....	16
1.7.7 Work Pressure	16
1.8 Organisation of Thesis	16
 CHAPTER TWO: LITERATURE REVIEW	 18
2.1 Introduction	18
2.2 Employees' Deviant Behaviours	18
2.3 Shadow IT literature search overview.....	21
2.3.1 Description of Shadow IT	24
2.3.2 Impact of Shadow IT.....	26
2.3.3 Shadow IT Usage in Nigeria	30
2.4 Factors influencing shadow IT usage.....	34
2.4.1 IT Accessibility	38
2.4.2 SETA	43
2.4.3 Work Overload	46

2.4.4	Work Pressure	48
2.5	The Comparison of Prior Theories on Strain Theory.....	51
2.5.1	Neutralisation Theory.....	52
2.5.2	Social Presence Theory	53
2.5.3	Strain Theory.....	54
2.6	Prior empirical research on the structural factors and shadow IT usage....	55
2.6.1	IT accessibility and Shadow IT usage.....	56
2.6.2	SETA and Employee Shadow IT Usage.....	59
2.6.3	Work Overload and Employee Shadow IT Usage	62
2.6.4	Work Pressure and Employee Shadow IT Usage.....	64
2.7	Strain Theory.....	67
2.7.1	Overview of the Strain Theory.....	68
2.7.2	Development and Evolution of Strain Theory	69
2.8	Past Empirical Literature on Strain Theory	75
2.8.1	Strain and Employee Shadow IT Usage.....	77
2.8.2	Structural Factors and Strain.....	80
2.8.3	The Mediating Role of Strain in the Relationship between Structural Factors and Employee Shadow IT Usage	91
2.9	Underpinning Theory: Strain Theory	96
2.10	Conceptual Framework	96
2.11	Research Gap	99
2.12	Chapter Summary.....	100
CHAPTER THREE: RESEARCH METHODOLOGY		101
3.1	Introduction	101
3.2	Research paradigm	101
3.3	Research Design.....	105
3.3.1	Research Design Nature	105
3.3.2	The Qualitative Research Approaches	106
3.3.3	The quantitative approach.....	107
3.4	Unit of Analysis	110
3.5	Population of Study.....	110
3.5.1	Sample Size Identification	111
3.5.2	Sample Frame.....	114
3.5.3	Sampling Technique	116
3.6	Research Instrument Development	117
3.6.1	Questionnaire Design	117
3.6.2	Operationalisation and measurement of variables	118
3.7	Data Collection Procedure	127
3.8	Data Analysis	132
3.8.1	The Technique of Data Analysis	134

3.9	Chapter Summary.....	135
CHAPTER FOUR: DATA ANALYSIS AND RESULT		136
4.1	Introduction.....	136
4.2	An Overview of Data Analysis	136
4.3	Response rate	136
4.4	Preliminary Analysis	137
4.4.1	Data Coding and Screening.....	137
4.4.2	Procedural Examination of Data	139
4.5	Descriptive Statistics.....	142
4.5.1	Profile of Respondents	142
4.6	Common Method Bias (CMB).....	145
2.13	Research Model Testing/ Main Analysis.....	146
4.6.1	Measurement Model.....	146
4.6.2	Assessment of Structural Model	153
4.7	Direct-Effects Hypothesis	158
4.8	Mediating Effects Analysis	162
4.9	Chapter Summary.....	165
CHAPTER FIVE: DISCUSSIONS.....		166
5.1	Introduction.....	166
5.2	Overview of Research.....	166
5.3	Discussion of Result.....	170
5.3.1	Research Question 1: The Relationship between Structural Factors and Employee Shadow IT Usage.....	170
5.3.2...	Research Question 2: The Relationship between Strain and Shadow IT Usage.....	184
5.3.3	Research Question 3: Structural Factors and Strain.....	187
5.3.4	Research Question 4: The Mediating Effect of Strain	203
5.4	Conclusion	210
5.5	Implications of this Research	213
5.5.1	Theoretical Implication	213
5.5.2	Managerial/practical Implication	217
5.6	Limitations of the Study and Suggestions for Future Research.....	221
REFERENCES.....		224
APPENDIX.....		278
Appendix A: Existing articles (published in journals) on shadow IT.....		278

Appendix B: Other existing publications (Conference Papers and lecture Notes) on Shadow IT	286
Appendix C: Construct Measurement.....	297
Appendix D: Validation	300
Appendix E: Modification to the Questionnaire following the result of the pilot study	303
Appendix F: Validated Items Used for Questionnaire	304
Appendix G: Survey Questionnaire	307
Appendix H: Calculation of the sample frame.....	312
Appendix I: missing number.....	314
Appendix J: Multivariate Outlier	316
Appendix K: Outlier cases	318
Appendix L: Collinearity	319



List of Tables

Table 2.1 Description of Shadow IT	25
Table 2.2 Summary of hypotheses	98
Table 2.3 Summary of prior literature and gaps	99
Table 3.1 The quantitative and qualitative research approaches.....	108
Table 3.2 Sample size	114
Table 3.3 Calculation of the sample frame	116
Table 3.4 Items validated by Pilot Test.....	126
Table 3.5 Questionnaire Response Based on Regions	131
Table 4.1 Response Rate	137
Table 4.2 Data Coding	138
Table 4.3 Regression With and Without Outliers	141
Table 4.4 Demographic profiles of the respondents	142
Table 4.5 Variance inflation factors (VIF).....	146
Table 4.6 Item loading, T value, P-value, and VIF	147
Table 4.7 Discriminant Validity (HTMT).....	151
Table 4.8 Measurement Model result used for Structural Model Assessment	151
Table 4.9 The predictive relevance (Q^2)	156
Table 4.10 Coefficient of Determination (R^2).....	157
Table 4.11 The direct relationship between Strain, IT accessibility, SETA, WL, and WP on SIT.....	160
Table 4.12 The direct relationship between IT, SETA, WL and WP, and Strain	161
Table 4.13 Indirect effect of strain.....	163
Table 5.1 Overview of Research.....	168

List of Figures

Figure 2.1: Employees' deviant behaviours within organisations	19
Figure 2.2: Flow Diagram.....	22
Figure 2.3: Countries affiliated with shadow IT publication	23
Figure 2.4: Structural factors influencing employee shadow IT usage.....	38
Figure 2.5: The subject areas of available literature that used strain theory.....	68
Figure 2.6: An Illustration Of Merton's Deviance Typology Reflecting The Five Alternative Deviance Behaviours	72
Figure 2.7: Strain Theory Framework.....	75
Figure 2.8: Theoretical Framework.....	97
Figure 3.1: Sample Size Calculation.....	113
Figure 4.1: All Items Loading before Measurement Model Analysis.	147
Figure 4.2: Result of the Measurement Model Assessment.....	153
Figure 4.3: Result of the Structural Model.....	158
Figure 4.4: Result of the Proposed Model	164
Figure 5.1 Extended Strain Theory Model in Shadow IT Usage Context	212



CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Information technology has changed the organisation's information systems paradigm from traditional-based hosting systems to automated cloud-based systems known as cloud computing (Sabi et al., 2018). Cloud computing is a technological revolution that typically involves virtual interaction with cyberspace by accessing organisation technology (IT) needs, communicating organisation data and initiating and completing tasks over remote internet services (Büyüközkan et al., 2023; Khan & Al-Yasiri, 2018; Sharma et al., 2023). This has provided opportunities for effectively sharing, storing, analysing and retrieving massive amounts of data (Agapito & Cannataro, 2023; Oke et al., 2023).

Researchers have devoted extensive consideration and focus to comprehending the issues relating to cloud computing in organisations (De Vargas Pinto et al., 2022; Jarrahi et al., 2020; Raut et al., 2018; Sabi et al., 2018; Yau Yeung, 2017). These studies have shown that the acceptance of cloud computing stems from the numerous benefits associated with its usage. Some of these include increased innovations, employee autonomy, organisation centralisation, improved performances, overall cost reduction, access to a broader pool of customers, improved efficiency and effectiveness, ease of access to data and information, faster transactions, and enhanced communication within organisations (De Vargas Pinto et al., 2022; Jarrahi et al., 2020; Raut et al., 2018; Sabi et al., 2018; Yau Yeung, 2017). Although cloud computing has provided

numerous benefits to individuals and businesses, its usage has also opened doors to various security concerns, mainly due to its unsanctioned use, otherwise referred to as shadow information technology (shadow IT) usage (Castellano et al., 2022). Researchers have studied the negative impacts of cloud computing extensively. Some of which include social engineering activities, information systems security breaches, and financial losses (Alsmadi & Prybutok, 2018; Born & Krönung, 2016; Grassegger & Nedbal, 2021; Khan & Al-Yasiri, 2018; Lv & Zhou, 2014; Peng et al., 2019; Sabi et al., 2018).

Shadow IT usage refers to the engagement of individuals with unapproved and unauthorised technological resources to conduct official operations (Kopper et al., 2020; Mallmann, Maçada et al., 2019). Shadow IT includes various IT systems, such as unauthorised applications, communication systems, office tools, storage, and repositories. Additionally, shadow IT usage involves the installation of arbitrary plugins, the transmission of organisational data through random websites, the usage of personal and cloud services, such as personal email accounts, cloud storage, and social media platforms for communicating organisational data, and in the execution of official tasks (Born & Krönung, 2016; Haag & Eckhardt, 2014, 2017; Rains, 2015).

Previous research has categorised shadow IT as deviant behaviour regarding employees and their information systems (IS) usage (Abbas & Alghail, 2021; Willison et al., 2018). Studies have also undertaken empirical investigations to explore the motivations behind shadow IT usage (Castellano et al., 2022; Mallmann, Maçada et al., 2019; Mallmann & Maçada, 2017; Sillic, 2019). These studies collectively suggest that while individuals might have utilised shadow due to its beneficial advantages, its

usage within organisations IS represents a double-edged sword, capable of yielding both positive and detrimental consequences.

It has been acknowledged that individuals employ shadow IT because it offers immense benefits to users especially, employees and departments within organisations (De Vargas Pinto et al., 2022; Keskin et al., 2021). The benefits include enhanced independence, decreased reliance on centralised IS systems, stimulation of individual initiatives, promotion of creativity, and potential cost-effectiveness (De Vargas Pinto et al., 2022; Keskin et al., 2021). Despite these benefits, shadow IT usage can also trigger detrimental impacts in organisation IS. Moreover, researchers have warned that, in the long run, the negative consequences associated with shadow IT usage may outweigh its initial advantages (Abbas & Alghail, 2021; Willison et al., 2018).

Some of the negative impacts of Shadow IT usage include security vulnerabilities, data breaches, and data control challenges, disharmony within organisation IS, loss of centralisation in organisational IS, discrepancies in IS transparency, increased vulnerability of organisational information to infiltrators, and difficulties in integrating with existing IT infrastructures within the organisation (Abbas & Alghail, 2021; Willison et al., 2018).

Consequently, to mitigate the potential detrimental impacts of shadow IT usage, organisations must strike a delicate balance between empowering employee autonomy and IT related creativities while simultaneously implementing security and control mechanisms to curtail the employee usage of shadow IT (Gozman & Willcocks, 2018; Klotz, 2019; Mallmann et al., et al., 2019; Ozkan et al., 2021). This approach enables

organisations to protect themselves against the inherent risks associated with shadow IT usage (Castellano et al., 2022). One such way is providing structures and systems that can aid employees in work-related activities.

Furthermore, it is more feasible to examine antecedents to shadow IT usage and take proactive measures to prevent it rather than to address the inherent threats resulting from its unregulated usage. These threats include substantial losses that extend beyond financial implications to encompass non-financial losses, such as damage to the organisation's reputation, loss of goodwill, copyright infringements, and potential legal disputes (Gozman & Willcocks, 2018; Klotz, 2019; Mallmann et al., et al., 2019). Despite the adverse implications of shadow IT usage, its prevalence among employees within organisation systems has been on the rise. Therefore, this study empirically investigates antecedents to employee shadow IT usage.

It is worth noting that the few available empirical articles (as discussed in section 2.4) investigating antecedents to shadow IT usage have majorly explored structural organisational factors influencing shadow IT usage (Mallmann & Maçada, 2017; Silic et al., 2017; Silic 2019). Therefore, the choice of social presence theory, neutralisation theory, and inertia is justified (Mallmann & Maçada, 2017; Silic et al., 2017; Silic 2019). These prior studies have highlighted the need for further empirical research to understand the subject comprehensively (Raković et al., 2020). Therefore, in addition to the structural factors, this research examines the psychological perspective towards shadow IT usage. Studies on Information Systems (IS) have shown that psychological factors are motivating factors that influence employees' IS behaviours (Bock et al., 2005; Han & Kim, 2015; Vignoli et al., 2015). However, given the limited empirical

articles on shadow IT, prior research has not thoroughly examined this psychological dimension. Hence, this study extends the existing literature by empirically examining the psychological and structural perspective on employee shadow IT usage.

To achieve the stated research objective, this study draws upon strain theory, a psychological and sociological theory, as it is posited to address both the structural and psychological perspective toward deviant behaviour (Agnew, 2015; Antonaccio et al., 2015; Broidy et al., 2017; Farnworth & Leiber, 2019; Lianos & McGrath, 2018; Moon & Morash, 2017; Paez, 2018). Since shadow IT is a deviant IS behaviour, this study seeks to extend strain theory's application in the IS domain, specifically, employees' shadow IT usage. Furthermore, as discussed in section 2.3, prior research on shadow IT usage has left a notable gap in examining its usage in African countries. The identified gap is addressed by examining its usage among Nigerian employees (Magunduni & Chigona, 2018). The discussion on shadow IT usage in Nigeria is presented in section 2.3.3.

Drawing upon the prior studies which classified organisational structural factors as significant antecedents of employee deviant behaviours (Arnold et al., 2016; Guo, 2013; Korunka et al., 2010; Mainemelis, 2010; Pan et al., 2017; Thatte et al., 2014), this study examines the impact of structural and psychological factors on employee shadow IT usage. To the researcher's understanding, no prior study has examined the links between structural factors, psychological perspective (strain), and shadow IT usage using strain theory as the theoretical background. Therefore, this research is desired to contribute to the IS literature by providing an extended strain theory model that integrates organisational structural factors, strain, and shadow IT usage and

empirically testing the model. Moreover, it is desired that organisations provide structures relating to IT accessibility, SETA, work overload and work pressure to help minimise strain and mitigate their shadow IT usage.

1.2 Problem Statement

Existing security reports and literature consistently emphasise the widespread global usage of Shadow IT among employees due to increased acceptance of cloud-based IS (Abbas & Alghail, 2021; Castellano et al., 2022; Horton, 2020; Jarrahi et al., 2020; Nassar et al., 2021; Scalabrin Bianchi et al., 2022; Thales, 2020). Nigeria is not left out in this, as it has seen a significant surge in cloud IT usage, contributing to 29% of the African continent's internet activity (International Trade Administration, 2023). However, despite this high cloud engagement, more than 84% of the country's internet provision and usage originates from personal devices (Sasu, 2023). This may be due to the suboptimal organisational IT investment. Consequently, the high reliance on unofficial IT devices for work tasks is evident (Sule et al., 2023; Taofeeq et al., 2023; Yekinni et al., 2024).

Despite the expectation for employees to use IT systems at work, over 80% of the IT systems they use are unauthorised by organisation IT department (Keskin et al., 2021; Lv & Shou, 2014; Peng et al., 2019; Scalabrin Bianchi et al., 2022). This may, therefore, account for the rise in social engineering activities, numerous security breaches, and data theft issues, positioning Nigeria as one of the top countries globally facing cyber-security challenges (Njoku & Chukwu, 2023). Researchers have also confirmed that shadow IT usage has been identified as a primary contributor to various

security threats (Bourne, 2020; Goswami & Geetha, 2020; Horton, 2020; Peng et al., 2019).

However, despite the global usage of shadow IT and the associated security impacts, limited research is available (Ogedengbe et al., 2024). The available researchers, as presented in the literature review chapter, have majorly focused on employees in Western societies (Born et al., 2019; Haag et al., 2019; Fürstenau et al., 2021; Mallmann & Maçada, 2021; Scalabrin Bianchi et al., 2022), while studies focusing on African societies are lacking (Ogedengbe et al., 2024). These prior studies have called for more research and the need for organisational recognition of shadow IT usage existence rather than its denial or ignorance. Hence, this study responds to these calls by examining shadow IT usage among Nigerian employees.

While the available empirical research on shadow IT usage is still limited, most of the available literature has focused on the impacts of shadow IT usage, and the factors leading to its usage have received less attention. The impacts include risks, employee autonomy, performance and knowledge (Abbas & Alghail, 2023; De Vargas Pinto et al., 2022; Mallmann & Maçada, 2021). However, some researchers tried to investigate the antecedents to shadow IT usage (Gosman & Willcocks, 2018; Hatashima & Sakamoto, 2017; Mallmann et al., 2018). For instance, Mallmann et al. (2018) applied social presence theory to explore how interpersonal relationships at work affect shadow IT usage. Colleagues and superiors can influence employees to shadow IT usage. Additionally, research indicates that employees may rationalise their shadow IT usage due to deficiencies in the organisation's IT infrastructure and inadequate security policies addressing such usage (Klotz, 2019).

Theoretical frameworks have primarily concentrated on social and rational aspects, employing theories like social presence, neutralisation, and inertia to explore variables such as innovativeness, social presence, and perceived performance as potential factors impacting shadow IT usage (Haag et al., 2018; Mallmann et al., 2018; Silic et al., 2017). However, despite these efforts to address gaps in shadow IT research, as presented in section 2.4, limitations persist as these theories predominantly consider structural viewpoints, neglecting psychological aspects. While social factors shape employee behaviour, psychological aspects can also significantly influence behaviours, as humans often defy logic, probability, and predictability.

The discussion above highlights that employees' shadow IT usage is influenced by low organisational awareness, shaped by both structural factors and employees' psychological state. Strain theory is a framework that comprehensively addresses these aspects. Therefore, this study employs strain theory to investigate how structural and psychological factors impact Nigerian employees' shadow IT usage. Specifically, the study focuses on the psychological and structural factors of strain, IT accessibility, security education, training and awareness (SETA), work overload, and work pressure.

1.3 Research Question

This study aims to extend the knowledge about the organisation's information systems by addressing the following questions:

- I. Do the structural factors of IT accessibility, SETA, work overload, and work pressure influence employee shadow IT usage?

- II. Does strain influence employee shadow IT usage?
- III. Do the structural factors of IT accessibility, SETA, work overload, and work pressure influence Strain?
- IV. How is shadow IT usage affected by the mediating effect of Strain?

1.4 Research Objective

- I. To examine the relationship between structural factors (IT accessibility, SETA, work overload, and work pressure) and employee shadow IT usage.
- II. To examine the relationship between Strain and employee shadow IT usage.
- III. To examine the relationship between structural factors (IT accessibility, SETA, work overload, and work pressure) and Strain.
- IV. To examine how shadow IT usage is affected by the mediating effect of Strain.

1.5 Scope of Research

This study focuses solely on shadow IT usage in IS from the theoretical perspective of strain theory. It uses the organisation's structural factors (IT accessibility, security SETA, work overload, and work pressure) and the psychological factor (strain) as the antecedents to its usage. The justification is that Nigeria stands out as Africa's largest working population and biggest economy, with a GDP exceeding \$440 billion in 2021 (Iwedi, 2023; Ministry of Foreign Affairs Nigeria, 2022). Moreover, Nigeria is classified as Africa's largest ICT market. It accounts for 29% of the continent's internet users (International Trade Administration, 2023), making it an ideal setting to investigate shadow IT usage among employees.

1.6 Significance of Research

This study has both theoretical and practical contributions. These contributions are explained below.

1.6.1 Theoretical Contribution

First, this study attempts to replicate the strain theory in explaining employee shadow IT usage to fill the gaps in information systems literature. This study adds to the existing literature on IS and shadow IT research, which has called for more research into employee shadow IT usage. Since strain theory has been used to examine societal deviant behaviours, this study replicates strain theory in an organisational context regarding employees' IS deviant behaviour, specifically, their shadow IT usage. Second, this study contributes to the existing literature on information systems by developing a conceptual model for employee shadow IT usage based on the strain theory and empirically testing the conceptual model using a quantitative research method.

Third, prior studies have called for more empirical research to understand employee shadow IT usage further. Structural and psychological factors (strain) were used as the antecedents of shadow IT usage. The relationship between structural factors and strain was also tested. While this study contributes to the IS literature, it will also contribute to the available literature on shadow IT. Moreover, the Shadow IT area is still emerging and far from maturity. Hence, there is a need for more studies in this area.

1.6.2 Practical Contribution

This study adopts the strain theory to understand employee deviant behaviour toward shadow IT usage. Based on strain theory, there is a need to examine structural and psychological factors that motivate employee shadow IT usage, which has been described as deviant behaviour towards the organisation. By examining the antecedents to this employee behaviour, shadow IT usage can be proactively reduced, and employee compliance with IS and other organisational systems policies can be improved.

This study will help in understanding the existence of shadow IT in organisations and the employees' perception regarding their usage. Also, strain is a psychological factor that influences IS deviant behaviours. Thus, this study aids organisations in providing the essential structural factors that will improve employees' cognitive resources, reduce strain levels, and deter shadow IT usage when developing their IS structures. This research will also serve as a guideline for the IT departments in organisations to know the crucial factors to strengthen IS security.

Aside from the IT structure, the knowledge-impacting structures of SETA are also believed to impact employee behaviours. Organisations should provide structured training and education targeting the improvement of employees' knowledge, reducing redundancies in SETA activities, and eliminating obsolescence in activities. Mechanical learning, time, and resource wastages should be considered when creating SETA structures.

Besides, this study aims to explain the impact of work overload and work pressure on employees strain and their shadow IT usage. This study aids organisations in understanding that high employee turnover, limited timeframe of activities, and low workforce may reflect work overload, which causes strain and influences their deviant IS behaviours. Also, this study will assist the organisation in ensuring the maintenance of healthy human relationships at work. A toxic social relationship at work signifies work pressure. Organisations are encouraged to enable a positive work environment. Finally, this study encourages management investment in information technology because the importance of cloud computing, applications, and IT-related hardware within an organisation cannot be underrated.

1.7 Definition of Research Terms

1.7.1 Employee Deviant Behaviours

Employee deviance is the voluntary behaviour exhibited by employees due to the lack of motivation to conform to the organisation's expectations and their willingness to violate the organisation's norms (Kaplan, 1975). Organisation norms are the fundamental ethical standards and other social community standards, which include those prescribed formally and informally as the organisation policies and the rules and procedures established within the organisation.

Employees' deviant behaviours can also be described as unethical behaviours within an organisation (Wright et al., 2009). These are employees' behaviours outside the organisation's norms and the accepted standard. They are the activities that defy the organisation's policies, practices that deviate from ethical standards, the actions that impede the cognitive moral development of individuals within the organisation, and

the lifestyles that defy the empathy and moral philosophies expected within the organisation (Askew et al., 2015; Moore et al., 2012). Moreover, these deviant behaviours are explained to influence the organisation negatively (Askew et al., 2015).

These deviant behaviours, therefore, include non-compliant behaviour such as abusing the organisation's Internet policies and misuse of organisation IS (Verschoor, 2013). IS misuse involves situations in which organisation assets and resources are used unauthorisedly and shadow IT systems are used (Verschoor, 2013). People's cognitive moral development influences some of these deviant behaviours (Choi & Winterich, 2013). This includes the employee's basis for developing integrity, virtues, and character intention within an organisation, which might be formed due to the organisation's system. These cognitive moral developments, therefore, influence their deviant behaviours (Choi & Winterich, 2013). This study focused specifically on shadow IT usage as the IS deviant behaviour of employees examined by this research.

1.7.2 Shadow IT

Shadow IT is a generic word that describes IT services, cloud systems, software, and hardware used by business units independently of the whole organisation's IT system, which is not aligned with the centralised organisation's IT system (Kopper & Westner, 2016). Shadow IT usage refers to the deviant behaviour of employees towards interacting with systems that an organisation neither provided nor sanctioned by the organisation's IT department (Gozman & Willcocks, 2018; Haag et al., 2018; Ines et al. et al., 2017; Kopper et al., 2018). The various cloud and non-cloud base forms are part of the generic shadow IT systems. The non-cloud-based shadow IT includes

using personal computers, hard disks, hard drives, and USBs, making hard copies of confidential documents to store organisation data, and carrying out official activities.

This study, therefore, describes shadow IT usage as the employee interaction with IT mechanisms that were not sanctioned, authorised or provided for organisation use by the IT department. This includes the usage of a cloud-based repository, office assistive tools, IT hardware, and communication tools not provided for official use by the organisation's IT department. For example, using personal emails instead of the organisation's official emails when sending confidential documents and corporate information. Moreover, the usage of cloud repository and storage systems that were not provided for official use by the organisation's IT department, such as personal non-cloud storage and other cloud storage systems; the usage of unsanctioned applications and websites, for example, office tools online applications whose security might be compromised and privacy might be lacking; social media applications; random cloud plugins among others (Gozman & Willcocks, 2018).

1.7.3 Strain

Strain is the stressful mental condition experienced when the cognitive resources available are less than the cognitive activities (Albers, 1995). Cognitive resources refer to human mental resources distributed among all cognitive activities in carrying out functions (Ge et al., 2019). This study describes strain as the psychological stress experienced by employees due to imbalances in organisational structural factors. Some of the elements of strain include anxiety, inability to feel rested, stress, pressure and tension. Strain leads to deviant behaviours such as shadow IT usage.

1.7.4 IT Accessibility

IT accessibility refers to the availability of equitable IT systems that employees need to carry out their tasks effectively (Chilton et al., 2010). This study describes IT accessibility as providing all relevant IT systems for workers, including cloud and non-cloud-based IT systems (Ogedengbe, 2024). cloud-based IT systems such as organisation-provided internet services, office tools and teleconferencing systems, cloud repository and storage systems, communication tools, as well as all forms of cloud-based IT systems that are needed for employees to carry out their official tasks (Huber et al., 2017; Kopper et al., 2018; Kopper et al., 2016; Magunduni & Chigona, 2018). The non-cloud-based approach includes hardware, software, and physical IT structures such as USBs and disks.

1.7.5 SETA

For this study, Security education, training, and awareness (SETA) refers to the security knowledge impacting structures organisations provide to employees to facilitate their IT behaviour at the workplace. This includes providing IT assistive technologies, IS policies, awareness programs, education, and training on organisation policies regarding interaction with IT systems. It also consists of all forms of training and educative facilities that will assist employees' knowledge and skills development in the workplace. When SETA is available in the workplace, employees' usage of shadow IT may be reduced significantly (Kim et al., 2016; Kim et al., 2013; Oliveira & Martins, 2014).

1.7.6 Work Overload

Work overload is a form of work stress experienced by employees at the workplace. It is an excessive workload for the employee's official tasks (Dewangan & Verghese, 2018; Spector, 1998, 2012). This study, therefore, describes work overload as the extent of work demand on employees' which causes strain and may influence them to use shadow IT systems. This refers to functions to be carried out, the labour available to carry out the tasks, the timeframe to carry out those tasks, and the availability of support systems, such as the needed IT systems, to carry out the tasks effectively. Moreover, when low-level tasks, such as operations and technical activities, lack the required IT support to carry them out, it becomes work overload. Employees become drained mentally, and high-level tasks, such as interpretation of results and decision-making, may be influenced negatively.

1.7.7 Work Pressure

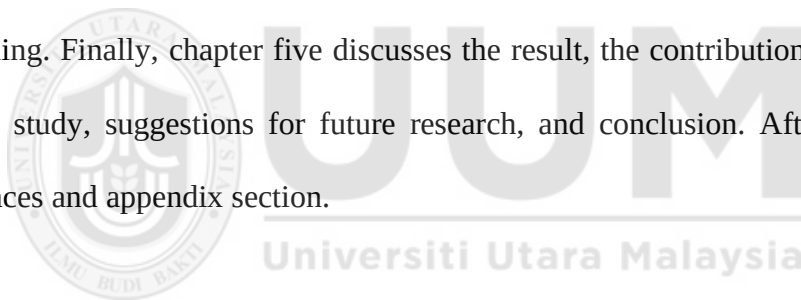
This study defines work pressure as the pressure from relationship factors within the organisation, which may influence employees into interacting with shadow IT. This refers to the imbalances caused by human social relationship factors within an organisation. Work pressure includes pressures caused by co-workers as well as superiors. When managers' attitudes towards shadow IT usage are relaxed, employees' usage of shadow IT may be influenced. Moreover, peer pressure can also impact employee shadow IT usage.

1.8 Organisation of Thesis

Chapter One reveals the introduction chapter to this study, which includes the study's background and problem statement, which shows the research gaps. The research

question aligned with the problem statement and explained the research objective. The definition of terms and the significance of the study have also been presented. Chapter two presents the related literature review, the framework for this study, and the hypothesis development.

Chapter three revealed the research methodology of this study. The research methodology includes the respondent's description, the population focus, the sampling techniques, and the data analysis overview. Moreover, the research instruments and data collection methods were also described. Chapter four presents the data analysis. This refers to the preliminary analysis, such as data screening and cleaning, and the main data analysis, including the descriptive data analysis and the structural equation modelling. Finally, chapter five discusses the result, the contribution and limitations of this study, suggestions for future research, and conclusion. After which is the references and appendix section.



CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

In this chapter, prior related literature was reviewed. This consists of a review of the literature on shadow IT usage and strain theory. This chapter also reviews the literature regarding the antecedents to shadow IT usage and strain, such as IT accessibility, SETA, work overload, and work pressure. The framework and hypotheses of this study were also developed based on the relationships between the related variables.

2.2 Employees' Deviant Behaviours

To understand shadow IT usage, discussing employee workplace deviant behaviour is necessary. Many studies have attempted to explain the various deviant behaviours exhibited by employees within the workplace (Askew et al., 2015; Choi & Winterich, 2013; Moore et al., 2012). Based on these studies, it can be summarised that employees' deviant behaviour can be categorised into two. The first is the deviant behaviour exhibited towards the organisation, and the second is the deviant behaviour exhibited towards one another (Adeoti et al., 2017; Tews & Stafford, 2019). Examples of interpersonal deviance directed at fellow employees include pulling pranks on people, making fun of people, and embarrassing people at work (Tews & Stafford, 2019). In this regard, Shadow IT is under the deviant behaviour exhibited towards the organisation. The study has attempted to show the classification of employees' deviant acts in Figure 2.1.

Moreover, deviant behaviours towards the organisation can also be categorised as direct or indirect acts. Direct deviant acts are behaviours performed directly by specific individuals. Within the organisation, direct deviant behaviour exhibited by employees includes violation of trust, conflicts of interest, self-dealing, lateness to work, using illicit drugs during work hours, rebellion, and failure to follow superiors' directions (Dewangan & Verghese, 2018; Tews & Stafford, 2019).

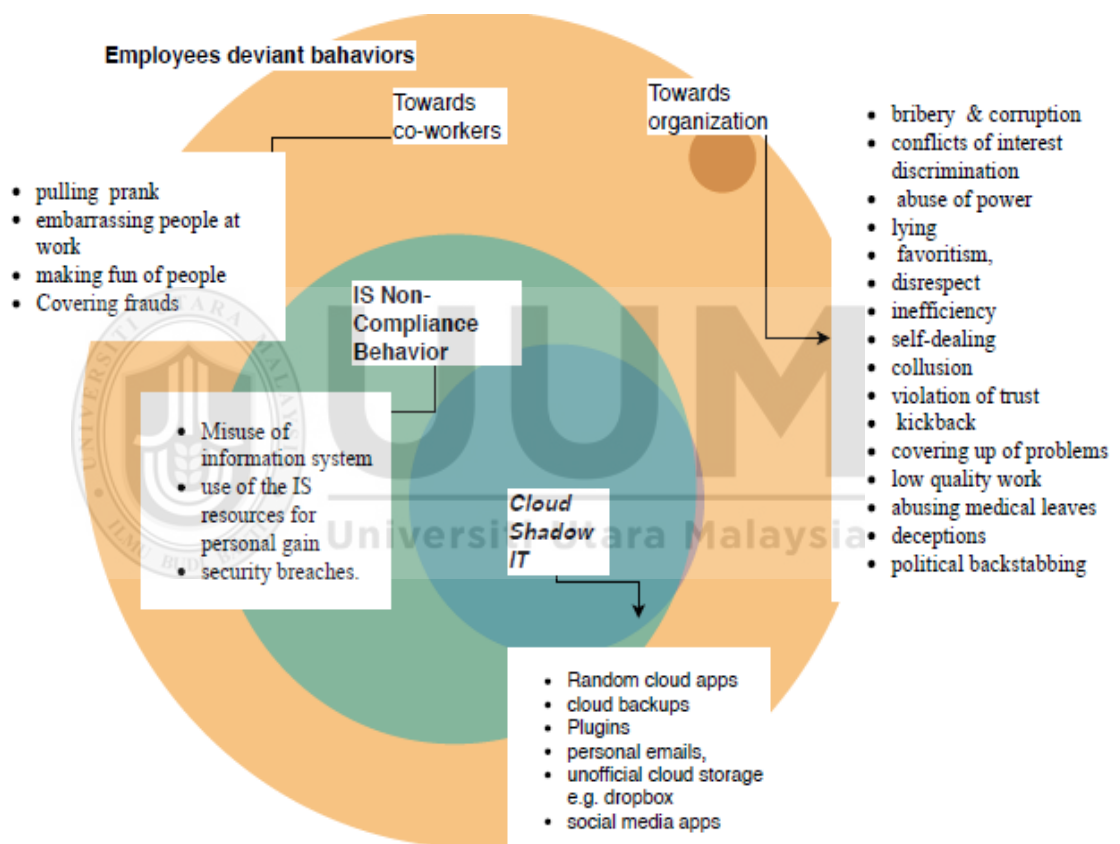


Figure 2.1
Employees' Deviant Behaviours within Organisations

Furthermore, direct deviant behaviours employees exhibit includes bribery and corruption, discrimination, abuse of power, lying, favouritism, disrespect, inefficiency, collusion, kickback, conflicts of interest, and unethical behaviours such as covering up

problems, low-quality work, abusing medical leaves, and deceptions (Appelbaum et al., 2007; Askew et al., 2015; Balkin & Gomez-Mejia, 2002).

The indirect deviant includes behaviours that individuals do not perform directly but may still be held accountable for due to their influence on others within the organisation. For instance, the lack of oversight by a supervisor on subordinate interactions with shadow IT can contribute to indirect deviant actions. Other examples of indirect deviance include intentionally overlooking colleagues' behaviours that can bring discredit to the organisation, political backstabbing of organisation leadership, and actions that drain other employees' energy and mental stability (Askew et al., 2015; Tews & Stafford, 2019). These acts, although unethical, may not be illegal. It is, therefore, essential to understand these different forms of deviant behaviours within organisations to mitigate the potential negative impacts on the workplace environment and overall productivity.

Differentiating between deviant and legal behaviour holds significant importance within the context of this study. It is imperative to acknowledge that employees' deviant behaviour does not necessarily imply their direct involvement in illegal acts (Askew et al., 2015). This distinction arises due to the fundamental focus of an organisation's ethical standards on providing specific directions and guidelines about behaviours and actions while ensuring compliance with moral principles. Moreover, the policies and ethical procedures can vary across organisations. Therefore, it is crucial to recognise that the ethical responsibilities of employees are not fixed and may not be articulated in a prescribed set of rules and policies. Instead, these responsibilities are subject to change and evolution in response to environmental factors, such as

technological advancement and paradigm shifts (Askew et al., 2015). Consequently, the term "Shadow IT" may be explicitly illegal acts but also IS deviant behaviours. Illegality is only achieved when an organisation criminalises the deviant behaviour. All shadow IT usage is therefore unethical and deviant, but may not necessarily be illegal; this study focused on Shadow within the context of it being a deviant IS behaviour.

2.3 Shadow IT literature search overview

This study relied on all relevant articles on shadow IT, as presented in the flow diagram in Figure 2.2. The terms used for the search include terms such as "shadow IT", "business-managed IT", "shadow information technology", "democratic IT", "rogue IT", OR "feral IT". From the literature search, only 105 studies were found to be relevant to shadow IT, and only 45 studies were peer-reviewed articles. Out of the 45 peer-reviewed articles, 30 papers are empirical articles.

The empirical studies are publications whose results are based on data collection and analysis. This includes triangulation method studies, quantitative studies such as surveys and experiments, and quantitative studies such as case studies and interviews. The rest of the papers, which include the non-empirical papers, conceptual papers, conference proceedings, lecture notes, and reports, were also used as references for this study.

Based on the available literature on shadow IT, it can be inferred that the shadow IT subject is still emerging and has several prospects for growth. Previous studies have also highlighted this perception (Raković et al., 2020).

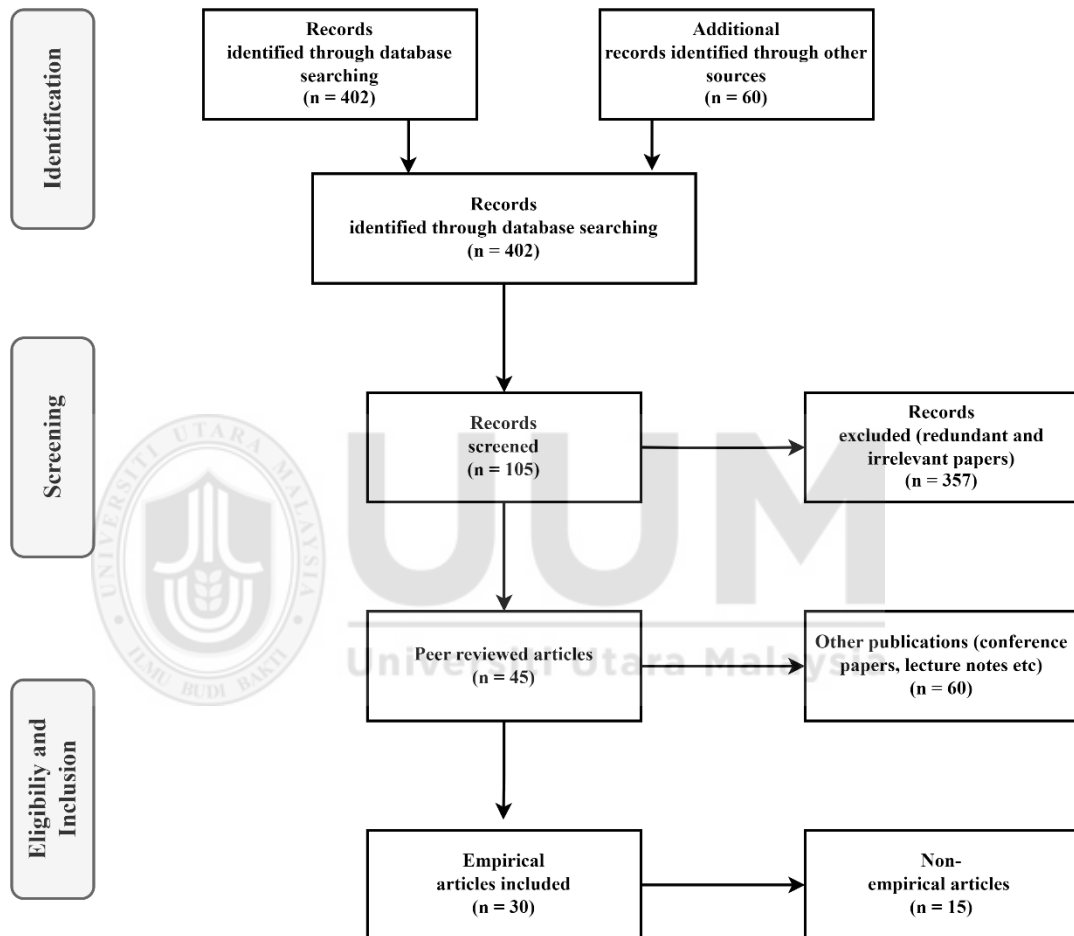


Figure 2.2
Flow Diagram

Figure 2.3 illustrates the publication locations affiliated with these studies, indicating a lack of strong representation in African and Asian countries. The affiliation of researchers shows that 39% of papers were affiliated with Germany, which ranks the highest in affiliation of papers by country. The second is the United States, which has

9% of the papers, and the third is the United Kingdom, which has 4 papers. New Zealand 3, Switzerland, Turkey, South Africa and India each have 2 publications.

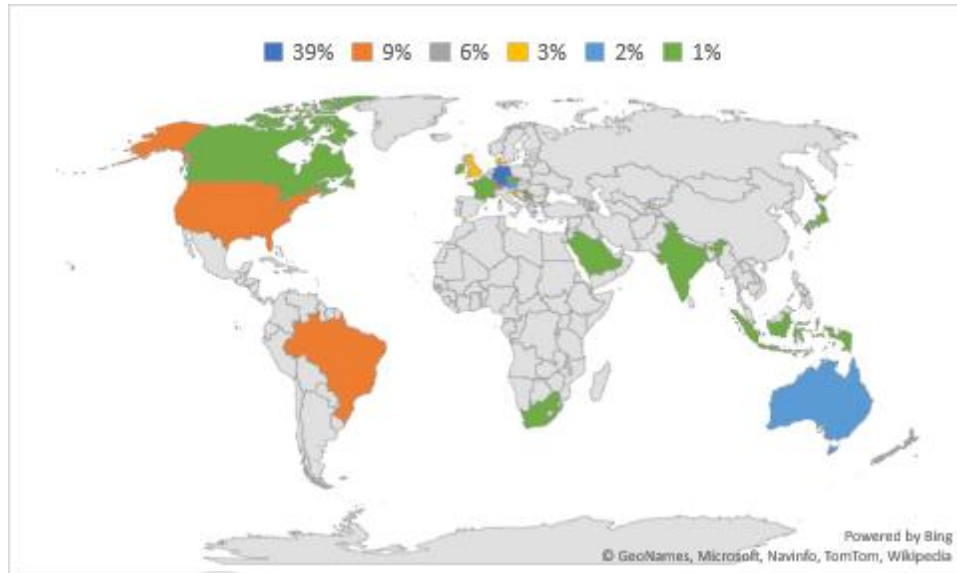


Figure 2.3
Countries affiliated with shadow IT publication

Moreover, the review indicates a lack of representation of shadow IT studies in Africa. Despite the acceptance and utilisation of cloud IT in Africa, research on shadow IT in this region is scarce. From the dataset, only two papers were affiliated with Africa. While one is a conceptual paper (Magunduni & Chigona, 2018), the other is an empirical paper that examines shadow IT usage in hospitals in Namibia and South Africa (Kapepo et al., 2021). Most shadow IT-related papers used for this literature review are affiliated with Western countries. This highlights the necessity for more publications exploring individual behaviours concerning shadow IT usage in other economic contexts. This is the motivation for examining shadow IT in the context of Nigerian perceptions. Based on the literature, this study discusses shadow IT usage in

terms of its description, beneficial impacts, negative impacts, usage in Nigeria, and the factors influencing its usage.

2.3.1 Description of Shadow IT

Shadow IT usage has been described as a deviant behaviour exhibited by people who use and interact with information technology to carry out their job tasks effectively (Haag et al., 2022). Shadow IT refers to all information technology systems that neither originate from the organisation's IT department nor receive explicit authorisation for official usage. Scalabrin et al. (2022) describe shadow IT usage as using devices, software, systems, and applications without the IT department's approval. This includes all technologies not officially authorised to be used or provided by the IT department, which people within the organisation use to carry out official duties and meet their information technology needs (Mallmann et al., 2018).

Therefore, this study conceptualises shadow IT usage as the usage of any IT systems outside the IT system approved and provided for use by the organisation's IT department (Ogedengbe et al., 2024). This includes any hardware, software, or applications introduced by employees to complete their official duties and work tasks.

Many terms have been used to describe shadow IT. These terms include shadow system, business-managed IT (Kopper et al., 2018), rogue IT (Chua et al., 2014), shadow sourcing, feral IT (Thatte et al., 2014), and democratic and workaround IT (Röder et al., 2014). Shadow IT can be brought individually or collectively as a team by those inside the organisation (Hulsebosch, 2016). This includes mobile devices and social media applications. Top the list of these are personal emails, applications, social

collaboration networks such as WhatsApp and Skype, and applications used in sharing information and documents such as Google Drive (Haag et al., 2019; Hulsebosch, 2016; Ines et al., 2017; Mallmann, Gastaud, et al., 2018). The description of shadow IT is presented in Table 2.1.

Table 2.1
Description of Shadow IT

Authors	Definition of Shadow IT
Haag et al. (2022)	Deviance actions enabled by novel information technologies (ITs) like mobile devices and third-party cloud services but are against organisational IT policies.
Scalabrin et al. (2022)	Devices, software, systems and applications without the approval of the information technology (IT) department.
Fürstenau et al. (2021)	Information systems hidden from managers and official IT units.
Bour et al. (2019)	Democratic information system in organisations
Richter et al. (2019)	The voluntary use of private devices by employees without the IT department's formal approval is called Shadow IT.
Klotz Westner et al. (2019)	The autonomous deployment/management of IT instances by business units
Šedivcová Nesvedová & Potančok (2019)	Software, hardware, or any other solution used by employees within organisations that have not received any prior formal approval from the IT department to be used
Mallmann & Maçada (2017)	unauthorised technologies in the workplace
Klotz Kopper et al. (2019)	The autonomous deployment/procurement or management of Information Technology (IT) instances, i.e., software, hardware, or IT services, by business entities
Mallmann al. (2019)	The use of Information Technology (IT) without formal approval and support of the IT department
Cox (2019).	Unsanctioned IT
Sillic (2019)	IT solutions and systems used without prior explicit organisational approval.
Haag et al. (2019)	Technologies introduced into an organisation are a form of non-compliance behaviour to IS policies. This includes Dropbox, WhatsApp, Google Docs and cloud applications.
Magunduni & Chigona (2018)	Implementation of IT solutions by end-users while bypassing formal IT processes and controls

Authors	Definition of Shadow IT
Mallmann Maçada & Oliveira (2018)	Unauthorised collaborative systems employees use to collaborate, communicate, and share content with coworkers, clients, or external partners.
Shaikh (2018)	Unauthorised use of IT resources/tools is defined as collaborative systems for communication and sharing content among employees of an organisation.

2.3.2 Impact of Shadow IT

The effects of shadow IT usage can be seen from positive and negative perspectives. Studies have shown that individuals within organisations engage with shadow IT due to the perceived benefits and impacts associated with its usage. Some other studies have examined the negative impacts of shadow IT usage. These impacts are discussed in this section.

2.3.2.1 Beneficial Effect of Shadow IT Usage

The positive perspective refers to the benefits that accrue to shadow IT usage. Both conceptual and empirical papers have indicated that people use shadow IT due to its benefits (Haag et al., 2019; Hasnat & Philbin, 2021). Moreover, shadow IT yields positive outcomes when tailored to the users' local needs Kopper et al. (2020). These benefits are the same as the benefits gotten from the usage of approved organisational IT structures. This includes an increment in productivity and gains, an increase in innovation, agility, and flexibility, an improvement in the satisfaction of users, and an enhancement of the relationship between the IT department and the various business units in alignment towards similar goals (Born & Krönung, 2016; Francisco et al., 2017; Haag et al., 2018 Johnson, 2017). The primary benefit difference between official IT and shadow IT is the cost and usage authorisation. Most of the time, shadow

IT is easy to access and very cheap, unlike organisation-approved IT, which may be expensive.

Shadow IT usage is also a form of improvement of performance among employees. This was confirmed by the research, which shows that shadow IT leads to increased effectiveness and efficiency of employees in task completion (Scalabrin Bianchi et al., 2022). This is why studies show that people use shadow IT mainly to aid their work tasks. For instance, Shadow IT is a form of collaboration mechanism. This perception was confirmed by a study by Mallmann et al. (2018). The result shows that shadow IT provides knowledge sharing for employees and individuals working in geographically dispersed settings due to its real-time communication capability.

Moreover, shadow IT improves the social presence of users. This was based on the study of Mallmann and Maçada (2021) on 286 employees. The result shows that shadow IT provides access to interactive tools that offer immediate and dynamic interactions, enabling instant communication and facilitating information and knowledge sharing.

The benefits of shadow IT usage have also been described as a form of value creation for firms in gaining access to information technology, which they might not have been able to afford. Lack of access to information technology is seen as a significant impediment to organisational performance. Therefore, exposure and interaction with shadow IT remove such barriers. Other benefits include ease of communication, cheaper and affordable IT, improved innovation, employees' creativity, and

performance improvement (Born & Krönung, 2016; Haag & Eckhardt, 2015, 2015; Hulsebosch, 2016; Kopper, 2017; Mallmann & Maçada, 2016).

2.3.2.2 Negative Effect of Shadow IT Usage

Although individuals use shadow IT due to the benefits associated with its usage, studies have also revealed that shadow IT usage also leads to several adverse effects, majorly security risks. These security risks include data breaches, insider attacks, organisation assets vulnerabilities, system threats, and malware (Gozman & Willcocks, 2018; Netskope, 2016; NTT, 2016). Moreover, given that shadow IT does not take its corporate security measures from the organisation, nor does the central IT support them, shadow IT becomes unreliable. This is due to a perceived lack of continuity since its usage can be discontinued at anytime (Gozman & Willcocks, 2018).

An interview of 11 IT users conducted by Abbas and Alghail (2021) shows that shadow IT usage has a negative effect on knowledge protection within the organisation. According to the research, the drawbacks of shadow IT include security risks like data protection, potential misuse, and misinterpretation of communications, which can lead to knowledge leaks. It also results in loss of business control, particularly over IT functions, and lacks privacy assurances, with data potentially being collected and sold. Additionally, it can be time-consuming and cause work delays compared to official channels, with activity tracking being challenging.

Another research by Ali and Kaur (2019) described the negative impact of shadow IT usage by connecting shadow IT to bring your own devices (BYOD). The adverse

effects of shadow IT usage include significant security risks such as data theft and unsecured design architectures compromising security policies. Using external devices on internal corporate networks can lead to malware installation and severe damage . At the same time, challenges in revoking internet access for departing employees can also pose risks. Poor design of Bring Your Own Device (BYOD) policies can significantly increase cyber security risks, highlighting the need for trusted user access, monitoring BYOD-user activity, and ensuring audit compliance.

In addition, most shadow IT applications' security and data encryption are lacking, and most do not have audit logs showing consumer interaction with them. Additionally, they do not have any contracts stating that cloud users own the data (Castellano et al., 2022; Ozkan et al., 2021; Suer, 2017). Also, shadow IT does not take its corporate security measures from the organisation, nor are they supported by its central department, leading to high-security risks (Castellano et al., 2022; Ozkan et al., 2021; Suer, 2017).

Shadow IT usage also harms an organisation's security and puts confidential information at risk. This was confirmed by the experiment carried out by Myers et al. (2017). The experiment results show that the information from the shadow IT sources is less credible than those obtained from the official approved IT systems. Moreover, decision-making via dependence on shadow IT sources has increased error rates compared to decisions made from non-shadow sources. The negative effect of shadow IT usage is, therefore, summarised as cybercrime insurgencies, exposures of IS to malware, less credibility of information, confusing information sources, security Breaches, IS privacy compromise, and infiltration by external parties (Allen et al.,

2017; Francisco et al., 2017; Gozman & Willcocks, 2018; Sauerwein et al., 2018; Willison et al., 2018).

Preimesberger (2018) explained some tactics that should be followed for effective shadow IT management in organisations to reduce the adverse effects of shadow IT usage. This includes organisations' recognition of the existence of shadow IT and the need to stop denying its usage among employees (Fürstenau & Rothe, 2014). Moreover, the organisations should implement improved technology, and the management should officially set up rules and policies that discourage the acceptance and usage of these shadow IT.

2.3.3 Shadow IT Usage in Nigeria

According to the available empirical studies, shadow IT usage is a global phenomenon (Gozman & Willcocks, 2018; Khalil & Samhan, 2024; Ostermann et al., 2020; Rakovic et al., 2020). These studies have indicated that the usage of shadow IT in organisations is subject to the acceptance of cloud computing. This is why Gozman and Willcocks (2018) described shadow IT as a “cloud dilemma”. There is, therefore, a likely chance for shadow IT usage in any system that has accepted digitalisation (Gozman & Willcocks, 2018; Rakovic et al., 2020). Shadow IT also reflects IT consumerisation among individuals within organisations (Ostermann et al., 2020). It indicates the acceptance of IT systems wherein people introduce alternative IT covertly (Klotz et al., 2019). Therefore, Shadow IT usage is one of the challenges organisations face after adopting digital information systems. Nigeria, as a country, is not left behind in digitalisation (Adenekan & Okuonghae, 2023; Musa et al., 2023; Oyetunde et al., 2019; Oyewole & Onaolapo, 2023).

Regarding digitisation, security reports have shown Nigeria to generate almost 30% of internet usage in Africa (International Trade Administration, 2023). This reflects the high usage of cloud interaction in Nigeria. Therefore, based on the assertion of shadow IT being used due to digitalisation consumerisation, just as the organisations globally are facing the dilemma of shadow IT usage, Nigeria organisations are also not left behind in this assertion (Ogedengbe et al., 2024)

Due to the wide acceptance of digitisation in Nigeria, the government has promulgated several laws and regulations governing information technology (IT) and related activities. For instance, in 2019, Nigeria's National Information Technology Development Agency (NITDA) introduced the Nigeria Data Protection Regulation (NDPR), which governs information technology (IT) and related activities, specifically focusing on protecting individuals' privacy rights and regulating the processing of personal data by both public and private entities. Also, the Freedom of Information Act enacted in 2011 aims to promote transparency and accountability by granting citizens the right to access information held by public institutions, including government agencies dealing with information technology (IT). Despite all these regulations, organisations are still facing IT challenges in Nigeria.

Several factors contribute to these challenges, including IT accessibility in Nigeria. These include challenges such as limited internet connectivity, high cost of internet, and network issues (Abubakre et al., 2022; Adenuga et al., 2019; Ofusori & Subramaniam, 2022; Oyetunde et al., 2019). Additionally, despite regulations like the Nigeria Data Protection Regulation (NDPR) aimed at protecting privacy rights and

governing data processing (NITDA, 2019), there are still concerns about data security and breaches due to inadequate implementation and enforcement of these regulations (Olowo, 2020). All these create gaps in the implementation of IT solutions (Musa et al., 2023). These factors collectively contribute to the challenges faced in achieving comprehensive IT accessibility in Nigerian organisations.

Moreover, in 2019, amendments were made to the Public Procurement Act of 2007 to integrate e-procurement practices. However, implementing these amendments faced challenges due to unclear guidelines and policies that mandated ministries or agencies to transition to e-procurement (Musa et al., 2023). Additionally, limited investment in IT infrastructure has led agencies to continue using manual procurement methods, neglecting the potential benefits of IT solutions in enhancing transparency and accountability in public spending.

Because many employees are tech-savvy, they often use their IT setups to complete tasks (Adetayo, 2021; Ofusori & Subramaniam, 2022). The study conducted on bank employees in Nigeria confirms the widespread usage of personal IT devices among the workers (Ofusori & Subramaniam, 2022). Consequently, the absence of a comprehensive framework for IT adoption has allowed shadow IT practices to thrive as employees seek alternative technological solutions to meet their operational needs.

The usage of personal devices by employees has caused organisations in Nigeria to encounter security threats such as data leakage, Wi-Fi eavesdropping, phishing, viruses, and malware. Similarly, organisations are exposed to data leakage, viruses,

and phishing through lost or stolen employees' IT devices, mobile device sharing, and IT device disposal (Adetayo, 2021; Ofusori & Subramaniam, 2022).

For example, using personal cloud services for file storage poses risks, as corporate data stored in these services may be vulnerable to third-party hacks. Also, many Nigerian employees do not report lost or stolen devices, making it challenging for organisations to secure sensitive information (Adetayo, 2021; Ofusori & Subramaniam, 2022). Additionally, lending mobile devices containing sensitive information to family, friends, or colleagues can lead to unauthorised access and data breaches. Unsecured airwaves and public Wi-Fi networks potentially lead to data theft and security breaches. It is therefore recommended that relevant IT regulations be implemented in Nigerian organisations that cloud computing and IT structures be invested in, that personal device usage at work be abolished, and that organisations adhere to organisational security policies. These will secure confidential information and maintain physical control over data and information devices to mitigate these threats effectively.

In response to the challenges associated with shadow IT usage in Nigeria, this study examines the impact of structural factors (IT accessibility, security education training and awareness, work overload, and work pressure) and psychological factors (strain) on Nigerian employee shadow IT usage. The relationship between structural factors and strain was also examined.

2.4 Factors influencing shadow IT usage

This study reviewed the factors influencing shadow IT usage and focused on all the available empirical articles that focused on the factors that influence shadow IT usage. The first discovery made was that minimal empirical articles were available. Twelve articles (articles published in journals and not conference proceedings) were discovered that examined the antecedents of shadow IT usage. Some studies used the quantitative approach (De Vargas Pinto et al., 2023; Dirgantari, 2023; Nguyen, 2023; Ogedengbe et al., 2024; Ostermann et al., 2020; Silic et al., 2017). The other articles were conducted using a qualitative approach using case studies and interviews (Hasnat & Philbin, 2021; Jarrahi et al., 2020; Khalil & Samhan, 2024; Richter et al., 2019).

Secondly, most available studies have examined only the structural perspectives of shadow IT usage. For example, a quantitative study (De Vargas Pinto et al., 2023) shows that rational reasons, such as autonomy, and increased performance, influence shadow IT usage. Also, performance and innovation among IT consumers at work motivate shadow IT usage (Ostermann et al., 2020). another quantitative study (Nguyen, 2023) shows three factors as motivators for shadow IT usage. These factors include subjective norms, effort expectancy, and performance expectancy.

IT constraint is another structural factor influencing shadow IT usage (Haag et al., 2019). The study shows that individuals within organisations relate to shadow IT due to the constraints associated with the IT structures within the organisation. Moreover, the need for productivity within the IT constraint system motivates individuals to innovate and access IT structures, which may justify their shadow IT usage. This perception was confirmed by a qualitative study by Khalil and Samhan (2024), given

the limited empirical articles on shadow IT usage. The literature review was extended to all related publications, including conceptual articles, conference papers, and lecture notes, to identify the independent variables in this study. This study classifies organisation-influenced antecedents of shadow IT usage as structural factors (Klotz et al., 2019; Andreas Kopper, 2017; Andreas Kopper et al., 2018; Kopper & Westner, 2016).

The structural factors are reflected as the imbalances within the organisation and the social influence caused by individuals within the organisation. These encompass the reasons that attract users to adopt shadow IT solutions over the usage of approved organisations' IT structures (Klotz, 2019; Preimesberger, 2018). They are the rational, practical, and objective considerations that influence decisions and behaviours. These factors are often based on functionality, efficiency, cost, and other tangible benefits. Technical accessibility, user competence, and performance expectancy are structural factors influencing shadow IT usage (Born & Krönung, 2016).

Technological accessibility includes aspects such as the availability of applications, access to web services, user-friendly interfaces, and ease of use (Kapepo et al., 2021). Shortcomings in the IT department's ability to provide adequate resources and the misalignment between the IT department and the business units are among these technical accessibility issues (Klotz et al., 2019). This study, therefore, conceptualises all the challenges associated with assessing IT as IT accessibility. This serves as a structural factor that influences shadow IT usage.

User competence, conversely, relates to the IT proficiency of individuals using shadow IT, including their knowledge and ability to access and operate these IT systems. It is the IT competency of the shadow IT. (Klotz, 2019; Preimesberger, 2018). This includes the IT knowledge of the users to access the system's usage (Haag et al., 2018; Mallmann et al., 2018). This study classifies user competency and knowledge impact structures into security education, training, and awareness (SETA). SETA is therefore examined as a potential factor that can influence shadow IT usage.

The need for work efficiency during complex tasks can lead employees to seek alternative solutions to enhance their performance (Preimesberger, 2017). Additionally, the need for performance without effective structures can create stress (Haag et al., 2018; Mallmann et al., 2018). This study, therefore, classifies this into "work overload" as a factor that can influence shadow IT usage.

On the other hand, social factors are the influences that arise from the interactions and relationships among individuals within a group or organisation. These factors affect behavior, attitudes, and perceptions. The cultural, structural, and interpersonal dynamics of the environment often shape them. In shadow IT usage, social factors include peer pressure, social norms, organisation culture, communication channels, and subjective norms (Haag et al., 2018; Mallmann et al., 2018; Preimesberger, 2017). For example, the lack of organisation policies regarding the use of unauthorised IT systems and the absence of restrictions on shadow IT usage plays a role in encouraging its adoption IT (Allen et al., 2017; Born & Krönung, 2016; Francisco et al., 2017; Fürstenau & Rothe, 2014). This study, therefore, classifies all human factors related to

work as work pressure. This includes the perceptions of management, superiors, and colleagues regarding shadow IT usage.

Moreover, prior IS literature revealed that psychological factors influence employees' IS behaviours (Bock et al., 2005; Han & Kim, 2015; Vignoli et al., 2015). However, given the limited empirical articles on shadow IT, prior research has not thoroughly examined this psychological dimension. Hence, in addition to the structural factors, this study aims to extend the existing literature by empirically examining the psychological perspective on employee shadow IT usage. Strain theory is a sociological and psychological theory addressing structural and psychological factors. According to strain theory, the primary psychological factor examined is "strain".

In light of the literature review, this study classifies the structural factors inducing strain and motivating shadow IT usage into four factors: IT accessibility, security education, training and awareness, work pressure, and work overload. These categories provide a comprehensive framework for analysing and understanding the influences driving shadow IT usage among organisational employees (Haag et al., 2018; Mallmann et al., 2018). Following strain theory, the psychological factor examined is strain. Each of these factors forms the independent variables of this study.

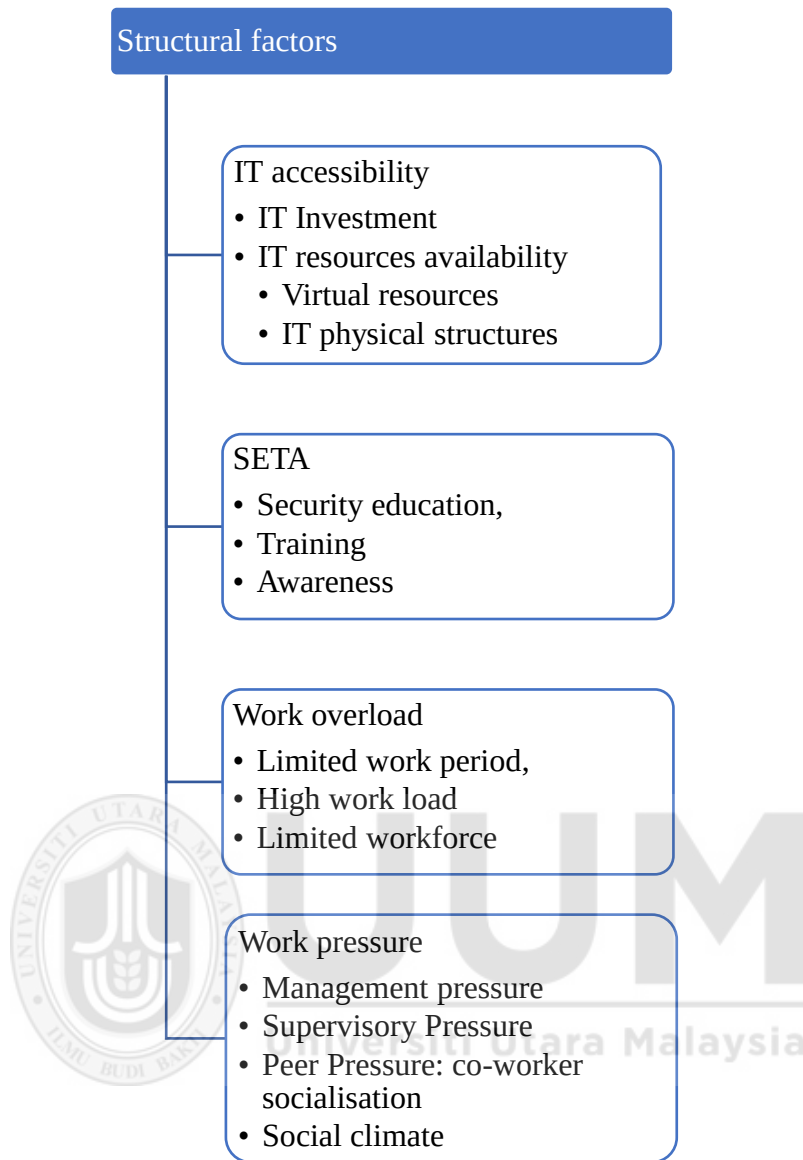


Figure 2.4
Structural factors influencing employee shadow IT usage.

2.4.1 IT Accessibility

IT accessibility refers to employees' access to equitable and functioning technologies within an organisation's information systems (Shaheen & Lazar, 2018). It is guided by the web content accessibility guidelines, focusing on robust, understandable, operable, and perceivable technology principles (Akman & Mishra, 2017; Kaye & Korbeck, 2016; Viaene, 2008). Access to digital

content, cloud services, and physical IT is crucial for employees to carry out tasks effectively. Inaccessibility to needed technologies hinders participation and interaction with digital services, affecting employees' performance and causing strain (Setor & Joseph, 2015). This refers to the IT physical design characteristics, IT infrastructures, and resources within the organisation IS, such as the available IT facilities provided to its workers (Sauter et al., 1981a).

The adoption of cloud computing, as explored by Khalil and Samhan (2024), has further emphasised the importance of IT accessibility. Cloud services have led to a shift in power dynamics and increased demand for cloud-related skills, highlighting the need for organisations to provide accessible IT resources and support to maximise their potential. In contemporary organisations, IT accessibility is critical in empowering users and enhancing overall performance.

A conceptual paper by Kapepo et al. (2021) classified technological issues as one of the major factors influencing shadow IT usage. According to Kapepo et al. (2021), issues like software compatibility due to incompatible operating systems on personal devices require employees to find alternative solutions outside of official IT channels. Similarly, design flaws in software, such as difficulties in controlling clinical information input, can lead employees to seek easier-to-use unauthorised tools. Subpar device specifications affecting quality can prompt employees to turn to shadow IT for better-performing devices. Additionally, limited internet connectivity can drive employees to use private data bundles and personal devices under BYOD policies, circumventing official IT infrastructure to access essential online resources and

services. These technological challenges often contribute to the escalation of shadow IT usage as employees seek more efficient ways to fulfil their tasks.

In Nigeria, many employees face poor organisation IT structures, which led to using personal devices at work (Adetayo, 2021; Ofusori & Subramaniam, 2022; Oyewo et al., 2021). Despite the available IT regulations in organisations, many organisations are not implementing these policies because they fail to provide adequate investment in technical structures, causing weak implementation of IT policies. Oyewo et al. (2021) explained that while big corporations are found to provide more IT structures, the same cannot be said of the small and medium enterprises (SMEs), even though SME in Nigeria accounts for more than 80% of the total labour force in Nigeria (SMEDAN/NBS, 2017). A similar IT challenge is also experienced by employees working in the public sector in Nigeria (Musa et al., 2023; Ofusori & Subramaniam, 2022).

The IT accessibility challenges faced by employees in Nigeria can be attributed to several challenges. These challenges include limited internet connectivity, network issues, high cost and limited IT investment (Abubakre et al., 2022; Adenuga et al., 2019; Ofusori & Subramaniam, 2022; Oyetunde et al., 2019; Oyewole & Onaolapo, 2023). According to a study conducted among Nigerian students on factors hindering the effective use of Emergency Remote Teaching (ERT) platforms in educational institutions (Oyewole & Onaolapo, 2023), while some challenges are related to students' skills and motivation, others stem from organisational resources and limited technical infrastructures.

Ensuring IT accessibility is, therefore, vital for an organisation's survival and success, enhancing employees' capabilities and improving organisational performance (Bharadwaj, 2000). Hence, IT accessibility is integral to creating a work environment where users can effectively utilize technology to achieve organisational goals and drive innovation. Research by De Vargas Pinto et al. (2023) emphasises the impact of the autonomy IT accessibility provides and its influence on individual work performance. Autonomy enables users to adapt technologies to meet specific needs, leading to the widespread use of workarounds and innovative IT solutions. This adaptability fosters faster and more dynamic communication, promoting collaboration among stakeholders.

inadequate access to robust information technology infrastructure is a significant driver behind employees resorting to shadow IT practices (Kapepo et al., 2021). When faced with IT system failures, outdated technology, or insufficient IT investment within the organisation, IT-inclined employees often seek alternative systems to fulfil their tasks (Huber et al., 2017; Kopper et al., 2018; Kopper & Westner, 2016a; Magunduni & Chigona, 2018). This highlights the direct correlation between IT accessibility and employees' propensity to shadow IT activities as a workaround to organisational IT constraints.

Similarly, an organisation's accessibility to reliable information technology significantly affects its operational efficiency. Studies have highlighted that organizational IT failures result in increased errors, strained workflows, and heightened task complexity (Ivancevich et al., 1985; Korunka et al., 2003, 2010). Moreover, technical inaccessibility, such as the absence of necessary technologies and

technological complexities, often leads to deviant behaviours related to unauthorised technology use (Barki et al., 2001; Keil et al., 2008; Sherer & Alter, 2004). This encompasses various aspects, such as the organisation's investment in IT, the availability of IT facilities, the technological infrastructure within the organisation, and the ease of conducting activities via the Internet (Barlett et al., 2018).

A robust IT system enhances operational efficiency and is crucial in boosting employee morale at work. Studies by Chilton et al. (2010) suggest that employees are more likely to perform better when their professional needs, including adequate IT resources, are met. Conversely, insufficient IT resources for tasks can become a stressor for employees (Sauter et al., 1981). This IT-related stress can stem from obsolescence within an organisation's IT infrastructure (Setor & Joseph, 2015), leading to employees resorting to deviant behaviours such as using unapproved information systems (Klotz et al., 2019).

The above explanations emphasise the crucial role of IT accessibility in mitigating shadow IT usage, enhancing employee productivity and morale, and bolstering data security within organisations. In Nigeria, employees are more likely to resort to unauthorised IT solutions when IT accessibility is insufficient or inadequate. This includes using personal internet connectivity if organisations fail to provide reliable data connections. Additionally, employees may opt to communicate sensitive data through personal devices and cloud systems if the organisation's IT infrastructure is lacking. As a result, this study utilises IT accessibility as a metric to assess shadow IT usage in Nigeria.

2.4.2 SETA

Investing in IT is insufficient for an organisation's sustainability, performance enhancement, cost reduction, and profit maximisation. Organisations must enhance their IT capability by fully utilising existing IT resources through capability development (Chae et al., 2014). This involves fostering knowledge awareness and educating employees on the proper utilisation of available technologies. Prior researchers consolidated these knowledge-oriented programs under the term SETA (Burns et al., 2018; Dincelli & Chengalur-Smith, 2020; Hu et al., 2024; Yaokumah et al., 2019). About these prior studies, this study examines SETA as a significant factor influencing shadow IT usage.

SETA has emerged as a pivotal structure shaping employees' security behaviour (Burns et al., 2018; Dincelli & Chengalur-Smith, 2020; Hu et al., 2024; Yaokumah et al., 2019). Le Roux (2007) emphasises the significance of practical training and fostering a culture of security awareness within organisations. A lack of knowledge about IT policies represents a critical structural imbalance concerning organisational IT, encompassing IT awareness and educational provisions by organisations. When employees are inadequately informed about the organisation's IT, it significantly impacts their behaviours (Kim et al., 2016; Kim et al., 2013; Oliveira & Martins, 2014).

SETA programs are also integral components of organisational information security strategies aimed at mitigating risks associated with human behaviour, infrastructure protection, enhancing security awareness, and promoting a culture of cyber resilience (Franchina et al., 2021; Young-McLear et al., 2016). SETA programs are designed to

influence employee behaviour and foster compliance with information security policies. Research suggests that effective SETA initiatives can decrease reactive computer abuse and improve adherence to security protocols (Hu et al., 2024). Moreover, by instilling a sense of trust, clear communication, and understanding among employees, SETA contributes significantly to behavioural change and compliance with security standards.

SETA programs should elicit positive user perceptions, streamline systems for ease of use and adaptability, and ensure tangible benefits for users (Dincelli & Chengalur-Smith, 2020; Hu et al., 2024). Moreover, organisations need to align SETA programs with organisational objectives, focusing on specific areas of security awareness and behaviour to protect information assets efficiently. For example, Alshaikh et al. (2020) propose integrating social marketing principles into SETA development, aiming to foster a culture of cyber resilience within organisations. This approach promotes positive security behaviours and encourages active participation in maintaining robust security practices, ultimately enhancing the overall effectiveness of SETA programs in driving meaningful behaviour change and improving security compliance among employees.

By educating employees about evolving cybersecurity threats, best practices, and potential consequences of security breaches, employees can recognise and respond to security incidents proactively (Mady et al., 2023). Employees are empowered with skills required to safeguard information assets effectively when organisations tailor SETA programs to address critical security awareness and knowledge areas. Therefore, effective and relevant SETA initiatives contribute to heightened employee

risk perception, thus bolstering the organisation's defence against cyber threats (Mady et al., 2023).

SETA programs address insider threats and prevent information leakage by educating employees on online risks, social engineering, and data protection (Molok et al., 2010). Thus creating a security-aware workforce mitigates vulnerabilities caused by human errors or malicious intent. SETA also helps reduce reactive computer abuse and allows employees to counter information leakage via online social networking, showcasing its proactive stance against evolving security challenges (Lowry et al., 2015; Molok et al., 2010).

Knowledge can be impacted within the organisation by using instructional materials, and IT and adhering to educational laws to ensure a comprehensive understanding of IT (Hanaysha, 2016a). Integrating IT assistive technologies has also been shown to improve organisational environmental health (Chae et al., 2014; Kim & Kim, 2017; Mallmann et al., 2016; Wu et al., 2014). Effective communication of information to employees is vital for maximising the benefits of IT investments, highlighting the importance of IT governance in establishing clear responsibilities, management practices, and boundaries. Therefore, establishing norms and guidelines policies ensures alignment across all departments and promotes desirable behaviours among employees, ultimately reducing shadow IT usage and enhancing information security (Barlow et al., 2018; Bauer et al., 2017).

Moreover, SETA significantly impacts organisational cybersecurity resilience by fostering a security-conscious culture, empowering employees with knowledge and

skills, promoting positive security behaviours, and reducing insider threats and information leakage. The researcher therefore considers SETA to be a significant factor that influences shadow IT usage in Nigeria. Moreover, research has shown that implementing policies is the major reason why people do not follow IT regulations in Nigeria (Musa et al., 2023). Therefore, if organisations implement SETA policies and communicate needed information to employees, they will likely comply with regulations.

Furthermore, employees may not ignore policies when organisations are aware of and implement such policies. Also, employees with the knowledge and skills regarding the security implications of their IT behaviours are bound to comply with the regulations. Hence, this study uses SETA to determine shadow IT usage in Nigeria.

2.4.3 Work Overload

Work overload signifies an organisational imbalance where employees are burdened with responsibilities that surpass their ability to complete them effectively within the allotted timeframe or available resources (Ogedengbe et al., 2024). This imbalance can stem from various factors such as unrealistic expectations from management, inadequate staffing levels, insufficient timeframe to complete those tasks, the availability of necessary IT systems to carry out tasks effectively, and the inefficiency in workflow processes (Ogedengbe et al., 2024).

Studies have described work overload as the major organisational stressor that induces mental health, resulting in negative behavioural influences (Korunka et al., 2003; Moyle, 1995; Nasurdin et al., 2005). This perception is supported by the job-stress

theory, which explains how excessive workload leads to employee stress (Cousins et al., 2004). Aside from this, work overload can also be reflected in the time frame for completing tasks (Dewangan & Verghese, 2018; Spector, 1998, 2012). Work overload is shown when the time frame available for task completion is limited compared to the amount of work to be completed (Radzali et al., 2013).

Previous studies have revealed a significant relationship between work overload and negative emotions, such as frustration and stress (Radzali et al., 2013). According to Albers (1997), excessive workload results in frustration. When the exertion of employees is not proportional to the available organisation resources implemented to aid task completion, employees become overloaded, which causes them to be frustrated and stressed (Albers, 1997; Keller & Weibler, 2015). Beehr and Bhagat (1985) and Bhagat et al. (2010) have empirically demonstrated that work overload results in psychological stress. Cousins et al. (2004) also reveal a significant relationship between high workload demands and stress.

Hamizah et al. (2018) and Omar et al. (2011) revealed that work overload leads to decreased self-regulation and non-affective responses such as dissatisfaction, reduced concentration, anxiety, and work tension, and (Mirsim, 2014) have described the influence of work overload on dissatisfaction. Because negative emotions cause cognitive resources to deplete faster, when overburdened with work, the frustration of workers increases (Albers, 1997). Since it may be difficult for a frustrated person to think logically, deviant behaviour may be influenced (Pan et al., 2017).

Workload demands can impact different aspects of employee behaviour within an organisation. For instance, research indicates that high workloads contribute to workplace intimidation, which is considered a form of deviant behaviour (Kimura et al., 2018). Additionally, studies have linked work overload to interpersonal deviant behaviour among employees (Adeoti et al., 2017). Recent research has highlighted increased employee workload during the COVID-19 lockdown period (Camacho & Barrios, 2022; Ghali-Zinoubi et al., 2021).

On realisation of the detrimental effect of work overload, Bhagat et al. (2017) explained how organisations could reduce its effects on employees' behaviours. Some of the ways organisations can relieve the effects of work overload include providing relief activities, subsidies, and making other benefits available for their employees and their families.

In this study, the researcher is focusing on work overload as a factor that influences strain and shadow IT usage among employees in Nigeria. This is based on the premise that shadow IT may be used to reduce strain caused by high workload, limited workforce, and available time for task completion. Employees in Nigeria may, therefore, use shadow IT to increase their performance efficiency. Organisations should, therefore, implement systems that will reduce work overload to counter employees' shadow IT usage.

2.4.4 Work Pressure

This study describes work pressure as the imbalance in the human relationship within the organisation, specifically the supervisory and coworker (peer) pressure, which

influences employees' strain and shadow IT usage (Ogedengbe et al., 2024). Supervisory influence stems from leaders to subordinates, while peer pressure originates from coworkers (Bosak et al., 2013; Ghasemi et al., 2018; Rubington, 1965).

The perception of individuals within organisations regarding managing the organisation's resources influences the work pressure of employees (Korunka et al., 2003, 2010). Employees may feel compelled to adopt deviant behaviours if the environment supports it or they face pressure from others to conform (Mallmann & Maçada, 2021). Conversely, a supportive and collaborative environment can alleviate work pressure by providing opportunities for knowledge sharing, seeking help, and addressing challenges collectively.

The passive reaction of superiors to employees' IT behaviour can encourage shadow IT usage among subordinates. Similarly, individuals' usage of shadow IT within an organisation creates a perception of acceptance, leading others to follow suit. This aligns with research showing that subjective norms influence shadow IT usage (Hasnat & Philbin, 2021). Additionally, organisational climate plays a role when individuals indirectly use shadow IT (Nguyen, 2023).

Work pressure within organisations is a multifaceted phenomenon influenced by various factors encompassing formal and informal structures and employee interactions. While formal structures contribute to work pressure, informal factors also play a significant role (Hasnat & Philbin, 2021; Nguyen, 2023). Work pressure can arise from formal structures such as management expectations and conflicting directives. This kind of work pressure can lead to stress, burnout, and a higher

likelihood of engaging in deviant behaviours like shadow IT usage as a coping mechanism. Studies by Adeoti et al. (2017) and Johnson & Indvik (2001) highlight the impact of communication constraints and uncourteous behaviour in exacerbating work pressure and straining relationships among colleagues.

Informal systems, such as subjective norms and organisation climate, also significantly influence employee shadow IT usage (Hasnat & Philbin, 2021; Nguyen, 2023). In Nigeria, as in many other contexts, the organisational climate and subjective norms significantly shape employees' behaviour and attitudes towards IT usage. These encompass the collective perceptions, attitudes, and behaviours related to IT policies and practices within the organisation. Research by Ogedengbe et al. (2024) highlights the importance of fostering a conducive IT climate that discourages shadow IT usage. A positive IT climate promotes adherence to IT policies. It reduces the pressure on employees to resort to unauthorised IT solutions. This can be achieved through clear communication, effective leadership, and supportive organisational practices that prioritise IT security and compliance.

Work pressure has been established as an antecedent to workplace deviant behaviours (Amponsah-Tawaih & Adu, 2016; Bosak et al., 2013; Varonen & Mattila, 2000). This is reflected in the perception that conflicting interests, management expectations, and cultural factors influence the atmospheric condition within the organisation. Workplace communication barriers and discourteous conduct contribute to strained colleague relationships (Adeoti et al., 2017; Johnson & Indvik, 2001).

Therefore, creating a positive organisational climate that encourages open communication, collaboration, and adherence to IT policies is essential in managing work pressure and minimising shadow IT usage. This approach promotes a healthier work environment and reduces the likelihood of employees resorting to unauthorised IT solutions due to perceived pressure or lack of support. By recognising work pressure as a factor influencing strain and employee shadow IT usage, organisations can implement strategies to address both the formal and informal aspects of work dynamics, fostering a culture of compliance and responsible IT behaviour among employees.

2.5 The Comparison of Prior Theories on Shadow IT

Empirical studies on shadow IT usage have predominantly relied on qualitative research methodologies. This preference for qualitative studies stems from the evolving nature of the field and the need for in-depth exploration of complex phenomena. Qualitative research is particularly suitable when there is a limited understanding of a system or researchers seek to gain deeper insights into individuals' behaviours, motivations, and perceptions. Using techniques such as interviews, focus groups, and observations, Prior qualitative studies have captured contextual data that provide a comprehensive understanding of shadow IT usage. Hence, most of these studies have not used theoretical justifications to examine shadow IT usage.

The few available quantitative articles in shadow IT have used neutralization and social presence theories. Although this study used strain theory as the theoretical background, there is a need to discuss these other related theories.

2.5.1 Neutralisation Theory

Neutralisation theory, as proposed by Sykes and Matza, suggests that individuals use neutralization techniques to rationalize and justify their deviant behaviours. These techniques allow individuals to temporarily suspend their adherence to conventional norms and values, enabling them to engage in actions that would otherwise be considered unacceptable. The neutralisation theory explains people's intentions and actions toward crimes and other deviant behaviours (Haag et al., 2019). It explains the justification individuals give for breaking the rules of the law. It involves the excuses given psychologically by redefinition of situations and justifying of self in order to minimise guilt and culpability.

In shadow IT usage within organisations, neutralisation theory provides insights into how employees rationalise their unauthorised use of IT solutions (Silic et al., 2017a). People consciously form reasoning that justifies illegal actions by suppressing some values that would have otherwise prohibited them from acting against the law. This includes developing defence mechanisms to underestimate the gravity of their offences. When these defence walls are built in people's minds, the feeling of shame and guilt is suppressed. They do what they usually would not have done without having a conscientious sense of violations of the rules of law (Silic et al., 2017).

Another technique is denying injury, where employees downplay the potential harm or risks associated with shadow IT usage. They may argue that their actions do not cause significant damage to the organisation or that the benefits of using unauthorised IT outweigh the potential consequences. This rationalisation helps employees justify

their behaviour and minimise feelings of guilt or concern. Furthermore, neutralisation theory includes techniques such as condemning the condemners, where individuals criticise or question the authority of those who enforce IT policies and regulations. Employees may view IT restrictions as overly restrictive or unnecessary, leading them to challenge the legitimacy of IT policies and justify their non-compliance with shadow IT usage.

Additionally, neutralisation theory encompasses techniques such as appealing to higher loyalties, where individuals prioritise loyalty to their team, department, or clients over adherence to organisational policies. This loyalty-driven justification can lead employees to prioritise productivity and efficiency, even if it means resorting to unauthorised IT solutions.

2.5.2 Social Presence Theory

The structural factors are reflected as the imbalances within the organisation factors or the social inducing factors caused by individuals within the organisations. Another theory related to this study is the social presence theory, which explains how social relationships influence employee behaviours. The origins of social presence theory can be traced back to the work of Short, Williams, and Christie, who proposed the theory to explain users' preferences for different communication channels based on their capacity to transmit social signals. (Biocca, 2002; Biocca & Gregg, 2001). Furthermore, the theory emphasises social presence's interactive and dynamic nature, highlighting that it is based on mutual interactions and perceptions among individuals (Biocca, 2002; Mallmann & Maçada, 2021; Oh et al., 2018). This mutual exchange of

feelings and perceptions regarding the presence of others is fundamental to fostering a sense of connection and engagement in virtual environments.

In shadow IT, this theory highlights the role of social interactions, peer influence, and social validation in shaping employees' attitudes toward using unauthorised IT tools (Mallmann & Maçada, 2021). For instance, employees may perceive a higher level of social presence when using particular shadow IT solutions that enable real-time interactions or provide visual representations of colleagues and peers.

In addition, employees may be more inclined to use unauthorised IT tools if they perceive a sense of social validation or peer acceptance within their workgroups or departments (Mallmann & Maçada, 2021). By considering these social dynamics, organisations can better address the motivations and behaviours driving unauthorised IT adoption and effectively implement strategies to manage and mitigate associated risks.

2.5.3 Strain Theory

Strain theory, initially developed in criminology, offers valuable insights into understanding deviant behaviours within society. An in-depth discussion of strain theory is presented in section 2.7 of this chapter. In information technology and cybersecurity, strain theory posits that individuals may engage in deviant behaviours, like using unauthorised IT solutions, as a response to perceived strain or stressors in their environment (Akello et al., 2021; Thatte et al., 2014). The studies explained that shadow IT may result from anomie/ structural imbalances within the organisation.

These imbalances in the structural factors can be seen in resources or support provided by the organisation's official IT systems. For example, employees may experience strain when organisation resources are lacking or incompatible with employee workflow needs (Akello et al., 2021; Thatte et al., 2014). Moreover, the imbalances can be reflected in the role of external pressures and influences in driving deviant behaviours. Employees may be influenced by peer behaviour, organisational culture, or external factors such as industry trends and competitive pressures to use unauthorised IT solutions (Akello et al., 2021; Thatte et al., 2014). Moreover, employees can be influenced to engage with shadow IT as performance improvement is needed to aid their workloads.

Hence, this study, having considered the other alternative theories that have been used to examine the impact of shadow IT usage, perceived that strain theory can examine both the structural factors and the psychological factors that may influence behaviours within an organisation. Social presence theory can examine the social perspective of shadow IT usage. Neutralisation theory can assess logical perspective. However, strain theory can assess sociological and psychological perspectives to shadow IT usage.

2.6 Prior empirical research on the structural factors and shadow IT usage

This section examines the prior literature that tested the relationship between the structural factors and employee shadow IT usage. Four structural factors are examined in this study. They are IT accessibility, SETA, Work overload, and Work pressure. Therefore, this section examines the prior literature and formulates hypotheses to test

the relationship between these structural factors and shadow IT usage. They are described in each of the sub-sections below.

2.6.1 IT accessibility and Shadow IT usage

Employees' accessibility to IT in the organisational environment influences their shadow IT behaviours (Shaheen & Watulak, 2019; Thatte et al., 2014). Prior studies have indicated mainly that shadow IT usage is primarily due to the failure and gaps in organisation IT systems. Hence, to provide solutions to these IT gaps, people interact with various IT options beyond their organisations' provisions and recommendations (Silic et al. (2016). This study summarised all the IT inadequacies under the term "IT accessibilities". It is inevitable for organisational survival, helps shape employees' organisational behaviours, and influences employees' development (Chae et al., 2014; Chilton et al., 2010; Guo, 2013; Mainemelis, 2010; Thatte et al., 2014).

Poor accessibility to relevant and updated IT within organisation IS serves as a primary reason for employees' IT innovation, which is seen in their introduction of shadow IT (Huber et al., 2017; Kopper et al., 2018; Kopper & Westner, 2016; Magunduni & Chigona, 2018). Moreover, IT-inclined employees who lack legal access to sound IT systems within an organisation tend to look for alternative methods in carrying out their tasks and activities (Huber et al., 2017; Kopper et al., 2018; Kopper & Westner, 2016; Magunduni & Chigona, 2018). In addition, obsolescence in an organisation's IT system leads to IT innovations among employees (Klotz et al., 2019; Setor & Joseph, 2015).

An empirical study by Junglas et al. (2019) has described shadow IT as IT innovations within organisations. When IT users are dissatisfied with organisational IS, they introduce shadow IT, which they perceive to offer superior technology compared to the organisation-provided structures. These findings reveal that innovative employees are more satisfied in high-performing IS environments.

An empirical study by Dirgantari (2023) explains the relationship between IT satisfaction and shadow IT usage. Using a quantitative methodology with 301 respondents from Indonesian universities, the study found that individual IT experience strongly supports shadow IT use, whether through task identity or job autonomy. The results suggest that prioritising employee IT experience and involving them in developing information technology can lead to greater satisfaction and reduced reliance on shadow IT in organisations.

Ostermann et al. (2020) investigate how dissatisfaction with organisational IT drives employees to use shadow IT. It explores phenomena like IT consumerisation and BYOD, focusing on the impact of organisational IS performance and private technology use on satisfaction with organisational IS. The research suggests that dissatisfaction with organisational IT leads to introducing alternative technology into the workplace, fostering behavioural change. This perception was confirmed by (Haag et al., 2019b), which explains that constraints in IT are a significant motivator for shadow IT usage. Moreover, (Haag et al., 2022) explained that once employees can afford deviant IT systems, there is a high chance they will introduce them to organisations to solve the challenge of IT constraints.

While access to IT improves employees' performance, inaccessibility to needed IT systems within an organisation creates work difficulties for IS employees, reduces their participation in organisation activities, reduces their digital interaction, causes inefficiency in IS activities, slows down their performance, and influences their non-compliance to IS security policies (Ragu-Nathan et al., 2008; Setor & Joseph, 2015). Hence, employees may use shadow IT to aid their effectiveness at work (Chae et al., 2014; Sabherwal, 2015; Verma & Bharadwaj, 2017).

Furthermore, based on the deviance typology presented in Figure 2.5, deviant behaviours have been explained in line with perspectives, one of which is innovation (Merton, 1938, 1940). People choose deviant behaviour as an alternative solution to an issue. So also, in the workplace, employees may relate to shadow IT as a means of providing technological and automation aid to their tasks.

Hence, this study believes that when organisations lack needed IT systems, employees may create alternative means to access IT systems, such as innovating individual IT systems and interacting with random websites and applications (Bour et al., 2019). For example, employees who cannot access the organisation's provided storage system may rely on shadow IT, such as the free cloud applications and their personal drop box. Also, when there is a lack of official organisation emails, employees may use shadow IT, such as their emails, which may lack security and privacy, thereby leading to organisation IS exposure.

Moreover, employees may carry out official tasks using their devices when there is a lack of access to IT structures and internet facilities, a form of shadow IT usage. Also,

employees with access to IT systems may not relate to shadow IT. However, employees may relate to random IT applications when there is a lack of access to needed IT applications, software, and plug-ins. This study also believes that employees may interact with shadow IT when there is a lack of access to official approved means of communication within the organisation. This is, therefore, the motivation for the first hypothesis.

H1: IT accessibility is negatively related to employee shadow IT usage.

2.6.2 SETA and Employee Shadow IT Usage

After a thorough search on the relationship between SETA and shadow IT, this study could not find any prior studies examining this factor. Although empirical papers have not examined this yet, the previous conceptual papers have listed security training and awareness as motivators for shadow IT usage (Klotz et al., 2019). Moreover, Dirgantari (2023) and Richter et al. (2019) explain that IT knowledge influences shadow IT usage. These papers have called for empirical validation of these assertions. Hence, this study attempts to bridge a gap in the literature by examining the impact of SETA on shadow IT usage. Moreover, employees' knowledge in matters like IS security facilitates their compliance behaviours with organisation policies (Kim et al., 2016; Kim et al., 2013; Oliveira & Martins, 2014)

Previous research on information systems (IS) has highlighted the importance of organisational interventions such as security education, IS training, and awareness programs. These interventions aim to provide employees with the necessary knowledge to comply with IS policies and reduce noncompliant behaviours (Abraham & Chengalur-Smith, 2019; Alfaqiri et al., 2019; Fujs et al., 2022; Gjertsen et al., 2017;

Snyman, 2017). Through SETA, complex tasks are presented to employees, repetitive drills are facilitated, mistakes are immediately corrected, and practice is eased, which, when used in training, continually reinforces desirable employee behaviours (Ge et al., 2019).

Organisations promoting educational initiatives create an environment where employees are well-informed about IS policies and behaviours (Abraham & Chengalur-Smith, 2019; Fujs et al., 2022; Klotz et al., 2019). Additionally, trained employees possess IS skills that enable them to navigate official IT structures effectively. SETA efforts also enhance employees' security awareness and reduce deliberate engagement in shadow IT practices, which can pose security threats to IS (Klotz et al., 2019). Consequently, the lack of SETA increases employees' vulnerability to shadow IT usage. This aligns with research highlighting the insufficient focus on employee training and awareness in organisations, with only half of them conducting regular IS training and offering security awareness programs (Abraham & Chengalur-Smith, 2019).

Some organisations lack effective SETA programs, while others treat these initiatives merely as checkboxes to be completed, lacking genuine commitment to employee development (Abraham & Chengalur-Smith, 2019; Fujs et al., 2022). Resource constraints, time limitations, and insufficient support structures further hinder the effectiveness of these programs (Abraham & Chengalur-Smith, 2019; Fujs et al., 2022). This lack of robust training and awareness may motivate IS deviant behaviours, including shadow IT usage.

Using SETA, organisations establish structures that effectively communicate information to employees regarding IT responsibilities, task completion, management, and boundaries (Barlow et al., 2018; Bauer et al., 2017). SETA also establishes norms and guidelines that align all employees and departments with organisational congruence, promoting desirable behaviours and ethical practices (Chae et al., 2014; Kim & Kim, 2017; Mallmann et al., 2016; Ping-Ju et al., 2014). Therefore, SETA enhances IT knowledge among employees, contributing to a more secure organisational environment.

Franchina et al. (2021) emphasise investing in training and simulations to strengthen critical infrastructure protection and resilience. The study advocates for developing a "human firewall" within organisations through Security Education, Training, and Awareness (SETA) programs. The authors suggest a hybrid approach combining engagement-based and less interactive training techniques to achieve effective security awareness. Chang et al. (2024) proposed proactive measures, including wellness programs and a zero-tolerance approach to violence, to enhance nurses' well-being and improve patient care quality.

Given that Shadow IT usage involves a social engineering system that can leak sensitive data, organisational management is crucial in security sensitisation, including creating employee awareness of IS-related issues (Grassegger & Nedbal, 2021). SETA is, therefore, a crucial factor that can help mitigate organisational security breaches and infiltration (Khando et al., 2021). Since SETA provides a cognitive boost and strongly influences employees' security-compliant behaviours (Bulgurcu et al., 2009, 2010; Haag et al., 2019; Zhu, 2015), this study posits that SETA can also mitigate

against Shadow IT usage. Based on the above justification, this study believes SETA can influence employees' shadow IT usage. When employees are exposed to knowledge-impacting structures, their interaction with shadow IT systems will be reduced. However, when they lack necessary SETA, their shadow IT usage may be influenced. This is, therefore, the justification for hypothesis two.

H2: SETA is negatively related to employee shadow IT usage.

2.6.3 Work Overload and Employee Shadow IT Usage

The literature search was also conducted to examine the studies available on work overload and shadow IT usage; based on the prior literature search, there are no prior empirical studies. Hence, there is a gap in the literature. No other related research has been conducted to the researcher's understanding. The prior studies on the relationship between work overload and shadow IT usage are not confirmed by this study; hence, other literature on work overload and IS deviant behaviours were used to predict the relationship between the two factors.

Work overload has been described as the imbalances in employees' workload, resulting in too many tasks to be performed within a limited work period. Work overload may result from employee shortages, high job turnover, deadlines, and a lack of structures that aid efficient job performance. For this study, work overload refers to a high employee workload and lack of IT systems within the organisation that will aid the effectiveness and efficiency of employees. Past studies have revealed that work overload within an organisation can result in employees' deviant behaviours (Adeoti et al., 2017; Lim et al., 2008).

High work demands without the needed technical support tend to reveal the innovativeness in people. The innovative solutions to structural imbalances are described by strain theory as one of the deviant behavioural reactions of individuals (Agnew & Agnew, 2013; Merton & Ashley-Montagu, 1940). In the context of this study, such behaviours include the usage of shadow IT, which will foster ease of initiating and completing tasks (Mario Silic et al., 2017). For example, when work demands analysis of extensive data, without access to conventional IT systems to assist in the analysis, employees may download macros and plug-ins and interact with random cloud sites that offer solutions that ease their tasks. This will boost their efficiency.

Past studies have confirmed that work overload plays a significant role in shaping people's deviant behaviour within society (Arnold et al., 2018; Asiya et al., 2013; Bonacchi et al., 2019; Cummings et al., 2015; Dabbish & Kraut, 2006; Gill, 2010; Hussain et al., 2016; Kanter, 1977; Mintzberg, 1983; Reder & Schwab, 1988). Work overload can significantly impact employees' deviant behaviour within an organisation. For instance, research indicates that work overload is linked to workplace intimidation, considered deviant behaviour (Kimura et al., 2018). Additionally, studies have found that work overload can lead to interpersonal deviant behaviour among employees (Adeoti et al., 2017). This issue was further exacerbated during the COVID-19 lockdown, as evidenced by the increased workload for employees (Camacho & Barrios, 2022; Ghali-Zinoubi et al., 2021).

This study proposes that employees might use shadow IT systems to respond to high job demands. This proposition is supported by existing literature, which suggests that

employees tend to deviate from policies under high job demands (Adeoti et al., 2017; Arnold et al., 2018; Shah, 2018). When technical tasks are challenging due to inadequate IT structures, individuals may turn to alternative IT systems like shadow IT to simplify their work processes. Such actions, although contrary to organisational policies, it may arise from the need to cope with job demands and improve task efficiency (Arnold et al., 2018; Beehr & Bhagat, 1985; Liu et al., 2005; Shah, 2018; Spielberger & Reheiser, 1994).

For instance, when an organisation is understaffed, the available employees tend to have increased tasks. In the bid for faster task completion, they may interact with the cloud and other IT offerings that can ease their duties without considering the security implications of the shadow IT systems on the organisation's overall well-being. The justification for this activity lies in the need to carry out tasks efficiently and to process extensive data and a heavy workload. Hence, the usage of shadow IT can be explained as a reaction to job-related stress, such as work overload. Therefore, based on this assumption, it can be hypothesised that work overload may lead to shadow IT usage among employees. This is the motivation for hypothesis three.

H3: Work overload is positively related to employee shadow IT usage.

2.6.4 Work Pressure and Employee Shadow IT Usage

For this study, work pressure includes pressures experienced by employees due to social influence at work. This includes the human relationship forces at work, such as the employee's relationship with the management and supervisors and the pressures from peers and co-workers (Ogedengbe et al., 2024). Given that humans are social beings, the activities and perceptions of others are forces that influence their

behaviours (Ghasemi et al., 2018). This review examines past studies on work pressure and shadow IT usage. Few previous studies have examined this relationship empirically or conceptually. For example, two conference papers were published that examine social pressure and shadow IT usage (Mallmann et al., 2018; Mallmann et al., 2019). These studies revealed that employees are influenced to use shadow IT due to pressure from colleagues and superiors at work.

Another related factor is the subjective norms. The Nguyen (2023) study revealed that organisations with no official policies discriminating against shadow IT may influence employees into its usage. Another empirical study confirmed this perception (Hasnat & Philbin, 2021). The study shows that the organisation climate predicts shadow IT usage. In cases where organisations have no policies to deter employees' shadow IT usage, there is a possibility that employees' will engage with these unauthorised IT systems. Their shadow IT engagement confirms that the structure in place within the organisation's systems influences employees' shadow IT usage (Hasnat & Philbin, 2021).

Additionally, managerial behaviour, including the stances of supervisors and superiors, has been shown to impact employee shadow IT usage (Gorter et al., 2019). Organisations that implement measures discouraging shadow IT usage, such as blocking specific ports, limiting cloud access, and restricting website access, tend to have lower shadow IT usage among their staff (Sillic, 2019).

In relation, previous IS studies have also empirically revealed that work pressure motivates employees' workplace deviant behaviours (Adeoti et al., 2017; Amponsah-

Tawaih & Adu, 2016; Bosak et al., 2013; Gulseren et al., 2019; Preimesberger, 2017; Tome & Vaart, 2020; Varonen & Mattila, 2000; Yang et al., 2017). According to these studies, work pressures such as marginalisation, discrimination, and backlash by management and individuals within organisations substantially affect employees' behaviours. Some of these corresponding behaviours relate to their sense of belonging, goals, performance, work relationships, and deviant behaviours. These deviant behaviours include decreased task focus, diminished work quality, fraud, and higher turnover rates (Adeoti et al., 2020; Tome & Vaart, 2020; Yang et al., 2017).

A study by Krassen and Aupers (2022) revealed that social pressure influences deviant behaviour (addiction to online gaming). Through interviews involving 21 players, the study identifies three types of social pressure: persuasion within gaming friendships, obligations within structured game groups, and coercion within competitive gaming environments. Hence, social pressure among peers is a significant influence that coerces people into deviant behaviours. Another study carried out during the COVID-19 pandemic shows that social pressure influences employees' attitudes (Sarfraz et al., 2022).

Since work pressure influences employee behaviour (Adeoti et al., 2017; Ghasemi et al., 2018; Ho-Jung & Cho, 2016; Mallmann et al., 2018), this study focuses on the perception that work pressures also influence employees' shadow IT usage. For example, employees may be tempted to use shadow IT if peers use it. In addition, when there is a lack of supervisors/managers' stance to prohibit shadow IT usage, employees may interact with them. However, when managers implement some actions to prevent shadow IT usage, employees will be deterred from its usage. Based on this perception,

this study believes that the influence of work pressure within the organisation, i.e., the manager/supervisor and the peer, will shape employees' behaviour towards shadow IT usage. This forms the basis for hypothesis four.

H4: Work pressure is positively related to employee shadow IT usage.

2.7 Strain Theory

To examine the relationship between strain and the other factors (structural factors and shadow IT usage), there is need to discuss strain. Moreover, strain is an important factor in strain theory. Given that this study is underpinned by strain theory, this study made an extensive review and discussion on strain theory.

The literature review on strain theory spans a considerable period, showing work published from 1938 to 2024 using prominent databases such as Scopus, ProQuest, and EBSCOhost. It is worth noting that the existing literature primarily focuses on disciplines such as social sciences, psychology, and medicine. There have been several applications of the strain theory in understanding the delinquencies in society and the unethical behaviour of people (Broidy et al., 2017; Jang et al., 2014; Lianos & McGrath, 2018; Radzali et al., 2013).

As presented in Figure 2.4, the limited representation of strain theory in IS reveals the significance and potential need for further investigation. Although limited studies have used strain theory in IS, its usage, specifically in shadow IT, remains scanty (Akello et al., 2021). Ultimately, this study contributes to the literature by expanding the

understanding of the intersection between the Strain theory and the phenomenon of employees' deviant behaviours in IS, particularly employee shadow IT usage.

Documents by subject area

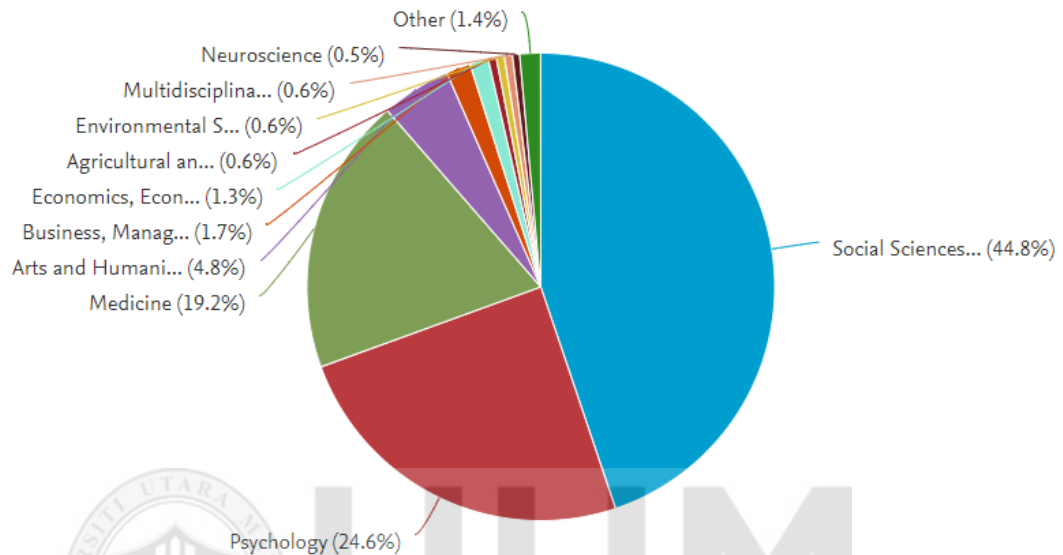


Figure 2.5

The subject areas of available literature that used strain theory

2.7.1 Overview of the Strain Theory

Strain theory, employed initially to understand delinquent and criminal behaviour, provides insight into how external factors, referred to as stressors, influence individuals' engagement in deviant conduct. Strain theory also examines the socio-psychological dynamics of human behaviours within the context of their environment. By exploring the relationship between individuals and their surroundings, strain theory aims to explain the factors underlying delinquencies.

Fundamentally, strain theory posits that individuals develop negative associations with their environment, which impede their ability to achieve positive goals and aspirations. Strain can emanate from the various societal factors that hinder individuals from pursuing their objectives, subsequently influencing their deviant inclination (Agnew, 1992, 2015; Merton, 1938; Merton & Ashley-Montagu, 1940; Özbay & Özcan, 2006; Rosenfeld, 1989).

Factors such as financial imbalances, academic stressors, work stress, relationship stress, marginalisation, discrimination, and victimisation have been identified as antecedents to strain and the corresponding deviant behaviours (Hinduja & Patchin, 2013; Paez, 2018; Patchin & Hinduja, 2011). Some of the corresponding deviant behaviours include assault, bullying, suicide, depression, crimes, delinquencies, anger, and offenses (Moon et al., 2012; Moon & Morash, 2017).

Drawing parallels with the application of strain theory in societal contexts, this study posits that the strains emanating from the organisational environment can significantly affect employees' attitudes and actions regarding their shadow IT usage (Akello et al., 2021). Just as the underlying premise of strain theory suggests, individuals within society and organisations may resort to illegitimate channels to achieve their goals; in the organisational contexts, this can manifest as employees using unauthorised structures to perform their tasks and meet their job goals.

2.7.2 Development and Evolution of Strain Theory

According to (Agnew, 2015), modern strain theories can be traced to Durkheim's Emile text "Suicide: A Study in Sociology" (Durkheim, 1897). Although Durkheim's

work was not precisely focused on crime or deviant behaviour, the study focused on suicide and the role played by society and environmental expectations, serving as strains on individuals which contributed to the rate of suicide in society. Merton developed many works on deviant behaviours, strain, and society (Merton, 1938; Merton & Ashley-Montagu, 1940).

Merton developed the theory to explain the prevalence of crime and delinquencies among individuals in the United States at that period. The strain theory was built upon the earlier concept of anomie proposed by Merton, which formed the foundation of the strain theory. The primary objective of the strain theory was to provide an understanding of a society that purportedly offered equal opportunities to all its members, irrespective of factors such as gender, social class, and educational background. However, Merton sought to question the prevailing belief system propagated by the government, which portrayed the notion of universal access to opportunities within society.

Additionally, the theory addressed the belief that individuals with talents, ambition, and hard work would inevitably achieve financial success. Merton challenged the idealised belief, highlighting the disparity between this society's portrayal and real-life circumstances. In practice, the resources are not equally distributed among all members of society, making it impractical for everyone to attain financial success based solely on this propagated notion. The strain theory further expounds on societal imbalance, also called anomie or stressors. These stressors strain individuals' ability to achieve the societal goal of financial success through legitimate means, like talents and hard work. Merton classified how people respond to these societal demands as part

of the deviance typology. Refer to Figure 2.6 for an illustration of Merton's deviance typology.

By comprehending strain theory and Merton's deviance typology, studies can gain valuable insights into the complexities of social structures, opportunities, and disparities that contribute to deviant behaviour within a society. This theoretical background is essential for comprehensively understanding the factors influencing crimes and delinquencies.

Merton's strain theory explains the concept of societal strain and its impact on individuals seeking financial success through legitimate means. When society emphasises a particular standard of economic achievement, individuals may encounter difficulties meeting these expectations, leading them to seek alternative means. Merton identified five distinct methods through which individuals adapt to these societal pressures: conformity, innovation, ritualism, retreatism, and rebellions.

Conformity entails individuals striving to meet societal demands by adhering to legal and accepted conditions to achieve their goals. On the other hand, innovation involves the development of systems or approaches not sanctioned by society, often displaying the creativity and ingenuity to attain financial success. Ritualism is a coping mechanism where individuals adjust their aspirations to more modest levels, employing legal means to meet suboptimal objectives using an accessible societal resource.

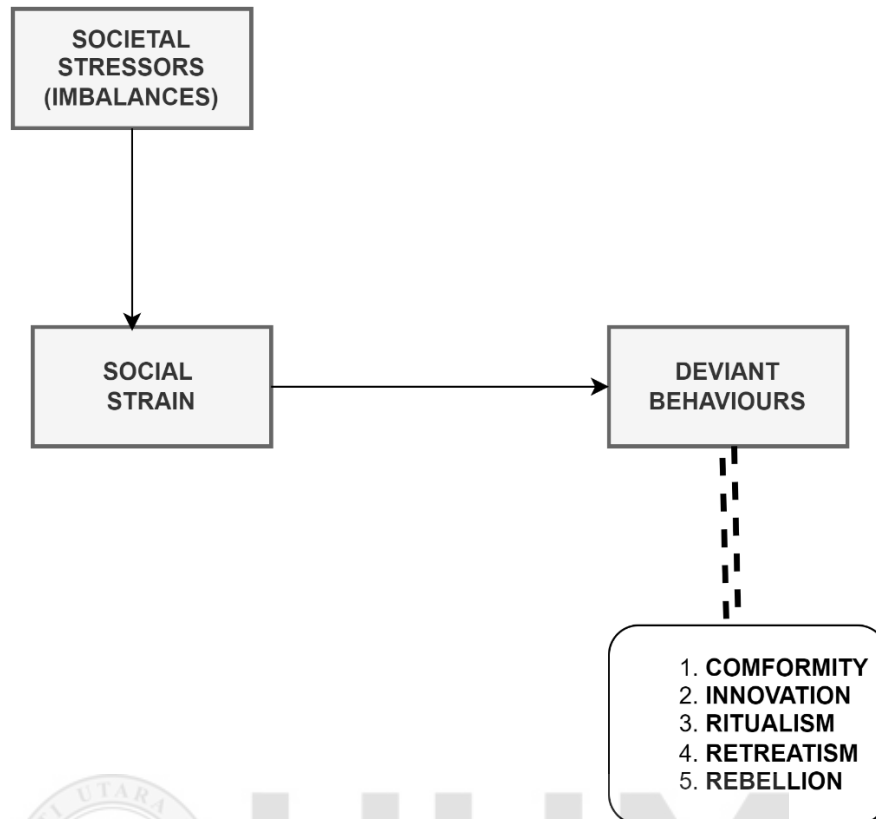


Figure 2.6
An illustration of Merton's Deviance Typology reflecting the five alternative deviance behaviours

Source: (Merton, 1938, 1940).

Retreatism represents a response to societal strain where individuals reject the established goals and accepted means of achieving them, ultimately disengaging from society and seeking an escape from its demands. The fifth adaption, known as rebellion, arises from the strain and inability to meet societal demand, prompting individuals to reject existing goals and beliefs while creating alternative frameworks that align with their values.

These anomie situations act as stressors that induce an individual's strain, often leading to criminal or deviant behaviour (Antonaccio et al., 2015). By applying the Merton

strain/anomie theory, the researcher can analyse various societal scenarios, such as financial disparities that influence the pursuit of success (Antonaccio et al., 2015). Consequently, people may resort to innovation, including illicit and unauthorised means, to achieve success based on societal demands.

Furthermore, Merton strain/anomie theory elucidates the roots of individual-level criminality. Macro-level societal conditions, emphasising material access, and cultural anomalies, can trigger specific responses leading to criminal activities at the individual levels (Chamlin & Cochran, 2007). For example, a study has highlighted the emphasis on material success as a significant catalyst for illicit responses within Soviet Union societies (Chamlin & Cochran, 2007).

This theory has evolved, and numerous researchers have expanded on these ideas, including Cohen's study on delinquency (Cohen, 1955, 2019), Cloward and Ohlin's differential opportunity theory (Cloward & Ohlin, 1960), and Agnew's general strain theory (Agnew, 1992), leading to its application across various disciplines such as corporate crimes, psychological disorders, and social sciences (Agnew et al., 1996; Bao et al., 2004; Baron, 2007; Broidy & Agnew, 1997; Hoffmann, 2019; Piquero & Sealock, 2010).

Although strain theory has undergone significant revisions since Merton first introduced it, it remains a prominent theory in the study of crime. Throughout these revisions, one consistent theme has emerged: the recognition of structural imbalances that shape human strain and behaviour. Critiques of Merton's classic strain theory spurred further research to refine the theory so it can be applied to various subjects.

For instance, Cohen (1955, 2019) addressed criticisms related to juvenile delinquency, while Cloward and Ohlin (1960) focused on legitimacy, highlighting how access to illegitimate opportunities can influence deviant behaviour more than the lack of access to legitimate opportunities.

Additionally, Agnew's revised general strain theory incorporated the mental impact of structural imbalances, such as the absence of positive stimuli and the presence of negative stimuli (Agnew, 1992). Furthermore, Agnew expanded on the psychological aspects of strain, emphasising how negative emotions like anger and frustration resulting from strain can lead to various forms of deviant behaviour, including crime, bullying, and other antisocial acts (Agnew et al., 1996). Therefore, for this current study, it is believed that strain theory can also be employed to examine the role of structural imbalances in creating employee strain and shadow IT usage. This is presented in the theoretical framework as illustrated in Figure 2.7

Applying this understanding to this study, the strain theory framework can be replicated to examine employees' engagement in shadow IT. Moreover, shadow IT usage has been classified as a form of IS deviant behaviour within organisations. When there are imbalances in organisational structures, such as inadequate IT assessment, lack of SETA, high workload, and work pressure, employees may experience strain, leading to their engagement in shadow IT activities to cope with these imbalances. This study will examine if these structural factors/stressors within the organisational context contribute to employees' shadow IT usage.

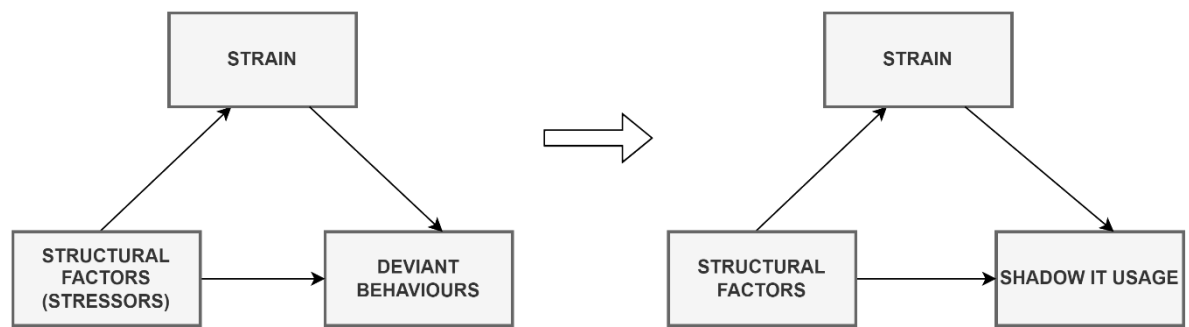


Figure 2.7

Strain Theory Framework

Conceptualised in shadow IT context

2.8 Past Empirical Literature on Strain Theory

The available empirical studies on strain using strain theory have focused on deviant behaviours within society. Most studies have examined the effect of imbalances and strain on delinquencies. Some of these studies have focused on financial aspirations, as exemplified by Monsurat's (2020) examination of cyber-scam prevalence in Nigeria. Hughes et al. (2018) also examined financial delinquency in Russia, aligning directly with Merton's concept of financial delinquency. Some studies have focused on victimisation. They suggest that victimisation is a type of delinquency that influences not only external negative emotions like anger but also internal negative emotions such as depression and feelings of worthlessness. Suicide is a deviant behaviour that has been widely examined by strain theory. Addressing victimisation is crucial in preventing adverse outcomes and promoting healthy emotional and behavioural development. Other social pressures, such as discrimination and marginalisation, have also been examined.

Studies also discussed how males and females respond differently to various antecedents of strains. These studies highlighted that different genders face distinct strains, focusing predominantly on males (Brady et al., 2019; Hoffmann & Ireland, 2004; Yang et al., 2018). Males often experience strains related to antecedents, such as societal expectations, masculine roles, financial pressures, and stricter parental discipline. This can lead to behaviours such as weapon carrying, drug use, bullying, and victimisation, which are more significant stressors for males. Their emotional response to strain typically manifests as anger, which can then lead to deviant behaviours (Brady et al., 2019; Hoffmann & Ireland, 2004; Yang et al., 2018).

On the other hand, females experience strain related to factors like marriage, relationships with in-laws, societal norms around marriage, and role stress. Their emotional response to strain tends to be a combination of anger and depression. Therefore, while anger predominantly drives deviant behaviours in males, females may exhibit both anger and depression in their responses to strain (Cheung, 2015; Moazam & Shekhani, 2018). This reflects that several factors can cause strain, and corresponding deviant behaviour can be exhibited by all individuals regardless of gender bias.

Furthermore, few studies explored the cultural perception of deviant behaviours, discussing how culture shapes attitudes towards behaviours like marijuana use, tobacco consumption, and alcohol intake (Akins et al., 2010; Black & Joseph, 2014). Similar to how strain theory was developed to understand suicide, racialised general strain theory emerged to address deviant behaviours linked to racial strains. This highlights the influence of societal systems and values on the perceived definition of

deviant behaviours, which may vary across cultures. While some behaviours like murder are universally condemned, others, such as tobacco use, may be culturally specific in their perception of deviance.

Organisational support for innovation was identified as a potential mitigating factor for employee strain, reducing deviant work behaviours. However, not all organisations have established such support systems (Tenzer & Yang, 2020). Despite the concerning implications of organisational strain on employee behaviour, there remains a gap in studies assessing employees' IS deviant behaviour, highlighting the need for further investigations in this area. This led to the examination of the literature of prior studies on the relationship between strain, IT accessibility, SETA, work overload, work pressure, and shadow IT usage.

2.8.1 Strain and Employee Shadow IT Usage

Strain refers to the depletion of human cognitive resources. Strain also embodies the mental drainage of individuals. For this study, strain refers to employees' mental and psychological exhaustion from structural imbalances within the organisation that lead to deviant behaviours.

The literature on the strain and shadow IT usage is very scanty; even by examining all the related strain synonyms, such as distress and stress, no prior empirical articles were relevant to this study. Two publications were related, one of which is a lecture note by Thatte et al. (2014), and the other is a conceptual conference paper (Akello et al., 2021). Both are unrelated since this section reviews the past empirical support for the relationship between strain and shadow IT usage.

Moreover, shadow IT usage has already been termed deviant behaviour within the organisation IS, which can be explained using strain theory (Akello et al., 2021; Thatte et al., 2014). Hence, by extending the literature to studies on the impact of strain on deviant behaviours, especially past studies that have used strain theory as their theoretical background, it has been empirically confirmed that strain leads to deviant behaviour. According to these prior studies, delinquent behaviour often stems from the strain from adverse environmental conditions (Agnew, 1999, 2017; Robert Agnew, 1992, 2015).

While Merton focused the strain theory on societal disparities and financial aspiration, Agnew and other scholars revised the strain theory and integrated mental effects on crime delinquency and various deviant behaviours (Agnew, 1992; Agnew et al., 1996). According to Agnew, societal imbalances create negative emotional states like anger, frustration, depression, and disappointment, which serve as motivators for deviant behaviours (Agnew, 1999, 2017; Robert Agnew, 1992, 2015). Strain encompasses the lack of positive stimuli and the presence of negative stimuli. Hence, negative emotions from strain, like anger and frustration, contribute to deviant behaviours such as crime and bullying. These negative emotions can be categorised into two types: externally directed emotions like anger often lead to delinquency and criminal attitudes, while self-directed emotions like depression may result in self-destructive behaviours such as suicides (Huck et al., 2012; Jang & Johnson, 2003).

Moreover, delinquency rates are notably higher among individuals who have experienced neglect or abuse (Iratzoqui & Watts, 2019). These delinquent behaviours

include various risky behaviours such as substance abuse, bullying, victimisation, cyberbullying, weapon possession, homicide, and sexual abuse (Beato & Marinho, 2009; Brady et al., 2019; Kim, 2019; Wood & Graham, 2020). These delinquencies can be mitigated through the establishment of nurturing environments for children. This suggests that strain leads to deviant behaviour, of which shadow IT usage is an example in the organisation's IS.

Another deviant behaviour where strain theory has been applied is in explaining suicide. Studies based on suicide notes and survivor responses highlighted the significant impact of psychological strain, including aspirations and deprivations, on suicidal tendencies (Lew et al., 2020; Liu et al., 2019; Song et al., 2019; Zhang et al., 2018; Zhang, Lester, et al., 2020). They also emphasised the crucial role of social support in mitigating the effects of psychological strain on suicidal behaviour. Contrary to popular belief, outwardly directed negative emotions like anger were found to have little influence on suicide, while inwardly directed emotions such as depression were directly linked to suicidal tendencies (Joon Jang, 2020; Baek et al., 2019). This suggests that suicide prevention efforts should prioritise fostering social support networks and enabling the healthy expression of emotions for individuals experiencing psychological strain.

Aside from deviant behaviours, studies have explained the behavioural negative responses to strain to include dissatisfaction, underperformance, and crisis (Gould et al., 1999; Meehan et al., 2004; Noblet et al., 2003; Tabei et al., 2012; Wagstaff et al., 2012). Prior studies on strain explained that because human cognitive resources are limited, strain occurs when the need to engage in cognitive activities exceeds the

available resources (Dabbish & Kraut, 2006; Keller & Weibler, 2015; Keller & Weibler, 2015). When cognitive resources are depleted, people may start malfunctioning by acting according to their mental dictates rather than rationally (Dabbish & Kraut, 2006; Keller & Weibler, 2015). Moreover, since the human mental condition reflects the human's ability to defy logic and forecast (Dabbish & Kraut, 2006; Keller & Weibler, 2015), deviant behaviour, resulting from cognitive exhaustion, can be influenced.

Based on these justifications, this study believes that employees may interact with shadow IT to cope with strain. Employees may use Shadow IT to boost cognitive resources, reduce cognitive draining activities, and facilitate task ease. For example, employees may become strained due to the manual completion of tasks, but to cope, they may use shadow IT to automate these tasks and ease their performance. Previous empirical studies have confirmed this assertion that performance is an antecedent to shadow IT usage (De Vargas Pinto et al., 2023; Nguyen, 2023; Ostermann et al., 2020). This study, therefore, aims to examine the relationship between strain and employee shadow IT usage. Thus justifying the motivation for the formulation of hypothesis five.

H₅: Strain is positively related to employee shadow IT usage.

2.8.2 Structural Factors and Strain

This section focuses on the prior studies that investigated each structural factor and strain. As explained in the previous sections, four factors are being examined as structural factors. The structural factors include IT accessibility, SETA, work overload, and work pressure. Based on these relationships, predictions were made, and hypotheses were formulated.

2.8.2.1 IT Accessibility and Strain

Based on strain theory, strain is a psychological reaction to the imbalance in the environment's structural factors. Previous studies have empirically established that organisational structural factors directly affect strain (Bhagat et al., 2010; Buttigieg, 2007; Dabbish & Kraut, 2006; Korunka et al., 2010; Rubington, 2014; Setor & Joseph, 2015). According to a past study, IT accessibility is a source of cognitive tools that help perform tasks (such as computer applications, plug-ins, and calculators) and boost cognitive capacity by reducing the strain on human mental faculty (Ge et al., 2019).

IT inaccessibility has been described as a source of technostress in organisations (Ragu-Nathan et al., 2008). Aside from the provision of needed IT systems, there is a need for IT modification, configuration, and customisation to suit the need for different organisational tasks. When lacking, these may result in mental strain for the workers. Ragu-Nathan et al. (2008) reveal that programming errors and inadequate technical resources lead to employee dissatisfaction and feelings of inadequacy among employees. However, when the needed IT systems are provided, it improves employees' information processing, knowledge, critical thinking, and ease of solving problems. Hence, IT is an intellectual partner in aiding employees' psychologically.

Moreover, employees working in an environment that is not conducive easily get strained. Lack of organisation IT investments and management's failure to provide up-to-date technology may prevent employees from carrying out tasks effectively and efficiently, causing stress (Preimesberger, 2017). The inaccessibility to the internet,

IS software, applications, plug-ins, and other IT systems from the 'rganization's IT department results in strenuous worker activities.

Furthermore, tasks become stressful when workers cannot access official IT structures when the need to access them arises. For instance, accessing organisation emails when there is a need for communication and information exchange. Also, some tasks include connection with customers, information flow within the organisation, management activities, online surveys, and electronic commerce, which may become strenuous without easy IT assessability. Aside from the virtual connection, this study believes that when the existing IT equipment is lacking, such as a slow computer operation system, interaction with the virtual cloud-based systems will become stressful. Based on this, this study, therefore, attempts to test how IT accessibility influences strain. This is, hence, the motivation for the sixth hypothesis.

H6: IT accessibility is negatively related to strain.

2.8.2.2 SETA and Strain

Several studies have examined SETA and strain either as a term (SETA) or by examining each SETA element, including security education, training, and awareness. One thing is consistent with the majority of these studies: the SETA element has been described as a mechanism for enriching knowledge (Barlow et al., 2018; Bauer et al., 2017a; Chae et al., 2014; Chang & Yang, 2023; Kim & Kim, 2017; Mallmann et al., 2016; Melo et al., 2020; Ping-Ju Wu et al., 2014). Some of these studies have examined the relationships between SETA and strain.

Research on SETA elements and their impact on individuals' stress levels presents varied findings. Some studies suggest that SETA can increase stress, while others argue it can reduce stress. These studies collectively emphasise the importance of integrating SETA strategies that are effective yet manageable, considering the potential stressors they may impose on individuals within organisational contexts (Chhetri et al., 2018; Snyman, 2017). For instance, Ament and Haag (2016) highlight the importance of awareness training and education programs on stress and security compliance. While SETA measures are crucial for enhancing information security behaviour, they may also induce stress if perceived as challenging, time-consuming, or intrusive, suggesting a need for a balanced approach to SETA implementation. Similarly, Doyle et al. (2017) discuss the heightened security awareness in response to terror threats, focusing on safety systems that, while effective, may introduce stress due to their complexity and demands.

Young-McLear et al. (2016) discuss the challenges cadets face at the U.S. Coast Guard Academy, where rigorous academic demands and military training may impact stress levels and situational awareness, especially cybersecurity. Sahin et al. (2015) emphasise the growing demand for cybersecurity professionals and the need for updated education that integrates hands-on research projects, acknowledging the strain this places on educators. Raval (2003) discusses the increased stress and inconvenience experienced by individuals due to heightened security measures, raising questions about balancing security and customer-friendly service.

On the other hand, several other studies have discussed how SETA reduces strain. For instance, Kellogg (2008) explained that equipping employees with training and skills

enhances their cognitive abilities, thus reducing mental strain. Additionally, IT assistive technologies are noted for improving organisational and IS health (Chae et al., 2014; Kim & Kim, 2017; Mallmann et al., 2016; Ping-Ju et al., 2014).

Moreover, skilled employees can efficiently navigate IS systems and perform tasks effectively (Gekara et al., 2014; Ozkeser, 2019). Conversely, untrained employees may experience confusion and increased cognitive strain, impacting productivity and satisfaction (Chae et al., 2014; Kim & Kim, 2017; Mallmann et al., 2016; Ping-Ju et al., 2014). Limited learning opportunities hinder skill development and may impede healthy competition and career growth (Xie et al., 2020).

Capellan et al. (2020) emphasised the importance of practical cybersecurity training in high schools to engage students' interest and reduce the stress associated with learning complex technical topics. Farazi et al. (2018) highlighted the role of fulfilling family needs and fostering job motivation through training in mitigating job-related stress. McCormac et al. (2018) further expanded on this theme by showing that resilience, cultivated through training and awareness programs, not only enhances information security awareness but also acts as a protective factor against stress in the workplace. Kankhare and Manjrekar (2017) address the consequences of inadequate security awareness in web applications, leading to vulnerabilities that can stress developers under tight deadlines.

Also aligning with cognitive load theory (CLT), limited cognitive resources result in strain (Chang & Yang, 2023; Chen et al., 2018). Knowledge accumulation enhances cognitive resources and reduces strain (Fischer et al., 2023; Gutierrez et al., 2023).

Insufficient sensitisation depletes cognitive resources, leading to strain (Chen et al., 2018), while outdated knowledge negatively affects performance and induces mental strain (Setor & Joseph, 2015).

Chang et al. (2024) proposed proactive measures, including wellness programs and a zero-tolerance approach to violence, to enhance nurses' well-being and improve patient care quality. Pedreira Filho et al. (2023) carried out research during the COVID-19 pandemic in Brazil. The findings revealed the importance of consistent safety education and awareness initiatives, especially for less experienced researchers, to promote a safer work environment.

Moreover, consistent SETA programs improve experience. Experience is shaped by an individual's knowledge of consequences, reduces user-related errors, and enhances output (Pahnila et al., 2007). Conversely, employees lacking knowledge of IS expectations and security measures may increase IS errors and organisational costs (Castellano et al., 2022; Thompson Jr., 2012). Engaging with shadow IT without proper training, awareness, and education can elevate vulnerability to data breaches (Castellano et al., 2022), and employees' behaviour may unintentionally breach regulations (Mooijman et al., 2017; Nelissen & Mulder, 2013; Torsvik et al., 2022), leading to public sanctions and diminishing self-confidence (Torsvik et al., 2022).

Since empirical studies show that SETA elements such as awareness, training, and education influence stress management by either reducing or increasing strain, based on the perception of this study, it is perceived that SETA will reduce employee strain (Creswell et al., 2018; Ifinedo, 2018; Lane et al., 2007; Rajna et al., 2009). When

employees have inadequate access to security education, informational materials, and training, they have reduced experience, and their existing knowledge becomes obsolete, causing them to do more work than needed and causing strain. Hence, the motivation for hypothesis seven.

H7: SETA is negatively related to Strain.

2.8.2.3 Work Overload and Strain

This section examines the previous studies that discuss the relationship between work overload and strain. Although there is little support for this when examining strain theory literature, extending the search to all subjects reveals that several literatures and prior research confirm the relationship between work overload and strain. The past literature shows that workloads can influence emotional feelings (Alghnimi et al., 2020; Bakker & Demerouti, 2007; Ghosh et al., 2020; Mirsim, 2014; Schaufeli, 2017), and individuals operating under huge workloads experience strain (Bhagat, 2017). Many of the studies may not use the term strain directly. However, other synonyms for strains have been examined by these previous studies, and burnout, such as stress, burnout, and frustration.

Burnout is a psychological syndrome that arises from prolonged exposure to work-related demands (De Beer & Bianchi, 2019; Maslach & Leiter, 2016). The relationship between workload and strain has been theoretically explained by the job-stress theory (Spector, 1998). The job-stress model explains that individuals can be psychologically strained due to the high work demands (Bhagat et al., 2017; Buttigieg, 2007).

Several studies have empirically demonstrated how work overload leads to psychological stress. For instance, poor work environments may cause increased cognitive impairment (Yean et al., 2022). Lack of flexibility in the arrangement of tasks causes rigidity and influences psychological strain (Alaminos-Torres et al., 2023; Yean et al., 2022). Also, employees in organisations that maintain an unbalanced workforce often exhibit increased strain (Bhagat et al., 2018; Suárez et al., 2017; Wei & Yan, 2010). Work overload, reflected in the situation where the tasks available for an entire labour force but distributed among few people, therefore, leads to physical and mental tiredness.

Aside from the physical manifestation of work overload, it also results in negative emotions such as reduced cognitive resources and reduced mental health and influences the exhibition of negative behavioural tendencies (Keller & Weibler, 2015; Korunka et al., 2003; Moyle, 1995; Nasurdin et al., 2005). Hamizah et al. (2018) revealed that work overload reduces student self-regulation. Also, mental exhaustion or cognitive fatigue can occur when individuals are constantly required to engage in complex cognitive tasks, make decisions under pressure, or handle a high volume of information. This can lead to difficulties in concentration, decreased mental clarity, anxiety, and impaired cognitive functioning. Mental exhaustion can also contribute to increased stress levels, irritability, and a reduced ability to effectively manage job demands and responsibilities (Mirsim, 2014).

In addition, some other studies have shown that work overload can result in several non-affective responses (Hamizah et al., 2018; Omar et al., 2011). These include cynicism, decreased sense of personal accomplishment, dissatisfaction, and decreased

concentration. When employees are having work overload, their satisfaction with their jobs decreases, and this causes reduced job dedication as well as tensions within the work environment (Hamizah et al., 2018; Omar et al., 2011).

Therefore, based on the prior studies that have shown the positive relationship between work pressure and strain, this study will empirically examine if the result will also align with the prior studies. Hence, it can also be asserted that, in the context of this study, work overload may also significantly influence strain. This is based on the justification that the exhaustion of mental and physical resources resulting from work overload can harm employee well-being. Also, when individuals are consistently faced with excessive work demands that exceed their capacity to cope, it can deplete their energy levels and lead to strain. Hence, based on this perception that work overload increases strain, this study predicts hypothesis eight.

H8: Work overload is positively related to Strain.

2.8.2.4 Work Pressure and Strain

As conceptualised by this study, work pressure encompasses all IT-related pressures caused by colleagues and superiors within the organisation, which can induce strain. Several studies have also confirmed this relationship empirically. The American Psychological Association (APA) explained the impact of work pressure on employee mentality (Gulseren et al., 2019). APA explained that employee involvement, work-life balance, and employee health and safety are healthy practices that management should infuse into the organisation. Moreover, an unhealthy work environment psychologically drains the employees of their cognitive resources, resulting in strain.

People's actions can induce several deviant behaviours in others. Victimization, marginalisation, discrimination, and backlash are aversions caused by people that directly affect others' mentality (Gulseren et al., 2019). Prior research on strain theory has examined the influence of people within society as sources of various aversions. Responses to these aversions can range from mild to intense negative emotions like anger, strain, and depression. For instance, studies have focused on victimisation, highlighting it as an antecedent to various negative emotions (strain) and deviant behaviours (Glassner & Cho, 2018; Walters, 2020; Ferguson et al., 2016; Lee et al., 2019; Walters, 2020).

These studies suggest that victimisation is a type of delinquency that influences not only external negative emotions like anger but also internal negative emotions such as depression and feelings of worthlessness. Addressing victimisation is crucial in preventing adverse outcomes and promoting healthy emotional and behavioural development. Victimization can take different forms, including physical bullying and cyberbullying, with both having significant impacts on individuals' well-being (Glassner & Cho, 2018; Walters, 2020). The consequences of victimisation are wide-ranging deviant behaviours. They can include substance abuse, academic underachievement, low self-esteem, social difficulties, engagement in illegal activities, association with deviant peers, and even suicidal thoughts (Ferguson et al., 2016; Lee et al., 2019; Walters, 2020).

Studies have focused on marginalisation, highlighting that marginalised groups experience factors such as victimisation and social isolation. A few of these studies specifically addressed marginalised groups such as sex workers (Bucher et al., 2015;

Button & Worthen, 2014), while others examined issues related to racial marginalisation. When people experience marginalisation, they experience strain, causing various deviant behaviours.

Some other studies have examined discrimination. Several studies on racial issues have been carried out in the United States, exploring how strain impacts marginalised racial groups and their deviant behaviours (Estrada-Martínez et al., 2012; Jang & Lyons, 2006; Piquero et al., 2016; Unnever et al., 2009). These studies highlighted factors like social disorganisation, perceived injustices, hate crimes, illicit drug use, biases, and disparities in wealth distribution as crucial influences on the strain and deviant behaviours among marginalised races. Exposure to financial stress and discrimination was also found to contribute significantly to depressive and violent behaviours (Estrada-Martínez et al., 2012).

Aside from the pressures from people within society that lead to strain, some papers have explored how organisational strains impact employees' mental well-being and behaviours. This includes strain from colleagues, superiors, and management, leading to work-related psychological strains contributing to depressive symptoms and even suicidal tendencies among employees (Lew et al., 2020; Liu et al., 2019, 2020; Zhang et al., 2018). Emotional exhaustion resulting from workplace strain has also been linked to behaviours like cyberloafing and negative emotions (Hinduja, 2007; Koay, 2018).

Furthermore, exposure to work stress has been associated with instances of domestic abuse, transferring aggression onto immediate family members (Anderson & Lo,

2011). Demerouti et al. (2010) highlight how work pressure leads to burnout, while Smith et al. (2019) empirically demonstrate that work pressure causes emotional exhaustion. These prior studies, therefore, explained that pressures from colleagues, superiors, within society, and organisations impact others' mental well-being, leading to depressive symptoms, suicidal tendencies, cyberloafing, negative emotions, and even domestic abuse.

Therefore, based on the perception that pressures at work influence people's strain, this study believes that this relationship can also be tested empirically to see if the result confirms these prior studies. Hence, just as peer pressure, superior pressure, and other individuals' pressure within society influence strain, this pressure within the workplace can also influence strain. Hence, based on this perception, this study proposes hypothesis nine.

H9: Work pressure is positively related to strain.

2.8.3 The Mediating Role of Strain in the Relationship between Structural Factors and Employee Shadow IT Usage

Strain theory hypothesises that strain mediates the relationships between social factors and deviant behaviours. Hence, by replicating this in the context of this study, strain is believed to mediate the relationships between the structural factors and employee's shadow IT usage. Extant studies have revealed the mediating influence of emotions such as anger, burnout, stress, and depression on the relationship between external factors and behavioural factors such as delinquencies, performance, satisfaction, and health condition of people (Buttigieg, 2007; Demerouti et al., 2004; Sigfusdottir et al., 2010). Also, strain theory proposes that strain mediates the relationship between

structural factors and societal deviant behaviours. Therefore, this study attempts to examine the mediating role of strain in serving as the intermediary between structural factors and employee shadow IT usage.

IT accessibility access is reflected in the organisation's IT investments and its provision of up-to-date technologies (Abed et al., 2017; Preimesberger, 2017b). IT accessibility also helps automate complex workstreams and reduce employee frustration (Ivancevich et al., 1985; Korunka et al., 2003, 2010). Therefore, the absence of robust information technology (IT) mechanisms within an organisation is a significant factor leading to employee strain and their engagement with shadow IT (Ogedengbe, 2024)

Moreover, employees become strained when faced with IT system failures, such as outdated IT infrastructure (Akello et al., 2021; Thatte et al., 2014). Previous research suggests that IT inaccessibility can lead to frustration and hinder employees' productivity (Chen & Yuan, 2018). Due to the need to cope with the strain, they often seek alternative systems to carry out their tasks using shadow IT (Thatte et al., 2014).

Also, based on the strain theory, which hypothesises that strain mediates the relationship between structural factors and deviant behaviours, this study proposes that strain mediates the relationship between IT accessibility and shadow IT usage. Studies have also shown that IT structures can boost human cognitive resources. In contrast, employees with limited access to necessary IT resources at work may need increased mental effort. (Bour et al., 2019; Setor & Joseph, 2015).

Strained employees may seek alternative solutions through shadow IT (Ortbach, 2016). However, due to the limited available empirical studies on shadow IT usage, there are limited previous empirical studies that have examined the mediating role of strain in the relationship between IT accessibility and employee shadow IT usage. Because the researcher could not find any prior study that has examined this relationship, this study attempts to bridge this gap by examining the mediating role of strain in the relationship between IT accessibility and shadow IT usage. Therefore, it is hypothesised that Strain mediates the relationship between IT inaccessibility and shadow IT usage.

H10: Strain mediates the relationship between IT accessibility and employee shadow IT usage.

According to this study, SETA relates to the organisation's provision of knowledge-impacting structures to employees. This includes security education, training programs, and awareness initiatives. SETA programs are designed to equip individuals with comprehensive knowledge and skills in information security (D'Arcy et al., 2009). Through SETA, individuals gain a foundational understanding of information security and have the opportunity to discuss different information security behaviours (Abdul Talib & Dhillon, 2015).

However, when organisations do not provide up-to-date SETA programs, employees may lack information, feel deficient and lacking, and become redundant and obsolete (Barlow et al., 2018; Bauer et al., 2017b). This makes them unable to compete fairly with their colleagues, causing various negative emotions, including strain. (Bour et al., 2019). To boost their self-esteem, a strained employee may become proactive,

interacting with shadow IT to gain knowledge and personal training, downloading random cloud automated systems and up-to-date technologies to perform official tasks effectively and efficiently (Ogedengbe et al., 2024).

Just as SETA provides updated knowledge regarding the security implication of shadow IT usage may increase employees' non-compliance with organisation policies (Kim et al., 2016; Kim et al., 2013; Oliveira & Martins, 2014), the continuous quality implementation of knowledge-impacting programs in organisations can reduce employee strain. (Korunka et al., 2003, 2010).

Velki and Milić (2021) examined the mediating impact of strain on awareness and risky behaviour among undergraduate students. The study was based on the perception that stress directly impacts individuals' decision-making processes by limiting their cognitive resources, which are redirected toward emotion regulation. Consequently, this neglect of inhibitory processes leads to increased risky behaviour. Although the study could not statistically confirm this perception, examining whether stress can mediate the relationship between SETA and employee behaviour at work is imperative.

Organisations failing to provide adequate SETA programs to develop employees' knowledge creates potential risks. Employees may experience strain due to uncertainty and lack of knowledge regarding appropriate IT practices. Strained employees unaware of non-compliance risks and security-related challenges may behave defiantly by using shadow IT, which can put the organisation at risk of deviant behaviours. Thus,

this research hypothesises that strain could mediate the relationship between security education, training, awareness, and shadow IT usage. Hence, hypothesis eleven.

H11: Strain mediates the relationship between SETA and employee shadow IT usage.

Work overload can impose cognitive demands on employees, increasing mental strain. Under excessive job demands and time pressure, employees may experience strain, affecting their ability to utilise authorised IT resources effectively. Consequently, they may use shadow IT as a coping mechanism to alleviate work-related pressures and improve task performance (Hiltz & Turoff, 2013). Therefore, it is hypothesised that strain mediates the relationship between work overload and shadow IT usage.

H12: Strain mediates the relationship between work overload and employee shadow IT usage.

Prior research on strain theory has examined the influence of people within the society as sources of various aversions. Responses to these aversions can range from intense negative emotions like anger leading to behaviours aimed at avoiding pain or achieving goals. For instance, a young person might flee from an abusive home environment. At the same time, another might engage in cyber scams for financial gain.

High work pressure can induce strain by increasing the sense of urgency and perceived need for expedited task completion (Tams et al., 2019). As a result, employees may experience strain, leading them to adopt shadow IT practices to meet job demands under time constraints and achieve desired outcomes (Gibson & Gibbs, 2006). Hence, strain is hypothesised to mediate the relationship between work pressure and shadow IT usage.

H13: Strain mediates the relationship between work pressure and employee shadow IT usage.

2.9 Underpinning Theory: Strain Theory

This study is underpinned by strain theory. Strain theory emphasises that individuals may resort to deviant behaviours when they experience negative emotions from structural imbalances. In shadow IT usage, employees may feel frustrated by cumbersome IT processes, slow response times from IT support, or the inability to access necessary tools and applications. This strain can lead them to seek alternative solutions outside the organisation's sanctioned IT infrastructure.

Strain theory has been discussed extensively in section 2.7 of this chapter. The justification for its usage has been discussed in section 2.4 after comparing theories used by prior studies such as neutralization theory and social presence theory.

2.10 Conceptual Framework

This study conceptualizes strain theory in the context of employee shadow IT usage to propose the extended strain theory model. The strain theory model established the relationships between social factors, strain, and deviant behaviours within society. Aside from direct relationships, strain is also established as a mediator between social factors and deviant behaviours. In this study, the researcher believes strain theory can also be conceptualised in the IS context to examine shadow IT usage, which is an IS

deviant behaviour. Hence, this study applies strain theory to examine the role of structural imbalance, employee strain, and shadow IT usage within organizations.

Therefore, this study proposes the extended strain theory model, which examines the relationship between structural factors, strain, and employee shadow IT usage. To explain the research framework, four structural factors are examined as independent variables. These are: IT accessibility, security education, training, and awareness (SETA), work overload, and work pressure, with strain and shadow IT usage being the dependent variables. Strain is also used as the mediating variable. This theoretical framework is presented in Figure 2.1.

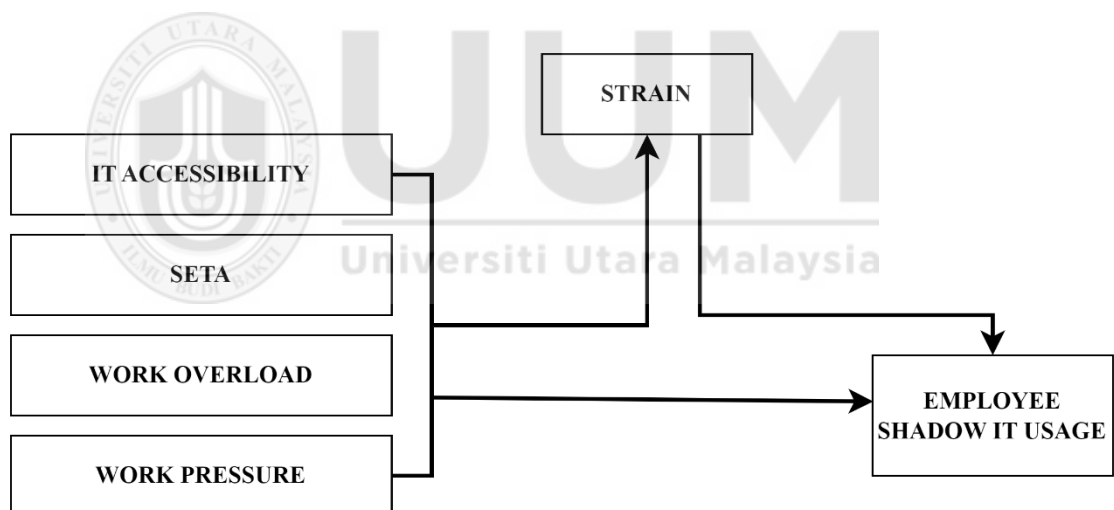


Figure 2.8

Conceptual Framework: The extended strain theory model

IT Accessibility, Security Education Training and Awareness (SETA), Work Overload, Work Pressure, Strain, Employee Shadow IT Usage.

According to the best knowledge of the researcher, no study has been conducted that examined IT accessibility, SETA, work overload, work pressure, strain, and employee Shadow IT usage in one study, and this study fills this gap. This research assessed four

major relationship linkages: (1) the relationship between the independent variables and employee shadow IT usage was assessed, (2) the relationship between the independent variables and strain was assessed, (3) the relationship between strain and employee shadow IT usage was assessed and (4) the mediating effect of strain in the relationship between the independent variables and employee shadow IT usage was assessed. These relationships were used in proposing the thirteen hypotheses of this research, as summarised in Table 2.3.

Table 2.2
Summary of hypotheses

Relationships	Hypotheses	Description
Structural factors and shadow IT usage	H1	IT accessibility is negatively related to employee shadow IT usage
	H2	SETA is negatively related to employee shadow IT usage.
	H3	Work overload is positively related to employee shadow IT usage.
	H4	Work Pressure is positively related to employee shadow IT usage.
Strain and shadow IT usage	H5	Strain is positively related to employee shadow IT usage.
Structural factors and strain	H6	IT accessibility is negatively related to strain.
	H7	SETA is negatively related to strain.
	H8	Work overload is positively related to strain.
	H9	Work pressure is positively related to strain.
Mediating effect of strain	H10	Strain mediates the relationship between IT accessibility and employee shadow IT usage.
	H11	Strain mediates the relationship between SETA and employee shadow IT usage.
	H12	Strain mediates the relationship between work overload and employee shadow IT usage.
	H13	Strain mediates the relationship between work pressure and employee shadow IT usage.

2.11 Research Gap

To the best of the researcher's understanding, based on the available literature that was reviewed, this study is the first to empirically examine shadow IT usage based on strain theory by examining the four structural factors of work overload, IT accessibility, SETA, work overload, and work pressure, together with strain and employee shadow IT usage.

Previous studies have examined some of these factors separately without considering these four structural factors together as a whole. For example, all the structural factors related to strain have been examined. Also, studies have shown that IT accessibility is a factor that influences shadow IT usage. Work pressure has also been examined as an antecedent to shadow IT usage. Work pressure has also been examined (Gorter et al., 2019; Mallmann et al., 2018; Sillic, 2019).

To the researcher's understanding, this study is among the first to examine strain and shadow IT usage. Also, this study is the first to examine SETA and work overload concerning shadow IT usage. Moreover, this study is the first to examine the mediating effect of strain in the relationships between the four independent factors and shadow IT usage. This gap is presented in Table 2.4.

Table 2.3
Summary of prior literature and gaps

Factors	Explanation
Strain and employee shadow IT usage	This study could not find prior empirical research on strain and shadow IT usage (gap in Literature)

Factors	Explanation
IT accessibility and employee shadow IT usage	IT accessibility is a primary reason employees introduce Shadow IT into the organisation IS (Huber et al., 2017; Kopper et al., 2018; Kopper & Westner, 2016; Magunduni & Chigona, 2018).
SETA and employee shadow IT usage	This study could not find prior research on SETA and shadow IT usage (gap in the literature)
Work Overload and employee shadow IT usage	This study could not find any prior empirical research on work overload and shadow IT usage (gap in the literature).
Work Pressure and employee shadow IT usage	Few studies have addressed the impact of work pressure on shadow IT usage (Gorter et al., 2019; Mallmann et al., 2018; Sillic, 2019).
Mediating effect of strain	This study is the first to examine the mediating effect of strain in the relationship between the independent variables (IT accessibility, SETA, work overload, and work pressure) and employee shadow IT usage (gap in the literature).

2.12 Chapter Summary

This chapter examined the literature available on the shadow IT area. Based on these previous studies, four structural factors have been examined. These are IT accessibility, SETA, work pressure, and work overload. Finally, this chapter conceptualised strain theory in information systems by explaining the motivation for employees' usage of shadow IT within the organisation. The research hypotheses and framework for this study are also presented in this chapter.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

The purpose of this chapter is to provide an overview of the research methodology adopted for the study. The discussion includes a dedicated research paradigm, research design, data collection, and data analysis adopted in the study. This chapter comprises sections explaining the research design adopted for this study.

The first section is the introductory section. The second section explains the research paradigm employed to address the research questions effectively. The third section describes the research design. The fourth section describes the unit of analysis. The fifth section describes the population and sampling technique. The sixth section describes the instrument. This section includes the survey questionnaire design, operationalisation, measurement of constructs, and demographic data. The section also discusses the pre-test and pilot test. The seventh section describes the data collection procedure. The eighth section describes the data analysis procedure, and the ninth section summarises the chapter.

3.2 Research paradigm

A research structure begins with selecting a topic and the research paradigm (Creswell & Creswell, 2017; Davies & Fisher, 2018; Rehman & Alharthi, 2016). A paradigm is a set of ideologies, myths, theories, perspectives, and approved procedures governing

people's thinking and acting (Baumgartner, 2014; Davies & Fisher, 2018). Hence, research paradigm refers to the scientific methodologies, ideologies, beliefs, assumptions, theories, standards, and perspectives guiding research. Social science research can be conducted within the context of quantitative or qualitative (Cavana et al., 2001; Sekaran & Bougie, 2016). According to Healy and Perry (2000), four research paradigms exist for which quantitative and qualitative studies may be conducted. These are positivism, critical theory, realism, and interpretivism.

The positivist paradigm is used for conducting social science research that follows a quantitative approach (Sekaran & Bougie, 2016). The other paradigms (interpretivism or constructivism, realism, and critical theory) are used for conducting research based on a qualitative approach (Cuba & Lincoln, 2005). The mixed method approach is a mixture of quantitative and qualitative research paradigms. Although this mixed method is acceptable and supported by some researchers, its usage remains unsupported by others. Hence, its usage remains an issue for debate (Creswell & Creswell, 2017). Each of these paradigms is described, and the justification for carrying out this research based on the positivist paradigm is presented in this section.

Critical theory explores social realities, aiming to critique and transform societal structures and values. Researches based on this paradigm often engage in long-term ethnographic and historical studies, focusing on understanding complex social, political, cultural, economic, ethnic, and gender dynamics. This approach challenges established norms and ideologies to uncover underlying power structures and advocate for social change (Healy & Perry, 2000).

Realism posits the existence of an objective reality independent of individual perceptions (Healy & Perry, 2000). This paradigm focuses on causality and discovering underlying truths about the world. Realist researchers seek to understand phenomena as they exist, albeit imperfectly apprehensible. The emphasis is on exploring causal relationships and uncovering objective realities through rigorous empirical investigation.

Interpretivism prioritises the richness of the research context. Researchers in this paradigm acknowledge the subjectivity of human experiences and focus on understanding meanings, interpretations, and subjective realities (Healy & Perry, 2000). Interpretive research methods include hermeneutics, phenomenology, and symbolic interactionism, aiming to establish deep understandings of phenomena by paying attention to nuanced details and highlighting subjectivity in conclusions.

The positivist paradigm is a philosophical approach to science built on the verified theory that emphasises the importance of empirical evidence and the scientific method in understanding the world (Cavana et al., 2001; Sekaran & Bougie, 2016). Also, the positivist approach is often associated with quantitative research methods, which rely on numerical data and statistical analysis to test hypotheses and theories. Positivism aligns with an objectivist deductive research approach, which starts with theory as a foundation. This approach allows for the formulation of testable hypotheses essential for testing cause-and-effect relationships and identifying operationalised concepts and variables.

Based on these explanations, this study chooses the positivist paradigm for this research, and the justification is based on several factors. The positivist approach is deemed suitable because this study is based on verifiable theory (strain theory) as the theoretical background. Also, positivism emphasises a confirmatory approach, where data collection aims to verify or refute hypotheses derived from established theories. This methodical and structured approach leads to incremental knowledge building, refining theories, and generating new causal explanations based on empirical evidence. Since this research is quantitative, it is necessary to follow the guidelines and rules for quantitative research and conduct it according to scientifically approved methods. Hence, the justification for the positivist paradigm.

Furthermore, positivism's emphasis on standardisation and objectivity makes it suitable for quantitative methods, such as statistical analysis, which are integral to testing hypotheses and drawing reliable conclusions from data. To make this study generalisable, there is a need to follow the linear progression from theory to hypothesis development, data collection, findings interpretation, and theory refinement, which aligns well with the rigorous and systematic nature of quantitative research. Overall, positivism provides a robust framework for conducting quantitative research that prioritises objectivity, hypothesis testing, and advancing scientific knowledge through empirical evidence. Hence, it is the most suitable of all the four paradigms, as explained.

3.3 Research Design

Research design is a work plan that describes the research information and reveals how the research questions will be answered (Dulock, 1993). The research design provides credibility to the study by showing that it followed the scientific research method (Cavana et al., 2001; Spector, 2019). Moreover, it provides a blueprint that the investigation will follow and is evidence that the research is carried out accurately.

3.3.1 Research Design Nature

The nature of the qualitative and quantitative research design is exploratory, explanatory, and descriptive. Exploratory research design is used when researchers seek to discover and understand a problem or situation for which there are few or no prior studies. The main purpose of exploratory research is to investigate an issue or phenomenon in depth, gain insights, and lay the groundwork for future research. Researchers commonly employ methods such as literature reviews, expert interviews, focus groups, and open-ended surveys. The flexibility and adaptability of exploratory research allow it to evolve as new findings and directions emerge during the research process.

Explanatory research design focuses on understanding the reasons or causes behind a phenomenon, aiming to explain the relationships between variables. This type of research seeks to establish causal relationships and understand the underlying mechanisms. Explanatory research aims to develop theories and models that explain observed patterns and relationships. Researchers typically use methods such as experiments, longitudinal studies, and regression analyses to test hypotheses and analyse data. By providing insights into causality, explanatory research contributes to

a deeper understanding of complex phenomena and informs practical applications and policy-making.

Descriptive research design aims to describe a population, situation, or phenomenon accurately and systematically. Descriptive research design provides a detailed, factual description of the characteristics, behaviours, and patterns of the subjects or phenomena being studied. Researchers often use surveys, observations, and case studies to collect data. The descriptive research design is used for this study as it enhances the description of the relationship between the constructs, as shown in the research model. This includes the relationship between the structural factors and employees' shadow IT usage, the relationship between the structural, the relationship between strain and employees' SIT usage, and the mediating influence of strain on the relationship between structural factors and SIT usage.

3.3.2 The Qualitative Research Approaches

The qualitative research approach follows the naturalistic research approach (critical theory, realism, and interpretivism), designed to understand the complex nature of human phenomena (Cavana et al., 2001; Sekaran & Bougie, 2016). Methods include interviews, observation methods, and focus groups. Qualitative research also does not depend on numerical and structured data. In contrast, qualitative research is focused on the richness of data through detailed explanations of the phenomenon using observations and involvement. It also follows the inductive approach, where the research observes a system and generates conclusions.

Although the qualitative approach tries to view the world from the lens of the subject perspective, it is often criticised due to its lack of generalizability, dependability on the subjective explanations, and difficulty in replicating studies by other researchers (Cavana et al., 2001; Sekaran & Bougie, 2016). This study employs a quantitative research approach because its objective is to examine the relationship between structural elements, strain, and shadow IT usage. This objective aligns well with the quantitative approach, which is suited for analyzing and quantifying relationships between variables.

3.3.3 The quantitative approach

Quantitative research follows the positivist research approach pattern through numerical data, predetermined questions, conceptual framework, and designs (Cavana et al., 2001). Quantitative research can be described as research using structured questions where the response choices have been pre-set, and many respondents participated (Sekaran & Bougie, 2016). Quantitative research focuses on statistically generalising results and predictions by searching for cause-and-effect relationships among constructs (Cavana et al., 2001; Sekaran & Bougie, 2016). Methods for the quantitative research context include field experiments, laboratory experiments, and questionnaires (Cavana et al., 2001).

As explained earlier, quantitative research is linked with positivist beliefs and a deductive approach, and it analyses data statistically (Cavana et al., 2001; Sekaran & Bougie, 2016). In the deductive approach, the research follows a set guideline, moving from the theoretical proposition to empirical evidence. (Cavana et al., 2001; Sekaran

& Bougie, 2016). The peculiarities of the qualitative and quantitative research approaches are presented in Table 3.1.

Table 3.1

The quantitative and qualitative research approaches

Aspect	Qualitative Research	Quantitative Research
Research Design	Flexible, emergent, iterative	Fixed, structured, predetermined
Ontology	Subjective, multiple realities exist	Objective, single reality exists
Epistemology	Emphasis on understanding meanings, interpretations	Emphasis on measurement, quantification, statistical analysis
Methodology	In-depth exploration, open-ended questions, interviews, observations	Controlled experiments, surveys, statistical analysis
Methods	Interviews, focus groups, observations, content analysis, ethnography	Surveys, experiments, statistical analysis, standardised instruments
Research Paradigm	Interpretivism/constructivism, critical theory, realism	Positivism

Source: (Cavana et al., 2001; Sekaran & Bougie, 2016)

Studies on research design have classified quantitative research into four broad types. These are an experiment, case study, longitudinal, and cross-sectional research. An experiment is the type of research design that involves manipulating one or more independent variables to observe their effect on a dependent variable, allowing researchers to establish cause-and-effect relationships.

Case study design focuses on an in-depth investigation of a single case or a small number of cases within a real-world context, often using multiple data sources to

understand the phenomenon comprehensively. Longitudinal research involves collecting data from the same subjects repeatedly over a period of time, allowing researchers to observe changes and developments in the subjects over time.

Cross-sectional research involves collecting data from a specific population at one point in time to achieve research objectives (Creswell, 2014). It is the most commonly used research design for quantitative research. Literature indicates that this research design offers several benefits, including cost savings and time efficiency for researchers (Sekaran & Bougie, 2010; Zikmund, 2003). Thus, a cross-sectional research design is employed. Collecting data from Nigerian employees at one point in time. The data was gathered from respondents between June 1, 2021, and June 1, 2022.

Concerning the above explanations, this current study is quantitative research that follows the positivist paradigm. The positivist approach will allow this study to fulfil the significant considerations for generalising results, including data validity, reliability, and objectivity (Cavana et al., 2001; Sekaran & Bougie, 2016). Moreover, this study is objective and separate from the researcher (Cavana et al., 2001; Sekaran & Bougie, 2016). The primary objective is to test the hypotheses based on the research model showing the relationships between structural factors, mediating factors, and the dependent variable of shadow IT usage.

The main reason for this adoption is that generating first-hand information from the respondents using the structured patterns of quantitative methods will provide in-depth information in answering the research questions (Cavana et al., 2001; Sekaran & Bougie, 2016). Therefore, a survey strategy was developed and used to collect data

from the subjects being employees in Nigeria. Employees are chosen because they are the ones who work in organisations, and their IT behaviours impact organisations' security risks and information systems. Employees who are IT users at work satisfy the condition of this study, given that IT-inclined employees are more susceptible to shadow IT usage (Huber et al., 2017; Kopper et al., 2018; Kopper & Westner, 2016; Magunduni & Chigona, 2018).

3.4 Unit of Analysis

The unit of analysis for this study is individual, that is, employees. Employees in Nigeria were the targeted respondents. For generalisation, the stratified random sampling method was used to get respondents quickly and in a structured manner (Zikmund et al., 2013). This divides Nigeria into six strata according to the six geopolitical zones in Nigeria. Respondents were from each of these zones. The strata include the southwest, south-south, southeast, north-central, northwest, and northeast. Exclusion criteria were used to limit respondents to employees who are IT users at work.

3.5 Population of Study

Population refers to the whole number of people, organisations, or elements involved in obtaining data for the research (Cavana et al., 2001; Sekaran & Bougie, 2016). For this study, the population includes employees in Nigeria. Based on the 2020 Nigerian Bureau of Statistics (NBS) report, the total labour force in Nigeria is 80 million people (National Bureau of Statistics, 2020). NBS resulted from the merger of the National

Data Bank (NDB) and the Federal Office of Statistics (FOS). Hence, the data regarding various statistics related to Nigerians can be accessed in the NBS. About 59 million Nigerians out of the labour force are employed as of 2020. The population for this study is based on the 59 million employed Nigerians (National Bureau of Statistics, 2020).

3.5.1 Sample Size Identification

The right sample size is needed for successful research, distributional assumptions, power, and the stability of the data analysis (Kock & Hadaya, 2018a; Marcoulides & Chin, 2013). A large enough sample size improves analysis estimates and reduces the total error rate. A small sample size may not allow the researcher to detect low-valued structural path co-efficient, and it causes higher standard errors (Kock & Hadaya, 2018b). Moreover, there is a need to make allowance for missing data. This is why Wold, the founder of PLS, suggests a more significant number of samples for improved consistency in the analysis (Abdi et al., 2013).

Aside from the potential for high error, which a small sample size might cause, insufficient data may create bias in the latent variables. Literature has suggested different methods for sample size determination in PLS analysis (Kock & Hadaya, 2018a; Marcoulides & Chin, 2013). This includes the rule of thumb suggesting at least ten times the number of model links pointing at the variables. The Monte Carlo simulation resampling is another method of determining sample size (Chin et al., 2003). One advantage of this method is its ease of generating sample size using the Mplus statistical analysis. The Monte Carlo simulation also is useful in obtaining precision of estimates. Although the likelihood of committing type 1 or type 2 errors

when using the Monte Carlo system cannot be ruled out, there is still a likelihood of minimising such errors.

Sekaran and Bougie (2016) suggested a sample size of 30 and 500 samples for research. The 500-sample size is the maximum sample size for analysis. This is to avoid type 2 errors, which lead to the acceptance of results that should be rejected. Tabachnick and Fidell (2007) also suggested a sample size calculation formula based on the number of independent variables (IV). The suggested formula for sample size calculation is $n = 50 + 8(m)$. Where m is the number of independent variables (IV), and n is the sample size. This study considers four independent variables. Hence, $50 + 8(4) = 82$ sample size.

Studies also suggested using the power tables in sample size determination (Abdi et al., 2013; Kock & Hadaya, 2018a). Moreover, a priori G* Power Analysis was computed to determine the sample size (Mayr et al., 2017). The minimum acceptable level for statistical power used was 0.80, and 0.05 for the alpha level (Chuan, 2006). For this study, by setting it as a t-test, point biserial model correlation, and a priori. Using the medium effect size of 0.15 and power of 0.80 with an alpha level of 0.05, the calculated sample size was 270. This is shown in Figure 4.1.

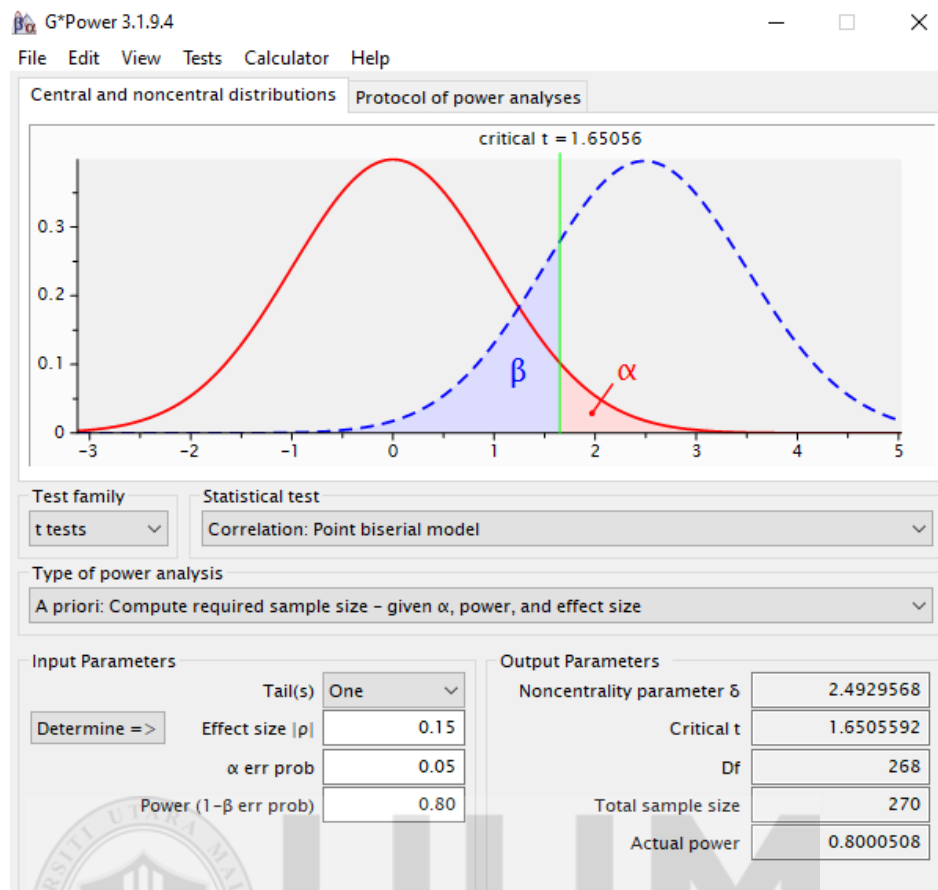


Figure 3.1
Sample size calculation
Source: G-Power

Moreover, this study also calculated the sample size using the Krejcie and Morgan table, as presented in Table 4.2 (Chuan, 2006; Krejcie & Morgan, 1970). The Krejcie and Morgan table suggests a sufficient sample size for a population above 100,000 is 384 (Chuan, 2006; Krejcie & Morgan, 1970). Since the population for this research is 59 million, the sample size based on Krejcie and Morgan formula is 384.

Compared with the other sample size methods assessed by this research (the rule of thumb, Monte Carlo simulation, Tabachnick and Fidell sampling and G power analysis), the Krejcie and Morgan sample calculation method gives the largest sample

size of 384. Thus, the sample size for this study is established after the Krejcie and Morgan method, which is 384 respondents.

Table 3.2

Sample size

N	S	N	S	N	S	N	S	N	S
10	10	100	80	280	162	800	260	2800	338
15	14	110	86	290	165	850	265	3000	341
20	19	120	92	300	169	900	269	3500	346
25	24	130	97	320	175	950	274	4000	351
30	28	140	103	340	181	1000	278	4500	354
35	32	150	108	360	186	1100	285	5000	357
40	36	160	113	380	191	1200	291	6000	361
45	40	170	118	400	196	1300	297	7000	364
50	44	180	123	420	201	1400	302	8000	367
55	48	190	127	440	205	1500	306	9000	368
60	52	200	132	460	210	1600	310	10000	370
65	56	210	136	480	214	1700	313	15000	375
70	59	220	140	500	217	1800	317	20000	377
75	63	230	144	550	226	1900	320	30000	379
80	66	240	148	600	234	2000	322	40000	380
85	70	250	152	650	242	2200	327	50000	381
90	73	260	155	700	248	2400	331	75000	382
95	76	270	159	750	254	2600	335	>100000	384

Note: N=Population size; S=sample size

Source: Krejcie and Morgan (1970)

3.5.2 Sample Frame

The sampling frame is the population of individuals from which a random sample will be drawn (Chuan, 2006). The total population is 59 million employed Nigerians (SMEDAN/NBS, 2017). Given that it is difficult to collect data from the total population due to constraints such as finances and time, the sample size was calculated, and it was 384 respondents.

In research, increasing the sample size before data collection is advised to ensure that the collected responses will not exceed the target sample size. In order to ensure the collected responses are not less than the expected sample (384), Salkind and Rainwater (2003) found a 40 – 50% increase in the sample to cover for uncooperative respondents and lost questionnaires. For online data collection, it is assumed that the response rate may not be precisely ascertained and could be very low. This assumption is based on existing literature, which indicates that calculating response rates for online surveys is challenging (Bhutta, 2012; Dusek et al., 2015). Consequently, this study determined the distributed sample size based on physical questionnaires rather than relying on online platforms. Thus, this study increased the physical questionnaire sample to 550, a 42% increase that falls within the 40-50% range, as Salkind & Rainwater (2003) suggested.

The sampling frame was calculated based on the geopolitical zones in Nigeria. Nigeria comprises six geopolitical zones: North-Central, North-East, North-West, South-West, South-East, and South-South. The sampling frame was calculated based on the employment rate in each geopolitical zone (National Bureau of Statistics, 2020). The employment rate was used to calculate the sampling allocation to each geopolitical zone and consider the anticipated response rate. This is presented in Table 4.2. The calculation of the sample frame is presented in Appendix H. The first column of the table presents the regional identification. The second column presents the percentage of each zone's employment rate compared to the total number of individuals employed nationally, which is 59 million. The third column allocates the expected respondents to each geopolitical zone based on the 550 samples.

Table 3.3

Calculation of the sample frame

Region	National employment rate (%)	550 sample
South-South Zone	15	82
South-East Zone	16.6	91
South-West Zone	18.6	102
North-Central Zone	16.69	91
North-East Zone	16.29	89
North-West Zone	16.7	91
Total	100	550

Source: based on the NBS 2020 report (National Bureau of Statistics, 2020).

3.5.3 Sampling Technique

There is a need to clearly define the sampling technique of this research to achieve an adequate and generalisable sample size. An appropriate sampling technique will reduce bias and misrepresentation. The sampling technique can either be probabilistic or non-probabilistic. The non-probability approach is when the elements do not have a chance of being selected as subjects with no random selection process. The non-probability methods include convenience sampling, judgment sampling, snowball sampling, and quota sampling.

In contrast to this, probabilistic sampling provides estimates of precision and generalisation of findings. Probability sampling allows every member of the population to be chosen as a respondent (Sekaran & Bougie, 2016). Hence, this study used the probabilistic sampling method. Probability methods include stratified random sampling, simple random sampling, systematic random sampling, cluster sampling,

and multistage sampling (Sekaran & Bougie, 2016). A stratified random sampling procedure was used for this research because of the peculiarity of the population, which was divided into six strata. Moreover, the method has the most negligible bias and provides generalizability (Sekaran & Bougie, 2016).

3.6 Research Instrument Development

3.6.1 Questionnaire Design

The survey questionnaire is the most common survey method used in social sciences due to its many benefits (Cavana et al., 2001; Sekaran & Bougie, 2016). This includes easy-to-manage questionnaires, trusted responses, a structured system of data interpretation through data analysis, ease of reaching a broader respondent base, and generalisability of results (Cavana et al., 2001; Sekaran & Bougie, 2016). Hence, this study employed a survey questionnaire for data collection.

Some disadvantages of the survey questionnaire method include an unwillingness to give some sensitive or private information, question-wording may provide a different interpretation to different respondents, misunderstandings may arise, and the honesty of responses may be complex to confirm (Cavana et al., 2001; Sekaran & Bougie, 2016).

This research recognised these disadvantages, and prior researchers recommended guidelines for mitigating them, such as relevancy, accuracy, and sensitivity. For instrument relevancy, only items related to the research were included in the survey instrument. This is to avoid redundancies and wasting of respondent time. In addition, as Boateng et al. (2018) suggested, the form, wordings, and responses the question is

designed to induce should be considered in developing items. Hence, the items were worded in simple English for ease of understanding and to avoid ambiguity.

For accuracy, Hair et al. (2021) and Zikmund (2003) suggested that the instruments should be characterised by a high degree of reliability and validity. Hence, the survey questionnaire items were adapted from validated previous studies. To ensure content validity, a pre-test using experts' validation was conducted. After this, the pilot study was conducted on the target population (Boateng et al., 2018).

For sensitivity, the items should be designed in a format that is consistently understood and communicated to the respondents. Moreover, the items should be designed to elicit correct responses from the respondents. In order to achieve this, the Likert-scale five-point scale was used. All items for the constructs used a five-point Likert scale ranging from strongly disagree (1) to strongly agree (5) (Brown, 2010; Leung, 2011). In addition, Sudram and Bradburn (1983) suggested the need to design the questionnaire format in a booklet form to collect data from respondents. This is because the booklet format makes it easy to respond to questions sequentially. Accordingly, the questionnaire for this research is based on the booklet format.

3.6.2 Operationalisation and measurement of variables

Operationalisation and measurement of the construct are carried out in tandem. While operationalisation transforms abstract concepts into measurable variables, measurement involves assigning numerical values to these variables. Thus, this process ensures the reliability and validity of the findings and improves the credibility

of the study's results. Moreover, All the items used for the measurements are reflective items.

3.6.2.1 Operationalisation and Measurement of Shadow IT Usage

This study defines shadow IT usage as the "employee interaction with IT mechanisms that were not sanctioned, authorised or provided for organisation use by the IT department." This includes the usage of a cloud-based repository, office assistive tools, IT hardware, and communication tools not provided for official use by the organisation's IT department.

Items were adapted from Mallmann and Maçada (2017) and Hatashima and Sakamoto (2017) to measure shadow IT usage. Two references were adapted to measure shadow IT usage. These two references were merged and modified as the instrument for measuring shadow IT usage by this study because just one reference could not capture the whole shadow IT as conceptualized in this research. Content validation was performed by sending the items to experts for content validation. Based on the expert's opinions, the items fully measured all aspects of shadow IT usage. A pilot test also showed that the composite reliability value of shadow IT using these eight items is 0.897. The instrument includes items such as "I use cloud-based services unauthorised by the IT department; I install unauthorised software; I use my devices to work; I store organisation data on personal devices; external storage devices, personal devices, and at home." All the items are reflective. The items are presented in Appendix F.

3.6.2.2 Operationalisation of Strain

This study describes Strain as "the mental, psychological stress experienced by employees due to the imbalance in organisational structural factors." Strain happens when the cognitive activities exceed the available cognitive resources and cause mental exhaustion and fatigue. Based on the strain theory, in the context of this study, it can be explained that when there is an imbalance in the available structural factors in the organisation, employees tend to exhaust their cognitive resources when carrying out activities. Hence, they may behave unethically by not complying with IT policies.

Mental stress goes beyond physical tiredness. It also influences behaviours. Therefore, employees' interaction with shadow IT can be predicted to cope with the strain. Items for strain measurement were adapted from (Hadzibajramovic et al., 2015)., there were six items; three were worded positively, and three were worded negatively, so this study maintained the exact wording. The items include "I feel rested, relaxed, calm, stressed, pressured, and tensed". Based on the experts' opinions, these items were suitable for measuring strain. However, experts advised against changing wording as it may confuse respondents and reduce the validity of the constructs. Therefore, the items were reworded into their original format, and data were reversed scored before analysis. This approach is consistent with prior research (Weijters et al., 2013) and maintains construct validity. The pilot study shows the composite reliability to be 0.865. Moreover, all the items are reflective items.

3.6.2.3 Operationalisation of IT Accessibility

This study describes IT accessibility as an organisation providing all relevant IT structures for workers. This includes internet and cloud-based IT, official

communication systems, investment in relevant IT structures and technological innovations (Ogedengbe, 2024). Lack of IT accessibility inhibits employees' interaction with legally approved IT systems and influences their interactions with unapproved IT within an organisation when performing their official duties (Ogedengbe, 2024). A seven-item system was adapted to measure IT accessibility (Barlett et al., 2018). After adapting, the items were sent for expert validity on whose suggestions the items were modified. The original and modified items and the expert suggestions are presented in the appendix (Appendix D & E). The survey instrument includes items such as easily accessible wireless connectivity, regulations regarding internet use and connectivity, communication systems, and technological innovation. The composite reliability for the items after the pilot test is 0.87. Moreover, all the items are reflective items.

3.6.2.4 Operationalisation of SETA

This study defines SETA as the security knowledge impacting structures organisations provide to employees to facilitate their IT behaviour at the workplace. This includes providing learning opportunities for the workforce, sensitising employees regarding their security behaviour, and providing the training and development structures to the employees by management. When an organisation fails to educate on the security impact of shadow IT usage, employees tend to interact with the systems ignorantly, which may expose the organisation's IS to security threats.

Eight items were adapted from Bauer and Bernroider (2017) and Hanaysha (2016). The items were adapted from two sources because the SETA items provided by a singular paper (Bauer & Bernroider, 2017) were insufficient to capture the whole

dimension of the SETA as conceptualised by this study, as it focused more on security education and awareness. For training, items were adapted from Hanaysha (2016). Hence, the items were modified in the context of this study and sent for expert validation. Based on the expert's opinion, the items were deemed suitable. After this, the pilot study was conducted, showing the composite reliability to be 0.923. All the items are reflective items. The survey instrument includes items such as my organisation provides learning opportunities, IT training and development, on-the-job training, and awareness of information security issues. The items are presented in appendix F.

3.6.2.5 Operationalisation of Work Overload

According to this study, work overload is the extent of work demand on employees' which causes strain and may influence them to use shadow IT systems (Ogedengbe, 2024). It includes excessive job demands, tight schedules and working hours, and other forms of over-burden on workers, which acts as a stressor causing burnout and mental and psychological exhaustion. A five-item scale has been adapted from Cousins et al. (2004) to measure work overload. These items were modified in the context of this study and sent for expert validation. Based on the expert's opinion, these items were deemed suitable for this research. After this, the pilot study was conducted, and the composite reliability was 0.718. The instrument includes items such as working long hours and unachievable work deadlines. These items are presented in Appendix F.

3.6.2.6 Operationalisation of Work Pressure

This study defines work pressure as the pressure from relationship factors within the organisation, which may influence employees into interacting with shadow IT

(Ogedengbe et al., 2024). This includes pressure from superiors and influence from peers. These social pressures may serve as motivating factors for Employee shadow IT usage.

Items were adapted from Mallmann et al. (2018) to measure work pressure. These items were mailed directly from Mallmann to the researcher, and authority was given to use the validated items in construct measurement for the study. Moreover, all the items were reflective items. This includes items such as " My boss is concerned about my usage of IT systems which the IT department did not provide." and " My workmates use IT systems, which were not provided by the IT department, to perform their work tasks." These items were sent for expert validation. The items were deemed suitable for this study based on the experts' suggestions. After this, the pilot study showed the reliability composite reliability as 0.885.

3.6.2.7 Demographic Data

Demographic variables are typically measured through categorical or nominal scales, which capture distinct characteristics within a population (Creswell & Creswell, 2017). This study uses five demographic variables measured through categorical scales. These include (1) gender, measured using two items: Male and Female. (2) Age, which was measured using five categorical items. These are under 25, 25-40, 41-55, 55 - 65, and over 65. (3) Academics, which was measured using five items. These include High school, diploma, first degree and equivalent, master's, and doctoral. (4) geo-political zone, which was measured using six items. These are south-south, south-east, south-west, north-central, north-east, and northwest. (5) The Sector was measured using four items: the public sector, private sector, non-governmental organisation, and

others. The public sector includes academics, health, and other areas. The private sector includes SMEs, corporations, and others. Moreover, the NGO includes social workers and other NGO workers.

3.6.2.8 Pre-Test

A pre-test was conducted based on the expert's assessment. This ensures that the items are meaningful to the respondents. Moreover, pre-testing eliminates poor wording. Experts were independent of the researcher and had no direct relationship with the study. The experts were experts in information systems, management, and information technology. Five experts conducted independent reviews to examine the items' appropriateness, accuracy, and interpretability. These are academic staff and lecturers in Universities. Items were either accepted, rejected, or modified in alignment with Boateng et al. (2018). As presented in Appendix D & E, modifications were made, redundancy was removed, and some constructs were rephrased to suit the current study.

3.6.2.9 Pilot Test

Scholars and researchers have recommended the pilot test to address various research issues relating to scale and instrument development (Boateng et al., 2018). A pilot study was carried out on the target population, as suggested by Boateng et al. (2018). The pilot test is a necessary data collection process since it is a trial run performed to test the procedural research plans, which determine the clarity of questions and assist in identifying problem areas that need clarification (Boateng et al., 2018). Hence, the pilot test enables clarity and understanding of questionnaires and the whole survey procedure.

In addition, the pilot study ensures that the questions are unmissable and that respondents' experience when responding to questionnaires is smooth. When the pilot study is well conducted within the formal framework, methodological rigour is encouraged, the study's validity is established, and the publishing ability of the work is determined. This will assist researchers in producing high-quality research (Lancaster et al., 2004). Pilot questionnaire testing is also encouraged to avoid problems encountered after distributing the questionnaires to the public respondents. Hence, some problems can easily be curtailed, minimised, and corrected at the pilot study stage, which may be difficult to rectify once the public has responded to the questionnaires. This is why pilot studies are expected to reflect the research population.

Regarding this study, the questionnaires were administered to employees online. The online method was used because the period was COVID-19, and movement restrictions were imposed. The online link was shared with employees using a convenience sampling technique. Convenience sampling can be used, as explained by (Albert et al., 2010; Baxter et al., 2015). This was achieved by sending the link to business pages, business groups, and industry groups on Facebook and WhatsApp. After this, items not measuring the constructs were removed.

Previous studies have recommended 50 respondents for the pilot study (In, 2017). Hence, to satisfy the sample size requirements, this study used a sample size of 66 respondents in the pilot test. The collected and analysed responses helped examine if the expectations regarding those constructs were experienced. A reliability test was conducted based on the pilot study. Questions that failed to provide useful information

and contribute to the research were removed or altered based on the items—a description of the changes made after the pre-test and pilot test is presented in Appendix D & E.

The final construct items used in the questionnaire are presented in Table 4.6. constructs measurements consist of 38 items that tested six variables: shadow IT usage, strain, IT accessibility, SETA, Work Overload, and work Pressure. Each variable comprises 8, 6, 7, 8, 4, and 5 items. This is shown in Table 3.4.

Table 3.4
Items validated by Pilot Test.
Number of respondents = 66

Construct	Number of the original items	Number of validated items	Cronbach alpha
Shadow IT usage	14	8	0.897
Strain	6	6	0.865
IT Accessibility	8	7	0.87
SETA	8	8	0.923
Work overload	4	4	0.718
Work pressure	10	5	0.885

The questionnaire was prepared in English. Although Nigerians speak different languages in various geopolitical zones, English is the only language uniting Nigeria and is the official language. Moreover, all education systems are in English. Hence,

English is generally understood by all literate individuals in Nigeria. Therefore, there is no need to translate the questionnaire into various languages based on the various geo-political zones.

3.7 Data Collection Procedure

The questionnaire was prepared using the constructs measurement items and distributed using a self-administered survey. This study employed the primary data collection method to get employees' perceptions of their behaviour towards shadow IT usage. Primary data is perceived as a feasible data collection method as it interacts directly with the employees (Jenkins et al., 1995; Marcano Belisario et al., 2015). For primary data collection, the period of data collection is referred to as the field study, an essential step in empirical research. Prior studies have shown that the field study enhances communication and interaction by allowing the researcher to have direct contact with the respondents (Lindell & Whitney, 2001; Sekaran & Bougie, 2016a; Sharma & Govindaluri, 2014). The interaction with respondents also improves the efficiency of the questionnaire administration.

Self-administered surveys can be collected electronically (Marcano Belisario et al., 2015) and physically (Jenkins et al., 1995; Marcano Belisario et al., 2015). For this study, data was collected directly from employees in Nigeria. The questionnaire was initially aimed to be distributed online only due to the COVID-19 pandemic limitation on physical movement. The questionnaire was coded on Google Forms, and a link was generated. This link was distributed to social network groups, Nigerian business pages, SME groups, and industry groups using Telegram, WhatsApp, and Facebook. Also, the people network was leveraged to reach potential participants who were not within

reach (Sakpere et al., 2023; Taylor Vinters, 2020). Due to low response, the online questionnaire distribution was extended for three months, and 90 responses were received. Also, many respondents specifically requested a physical questionnaire.

In Nigeria, the structure of the systems made it difficult and impossible to implement a complete online working schedule during the lockdown period (Taylor Vinters, 2020). For example, factors like epileptic electricity supply and the high cost of internet and data made online working conditions arduous (Muomah et al., 2023; Sakpere et al., 2023; Taylor Vinters, 2020). Hence, many organisations use the Flexi-work structure, where people report physically to work, although not daily, but a few days a week, to reduce the number of people in the workplace at a given time (Taylor Vinters, 2020).

The exclusion criteria for the questionnaire is that the respondents are employees who are IT users. Traveling physically to all six regions was not feasible due to security challenges, such as increased human abduction rates, heightened during this period (Nnam et al., 2020; Verjee & Kwaja, 2021). The researcher physically went to the southwest and north-central regions. Hence, people networks, otherwise called research assistants located in the remaining four regions (southeast, northwest, and north-central regions), were employed in printing and distributing hard-copy questionnaires (Sakpere et al., 2023). Researchers have described research assistants as people who facilitate primary data collection (Khidir et al., 2016; Stevano & Deane, 2017). Hence, researchers on data collection has encouraged their usage (Stevano & Deane, 2017).

While the study employed strata sampling in accessing each geopolitical zone in Nigeria, the convenience method was used in each zone due to the constraints and practical considerations during the COVID-19 lockdown period. This method facilitated timely and efficient data collection from the strata employed (Albert et al., 2010; Baxter et al., 2015), given that the study population consisted of employed Nigerians across various industries and sectors.

Convenience sampling was deemed suitable for several reasons. In Nigeria, where logistical challenges such as poor road networks, security concerns, and limited transportation infrastructure can pose significant obstacles, convenience sampling allows researchers to gather data from readily available participants (Nnam et al., 2020; Sakpere et al., 2023; Taylor Vinters, 2020; Verjee & Kwaja, 2021). Also, safety considerations were paramount. During the data collection period, there were high rates of insecurity in many regions of Nigeria, including frequent abductions and attacks on highways. These security concerns hindered the feasibility of visiting each industry and organisation individually. Using convenience sampling in each stratum, the study could proceed without exposing the researcher and the research assistants to undue risks.

The limited research funding is another reason for choosing convenience sampling in each stratum. The researcher is self-sponsored. Given that the six geo-political zones in Nigeria are vast and far from one another, convenience sampling in each of these strata allows for less expensive data collection (Bornstein et al., 2013). With limited funding, employing more sophisticated sampling techniques may be challenging.

Convenience sampling provides a practical alternative that aligns with available resources (Etikan et al., 2016).

Moreover, since this research aims to get perspectives of various people from various locations, given budgetary constraints, convenience sampling can be a cost-effective method as it minimises travel and resource expenditures within each of the six geopolitical zones in Nigeria. In addition, convenience sampling allowed researchers to gather data from readily available participants in commercial and public spaces without the need to visit each industry individually (Etikan et al., 2016). In some cases, the study may require data from specific groups more accessible through convenience sampling. For example, since the research focuses on employees, commercial areas where organisations are concentrated were used in data collection (Etikan et al., 2016). Hence, convenience sampling can be leveraged to efficiently gather relevant data from the target population. Distribution focused on commercial areas where industries and companies are well situated, allowing the researcher to engage a diverse range of respondents. Questionnaires were distributed in public spaces, with permission obtained from organisational management to distribute them to staff members. Additionally, distribution took place in cafeterias during lunch breaks. Data from the Southwest, South-south, and Southeast were collected using this method.

Also, some research may be conducted with the support of local institutions (e.g., religious organisations and NGOs) that can facilitate access to specific participant groups, thereby justifying convenience sampling. In some of the strata, data was collected using this method. Data from North-Central, Northwest, and Northeast were collected using this method. In summary, convenience sampling was an effective and

practical choice for this study, enabling diverse and comprehensive data collection while addressing time, financial resources, and safety constraints. Thus, while using strata sampling, a convenience technique was employed in each strata.

These filled questionnaires collected from respondents in these regions were mailed to the researcher using delivery services. The time spent finalising the physical questionnaire distribution was 12 weeks. Hence, the online and physical questionnaire distribution and collection lasted six months. However, the researcher believed the whole data collection process, had it been in a normal situation, would have been completed within eight weeks. Some drawbacks experienced include the fact that people are not comfortable filling out questionnaires, insecurities in these regions, and arduous physical transportation and movement. This caused the logistics and distribution of the questionnaire to be slow, and the return of the questionnaire was epileptic (Nnam et al., 2020; Sakpere et al., 2023; Taylor Vinters, 2020; Verjee & Kwaja, 2021). The result of the questionnaire distribution is presented in Table 4.6.

Table 3.5
Questionnaire Response Based on Regions

Region	Distributed hard copy	returned hard copy	Online response	Total response
South-South	82	39	10	49
South-East	91	37	32	69
South-West	102	75	35	110
North-Central	91	35	5	40
North-East	89	39	4	43
North-West	91	35	4	39
Total	550	260	90	350

3.8 Data Analysis

The Partial Least Square Structural Equation Model (PLS-SEM) is a method that has gained acceptability in analysing deductive quantitative research (Chin, 2016; Hair et al., 2014; Henseler, 2017). Consequently, SmartPLS is the software used for PLS-SEM analysis. Consequently, it is used to analyse this research data. The motivation for choosing SmartPLS for this study is its global appeal, acceptability, and usability. Moreover, it allows researchers to examine models of the complex multivariate relationship among all variables, facilitating direct and indirect evaluations (Becker et al., 2023; Cheah et al., 2018; Shmueli et al., 2019). This relates to this study, looking at direct, indirect, and mediating relations. Hence, SmartPLS is capable of performing the analysis.

Moreover, many studies have used the PLS-SEM analysis in the behavioural, educational, information, and social sciences (Ahmed et al., 2021; Mahfuz et al., 2016; Sarstedt, Radomir, et al., 2022). Besides, since Wold created PLS, it has evolved into an easy-to-use computer program that has been simplified and requires little technical knowledge about the processes of data transformations (Becker et al., 2023; Cheah et al., 2018; Shmueli et al., 2019). The latest version is the SmartPLS4 (Chua, 2022). Hence, SmartPLS can also efficiently perform analyses such as confirmation, factor, regression, and path analysis.

In performing the data analysis, this study uses the two-step approach suggested by Anderson et al. (1988). This includes the assessment of the measurement model and the testing of the structural model. SmartPLS is effective and capable software of conducting both two steps of analysis (Cheah et al., 2018; Hair et al., 2020; Legate et

al., 2023). Also, PLS-SEM can investigate the relationships among various latent variables (Cheah et al., 2018; Hair et al., 2020; Legate et al., 2023). PLS-SEM can also analyse the complexity of models that contain mediation and moderation (Cheah et al., 2018; Hair et al., 2020; Legate et al., 2023). Since this study attempts to use mediation in the model, SmartPLS is an effective software for data analysis. Also, PLS-SEM does not require normality assumptions since survey data is rarely normally distributed (Chin, 2016; Chin et al., 2003; Leung, 2011).

Additionally, PLS modelling is well-suited for handling large and small sample sizes, making it appropriate for this study. Furthermore, it is suitable when dealing with path models that include reflective indicators and offers flexibility in handling various constructs (Becker et al., 2023; Cheah et al., 2018; Hair, 2021; Hair et al., 2020). PLS-SEM is also deemed suitable since this study is theoretically grounded and aims to make predictions (Cheah et al., 2021; Sarstedt, Hair et al., 2022; Sarstedt et al., 2022; Shmueli et al., 2019).

Moreover, PLS-SEM is effective when the researcher has the intention of analysing the causal relationship between latent variables, such as the impact of the independent variable (IV) on the dependent variable (DV) (Cheah et al., 2018; Hair et al., 2020; Legate et al., 2023). In addition, PLS-SEM can uniquely assess the measurement properties and the theoretical relation with multiple relations simultaneously (Cheah et al., 2018; Hair et al., 2020; Legate et al., 2023). Consequently, SmartPLS can measure the constructs and the direct and complex relationships among the constructs. Hence, SmartPLS was adopted as the data analysis mechanism for this study.

3.8.1 The Technique of Data Analysis

All the items measuring the constructs are reflective, and the analysis follows the format prescribed for reflective items analysis based on the suggestion of Cheah et al. (2018, 2021). Descriptive and inferential statistical methods were used for the data analysis. Descriptive data analysis describes and explains the data set, and inferential statistics is used to make inferences from the data (Cavana et al., 2001; Cheah et al., 2018; Hair et al., 2020; Kock & Hadaya, 2018; Legate et al., 2023). Upon data collection from respondents, the data was coded using microsoft excel, statistical package software for social science (SPSS) for data analysis, and smartPLS. SPSS is mentioned here because it was used to screen data. To detect data entry errors, outliers, violations of assumptions, and missing values. Additionally, SPSS was used for descriptive data, which analyses the demographic details.

Furthermore, common method bias using multicollinearity was assessed (Kock & Hadaya, 2018; MacKenzie & Podsakoff, 2012). In addition, using the SmartPls, the validity, and reliability of the data were examined (Cavana et al., 2001; Cheah et al., 2018; Hair et al., 2020; Kock & Hadaya, 2018; Legate et al., 2023).

The researcher accesses the structural model after satisfying the validity and reliability requirements. This followed the recommendation of prior scholars on testing the path coefficient, effect sizes (f^2), coefficient of determination (R^2), and predictive relevance (Q^2) (Hair, 2021; Hair et al., 2012, 2014; Sarstedt, Hair et al., 2022). This was carried out to support the hypothesis testing and investigate the relationship between the variables. The analysis results are presented in the next chapter, Chapter Four.

3.9 Chapter Summary

This chapter presented the research methodology process, explained the research population, the sampling technique, the procedures for data collection, the measurement of the construct variables, and the approach for the data analysis. The pre-test, pilot test, and survey instrument items were also explained.



CHAPTER FOUR

DATA ANALYSIS AND RESULT

4.1 Introduction

This chapter presents the analysis data result based on the output from Statistical Package for Social Sciences (SPSS) version 26 and Partial Least Square-Structural Equation Model (PLS-SEM) version 4.0 path modelling software.

4.2 An Overview of Data Analysis

The data analysis process in this study consists of three stages: preliminary analysis, descriptive analysis, and model testing. The preliminary analysis involves data coding and procedural examination of data. The second stage is the descriptive analysis. The third stage is the research model testing, representing the main data analysis phase for hypothesis testing (Magno et al., 2022; Sarstedt et al., 2023).

4.3 Response rate

An online survey and physical distribution of questionnaires were employed to gather responses. Five hundred fifty questionnaires were distributed physically, and 260 questionnaires were filled and returned. This study, having achieved a response rate of 47%, lies within the 40 – 50% threshold, as suggested by Salkind and Rainwater (2003), and is deemed sufficient. After removing five unusable questionnaires, the final count of usable physical questionnaires was 255.

As for the online survey, 90 responses were usable. Consequently, the total number of usable questionnaires amounted to 345. The responses are presented in Table 4.1.

Table 4.1
Response Rate

Response	Response Rate
The number of distributed questionnaires	550
The number of questionnaires not returned	290
The number of returned questionnaires	260
The number of unusable questionnaires	5
Online response	90
The number of usable questionnaires	345
Response rate (physical distribution)	47%
Usable response rate (physical distribution)	46%

4.4 Preliminary Analysis

Preliminary analysis is essential in multivariate analysis as it identifies potential violations of assumptions applicable to data analysis techniques (Hair et al., 2013). Moreover, conducting a thorough preliminary analysis aids in obtaining a better understanding of the collected data for subsequent analysis. This stage encompasses data coding, screening, and a procedural examination of the data. Data coding and screening are interconnected processes that are carried out in tandem.

4.4.1 Data Coding and Screening

Data coding serves as the initial step in the preliminary analysis conducted by this study. Usable questionnaires were coded into a microsoft excel sheet prior to data

screening. Physical questionnaires underwent meticulous manual review and were assigned corresponding numerical identifiers. Invalid questionnaires were excluded from further analysis. Subsequently, the collected data was entered into microsoft excel.

From the opinion of Churchill (1999), data coding can be categorised into two. The first category of data coding assumes that each variable should have a unique coding (variable coding). The second category of coding is item identification (Item coding). Since every variable should have its own distinct set of questions below it, the items used should tally with the construct being investigated. This would ensure a hitch-free analysis. In this sense, this study follows Churchill's suggestion (1999) by arranging the items in conformity with the variables. The variables and the coded values are presented in Table 4.2.

Table 4.2
Data Coding

Variable	Function	Variable Coding	Item Coding
Shadow IT usage	DV	SIT	SIT
Strain	MV	Strain	CS
IT Accessibility	IV	ITA	IT
Work Overload	IV	WL	WL
Work Pressure	IV	WP	WP

Note: DV = Dependent Variable, MV = Mediating Variable, IV = Independent Variable, SIT = Shadow IT usage, CS = strain, ITA / IT = IT Accessibility, SETA = Security Education, Training and Awareness, WL = Work Overload, WP = Work pressure.

Furthermore, a crosscheck and comparison were performed between the Excel data and the physical questionnaires to rectify discrepancies. For online questionnaires, the data was initially extracted and downloaded into Excel. The researcher ensured

accuracy in these data points as respondents were required to answer each question before proceeding to the next. Each item was assigned a specific code aligned with the physical data coding, as presented in Table 4.2.

The subsequent step involved combining the data from physical questionnaires and online responses to ensure accurate coding and numerical identifiers merging. Data screening encompasses data cleaning and preparation. It entails eliminating incomplete data, resolving ambiguities, and rectifying response errors. This stage involves reviewing questionnaires for accuracy and completeness, assigning unique codes to differentiate between individual items, and entering the data for analysis (Kinnear & Taylor, 1996). Data screening aims to validate the accuracy of imputed data by ensuring that it does not generate distorted correlations. This study ensures the integrity and reliability of the subsequent data analysis process by conducting a preliminary analysis and data screening.

4.4.2 Procedural Examination of Data

The primary objective of the procedural examination is to ensure the accuracy and integrity of the data by addressing potential issues such as missing values and outliers (Schafer & Graham, 2002; Tabachnick & Fidell, 2007)

4.4.2.1 Missing Values Report

The usable questionnaires were coded into the SPSS data set for procedural examination. The first step involves checking for missing values. Missing values refer to information absent in returned questionnaires, where respondents choose to avoid or ignore answering specific questions while responding to the remaining questions

(Schafer & Graham, 2002). The presence of missing values can have a detrimental impact on the validity of the results. To address missing values, in cases where respondents have wholly ignored a question, options include calculating the mean and inserting the mean value in the missing cell or excluding the questionnaire with missing values.

Scholars such as Tabachnick and Fidell (2007) and Schafer and Graham (2002) argue that missing values can be considered negligible if they account for less than 5% of the data, ensuring valid statistical inference. In the data set developed for this study, the missing value percentage is below 5%, indicating adequacy for valid statistical inference (Schafer & Graham, 2002). The statistics table displayed the missing values in each item as zero. The result showing no missing number is presented in Appendix I. Analysis was continued by assessing the outliers.

4.4.2.2 Assessment of Outliers

Outliers are observations that appear inconsistent with the rest of the data (Field, 2009). They represent unique and extreme characteristics that deviate from other responses. In regression-based analyses, outliers can distort estimation and lead to inaccurate, unreliable, and distorted results (Field, 2009). Detection of outliers using the multivariate method has gained favour due to its efficacy in employing a predetermined threshold to determine whether a data point could be categorised as outlier (Leys et al., 2018). Hence, this study used a multivariate method of outlier detection based on the Mahalanobis distance (Nor, 2015). The cases with p-values close to 1 are assumed to have reasonable Mahalanobis distance. In contrast, cases with

p-values close to 0 are assumed to be outliers. The description of the multivariate outlier detection is presented in Appendix J.

To evaluate the influence of outliers on the model parameters, there are recommendations for treating outliers, such as deleting or transforming the cases (Field, 2009). Before deleting the outliers, this study executed regression analyses under two conditions: one including outliers and the other excluding them. The findings from these analyses demonstrated that outliers did not exert a substantial impact on the outcomes of the study. The detailed results, with and without outliers, are presented in Table 4.3. Consequently, all potential outliers were retained in the analysis, resulting in 345 cases, and the analysis proceeded to the next stage, which is the descriptive analysis. All the outlier cases are presented in Appendix K.

Table 4.3
Regression With and Without Outliers

Regression	without outliers			With outliers		
	T-value	P-value	Result	T-value	P-value	Result
Strain ->SIT	7.777	0.000	Significant	7.846	0.000	Significant
ITA ->SIT	-3.092	0.002	significant	-3.122	0.002	significant
SETA ->SIT	-1.257	0.210	Not significant	-1.270	0.205	Not significant
WL ->SIT	3.141	0.000	significant	3.173	0.002	significant
WP->SIT	2.403	0.017	significant	2.422	0.016	significant

4.5 Descriptive Statistics

Descriptive data analysis describes the dataset distribution based on the respondent's demographic information. The profiles of respondents were examined in this section. This includes the gender, age, academic qualification, geo-political zone, and sector of respondents.

4.5.1 Profile of Respondents

The demographic profile includes gender, age, academic qualification, and organisation type. This demographic information is found in Table 4.4.

Table 4.4
Demographic profiles of the respondents

Demographic item		Frequency (F)	Percentage (%)
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	19	5.5
	First-degree and equivalent	168	48.7
	Masters	65	18.8
	Doctoral	5	1.4
	Total	345	100.0
Geo-Political Zone	SS	44	12.8
	SE	69	20.0
	SW	110	31.9
	NC	40	11.6
	NE	43	12.5

Demographic item		Frequency (F)	Percentage (%)
	NW	39	11.3
	Total	345	100.0
Sectors			
Public sector	Academics	26	7.53
	Health	16	4.63
	Others public sectors	8	2.23
	Total	50	14.5
Private sector	SMEs	156	45.21
	Corporation	51	14.78
	Total	207	60
NGO	Social workers	75	21.73
	Other NGO workers	9	2.6
	Total	84	24.34
Other sectors		5	1.45
Total		345	100

The demographic analysis of the respondents reveals that the gender distribution is 51% male and 49% female. Most respondents fall within the age range of 25-55 years, making up 61.7% of the population. Among them, 40% hold bachelor's degrees, and 18.8% hold master's degrees, while 13.6% are nearing retirement age (55-65 years) and 9.6% are over 65. Interestingly, only 1.4% of the respondents hold a doctoral degree, indicating a relatively low percentage of highly educated individuals in the sample.

Regarding the geographic location of the respondents, the South-West region has the highest representation at nearly 32%, followed by the South-East (20%) and South-South (12.8%) regions. The Northern regions (North-Central et al.) comprise 35.4% of the sample. This is consistent with the NBS report on the Southwest being the highest employed region (Ajani & Oyekola, 2019; Guven-Lisaniler et al., 2018; National Bureau of Statistics, 2020; SMEDAN/NBS, 2017b).

The private sector emerges as the highest employment representation among the respondents, with a significant 60% representation among respondents. Following closely, the Non-Governmental Organisation (NGO) sector constitutes a noteworthy 24.3% of the surveyed individuals. Astonishingly, the combined total of the private sector and NGO employees reaches 84.34%, in line with the National Bureau of Statistics report on approximately 84% of the employed population working in the non-public sectors (Ajani & Oyekola, 2019; Guven-Lisaniler et al., 2018; National Bureau of Statistics, 2020; SMEDAN/NBS, 2017).

Contrasting the private and NGO sectors, the public sector holds 14.5% of the respondents. Prior studies have explained the reason for the limited number of employees in the public sector. One reason is the limited job availability in the public sector, and another is the income structure disparities that contribute to the private sector's prominence (Ajani & Oyekola, 2019; Guven-Lisaniler et al., 2018). Within the public sector, academics account for 7.53%, health sector employees constitute nearly 5%, and those in other sectors contribute 2.23%. This shows that in the public sector, a significant percentage of the employees falls within the academic and health

sector, which also aligns with the NBS statistics on public sector employment classification in Nigeria (Ajani & Oyekola, 2019; Guven-Lisaniler et al., 2018; National Bureau of Statistics, 2020; SMEDAN/NBS, 2017). Therefore, this sectoral breakdown is consistent with the overview of the employment distribution of this study's population.

4.6 Common Method Bias (CMB)

Common method bias refers to biases introduced in a dataset due to external factors, which must be conducted on single source data (Kock & Lynn, 2012). Single source data refers to data where the dependent and the independent constructs were collected from the same respondents. Single-source data is particularly susceptible to social desirability and coherence biases and can be assessed using the full collinearity test (Kock & Hadaya, 2018b; MacKenzie & Podsakoff, 2012). CMB was assessed using a full collinearity test for this research since the data was collected from a single source (employees).

This research tested full collinearity by regressing all the constructs against a random common variable generated for the 345 cases using a Microsoft Excel sheet. The random number was copied as a column of the data. SmartPLS regressed all six variables on the Random variable serving as a DV. The Variance inflation factor (VIF) was established by clicking the PLS Algorithm and Calculate. VIF value equal to or below 3.3 suggests the absence of common method bias, while values greater than 3.3 indicate its presence. The VIF for all constructs yielded values less than 3.3, which indicates that single-source bias is not an issue with the data. The VIFs for all the items

are presented in Appendix L. The VIF values for the constructs are presented in Table 4.5.

Table 4.5
Variance inflation factors (VIF)

Construct	VIF
SIT	1.718
Strain	1.633
ITA	1.014
SETA	2.286
WL	1.609
WP	2.481

Note: SIT = Shadow IT usage, ITA = IT Accessibility, SETA = Security Education, Training and Awareness, WL = Work Overload, WP = Work pressure.

2.13 Research Model Testing/ Main Analysis

The model testing results determine how well the data justifies the research theory. The model evaluation for this research followed the two-step approach recommended by Anderson and Gerbing (1988). This includes the (i) measurement model and (ii) structural model. Prior studies on data analysis have also prescribed this two-step approach for data analysis (Cheah et al., 2018; Hair et al., 2021).

4.6.1 Measurement Model

The measurement model assesses the validity and reliability of the constructs. Since all the items used for this analysis are reflective, this research is assessed based on the evaluation of (i) internal consistency reliability, (ii) convergent validity, and (iii) discriminant validity. Before assessing the measurement model, the results of all the item loadings are presented in Table 5.7. This shows each item's outer loadings, T-value, P-value, and VIF.

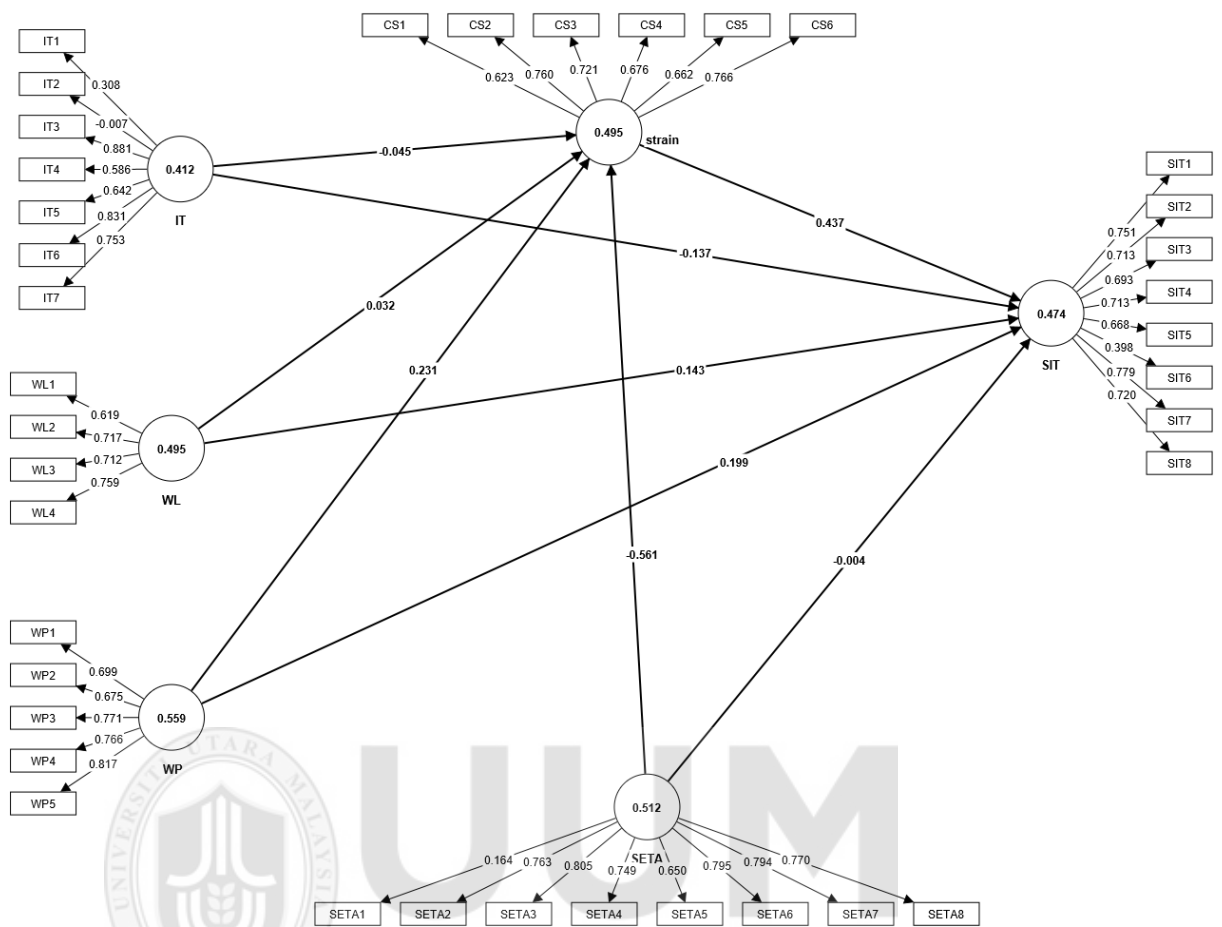


Figure 4.1
All Items loading before measurement model analysis.

Outer model: outer loading and T-value; Construct: average variance extracted (AVE)

Table 4.6
Item loading, T value, P-value, and VIF

Item	Outer loading	T values	P values	VIF
CS1	0.623	14.114	0.000	1.378
CS2	0.76	24.279	0.000	1.636
CS3	0.721	16.24	0.000	1.851
CS4	0.676	15.731	0.000	1.388
CS5	0.662	11.827	0.000	1.539
CS6	0.766	19.418	0.000	1.882
IT1	0.308	2.145	0.016	1.14
IT2	-0.007	0.039	0.485	1.38
IT3	0.881	7.428	0.000	3.045
IT4	0.586	3.372	0.000	2.02
IT5	0.642	3.704	0.000	2.392
IT6	0.831	7.133	0.000	2.655

Item	Outer loading	T values	P values	VIF
IT7	0.753	6.572	0.000	1.367
SETA1	0.164	2.550	0.005	1.028
SETA2	0.763	22.112	0.000	1.939
SETA3	0.805	30.694	0.000	2.455
SETA4	0.749	20.79	0.000	2.07
SETA5	0.650	9.742	0.000	1.647
SETA6	0.795	28.851	0.000	2.228
SETA7	0.794	27.534	0.000	2.13
SETA8	0.77	20.172	0.000	1.992
SIT1	0.751	17.378	0.000	1.947
SIT2	0.713	17.091	0.000	1.898
SIT3	0.693	11.854	0.000	1.63
SIT4	0.713	13.021	0.000	1.744
SIT5	0.668	11.583	0.000	1.699
SIT6	0.398	5.241	0.000	1.086
SIT7	0.779	21.59	0.000	2.261
SIT8	0.72	15.965	0.000	1.799
WL1	0.619	10.519	0.000	1.104
WL2	0.717	10.316	0.000	1.528
WL3	0.712	9.622	0.000	1.605
WL4	0.759	16.20	0.000	1.421
WP1	0.699	11.88	0.000	1.722
WP2	0.675	10.554	0.000	1.659
WP3	0.771	25.063	0.000	1.603
WP4	0.766	22.262	0.000	1.605
WP5	0.817	29.47	0.000	1.791

4.6.1.1 Internal Consistency Reliability

The internal consistency reliability of this data reflects the homogeneity of the construct's items, and it was evaluated by assessing the composite reliability. Composite reliability is efficient in assessing a PLS model due to its ability to prioritise the indicator loadings during the estimation of the model based on their reliability. Also, composite reliability does not assume- that all the indicator loadings have equal values in the population. Composite reliability (CR) can also accommodate differences in the indicator's reliability, which helps it avoid underestimation.

Hair et al. (2021) suggested that an item loading that exceeds 0.7 indicates high internal consistency reliability, while an indicator below 0.40 may be eliminated. Eliminating an item is recommended if the elimination aims to increase the composite reliability to above 0.708 and the content validity is unaffected. For IT accessibility, IT2 was deleted due to low loading and also to achieve a composite reliability of >0.70 . SETA1 (0.164) was also deleted due to low loading. After this deletion, all the constructs have CR greater than 0.7. Hence, no other item was deleted to validate the internal consistency reliability.

4.6.1.2 Convergent validity

The validity assessment has two dimensions: the first is convergent validity, and the second is discriminant validity. Convergent validity is the degree to which “a measure correlates positively with alternative measures of the same construct” (Hair et al., 2014, p.102), denoting a similar underlying construct (Henseler, 2017). Convergent validity for this study is measured using the average extracted (AVE). In the convergent validity, the item measuring the AVE value of 0.50 means that the latent variable explains a minimum of half of the particular indicator. Fornell and Lacker (1981) recommended that an AVE of 0.5 and above is a sufficient indicator and meets the criterion for assessing convergent reliability.

When conducting structural equation modeling, researchers recommend deleting some items that do not perform well (Awang, 2015; Cheah et al., 2016; Hair et al., 2019), for instance, due to low loadings and high cross-loadings. Generally, the researchers recommend not deleting more than 20% of the items as it may compromise the integrity and validity of the constructs. Based on this justification, to establish the

validity of this research, some items were deleted to establish an acceptable convergent validity and discriminant validity. To achieve an AVE of >0.5 , WL1 was deleted. CS1 was deleted to achieve a convergent validity of AVE >0.5 for Strain, and SIT6 was deleted to validate the AVE for SIT. In all, three items were deleted to ensure the convergent reliability of all constructs. To achieve a discriminant value, WP3 and WP4 were deleted. Overall, seven items were deleted from the 38 items. This was less than the allowable threshold of 20%. Hence, this justifies proceeding to the next stage of research. Although IT1 loading was slightly <0.4 , it was not deleted because the reliability and validity of the IT accessibility construct had been established.

4.6.1.3 Discriminant Validity

Discriminant validity is the “extent to which a construct is truly distinct from other constructs by empirical standards” (Hair et al., 2014, p. 104). Cross loadings and HTMT may be employed to measure discriminant validity (Memon & Rahman, 2014). The cross-loading shows that the items of each construct perfectly load under the corresponding construct. This is presented in Table 5.6. The result implies that discriminant validity is achieved.

The Heterotrait-Monotrait (HTMT) criterion is the measure of discriminant validity. The HTMT criterion is the ratio of correlations within the construct to correlations between the constructs. Gold Malhotra & Segars (2001) suggested an HTMT value of 0.90 as a discriminant validity problem. All the HTMT values of this study are less than 0.90, as presented in Table 4.7.

Table 4.7
Discriminant Validity (HTMT)

	SIT	Strain	ITA	SETA	WL	WP
1. Shadow IT usage						
2. Strain	0.786					
3. IT Accessibility	0.210	0.195				
4. SETA	0.647	0.844	0.116			
5. Work Overload	0.571	0.547	0.108	0.566		
6. Work Pressure	0.638	0.666	0.101	0.832	0.875	

Note: SIT = Shadow IT usage, ITA = IT Accessibility, SETA = Security Education, Training and Awareness, WL = Work Overload, WP = Work pressure.

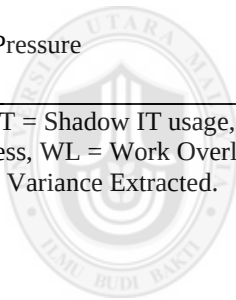
After assessing the measurement model, the result is presented in Table 4.8. Based on the result, which shows that the reliability and validity of the model has been confirmed, this study continued the assessment of the structural model.

Table 4.8
Measurement Model result used for Structural Model Assessment

Construct	Items	Loading	CR	AVE
Shadow IT usage	SIT1	0.77	0.856	0.533
	SIT2	0.725		
	SIT3	0.694		
	SIT4	0.717		
	SIT5	0.668		
	SIT7	0.802		
	SIT8	0.726		
Strain	CS2	0.764	0.795	0.548
	CS3	0.786		
	CS4	0.658		
	CS5	0.697		
	CS6	0.785		
IT Accessibility	IT1	0.313	0.879	0.502
	IT3	0.863		
	IT4	0.644		

Construct	Items	Loading	CR	AVE
SETA	IT5	0.701	0.881	0.584
	IT6	0.84		
	IT7	0.746		
	SETA2	0.76		
	SETA3	0.806		
	SETA4	0.746		
	SETA5	0.66		
	SETA6	0.798		
Work Overload	SETA7	0.795	0.732	0.65
	SETA8	0.772		
	WL2	0.821		
	WL3	0.835		
Work Pressure	WL4	0.761	0.817	0.656
	WP1	0.803		
	WP2	0.798		
	WP5	0.828		

Note: SIT = Shadow IT usage, IT = IT Accessibility, SETA = Security Education, Training and Awareness, WL = Work Overload, WP = Work pressure, CR = Composite Reliability, AVE = Average Variance Extracted.



Universiti Utara Malaysia

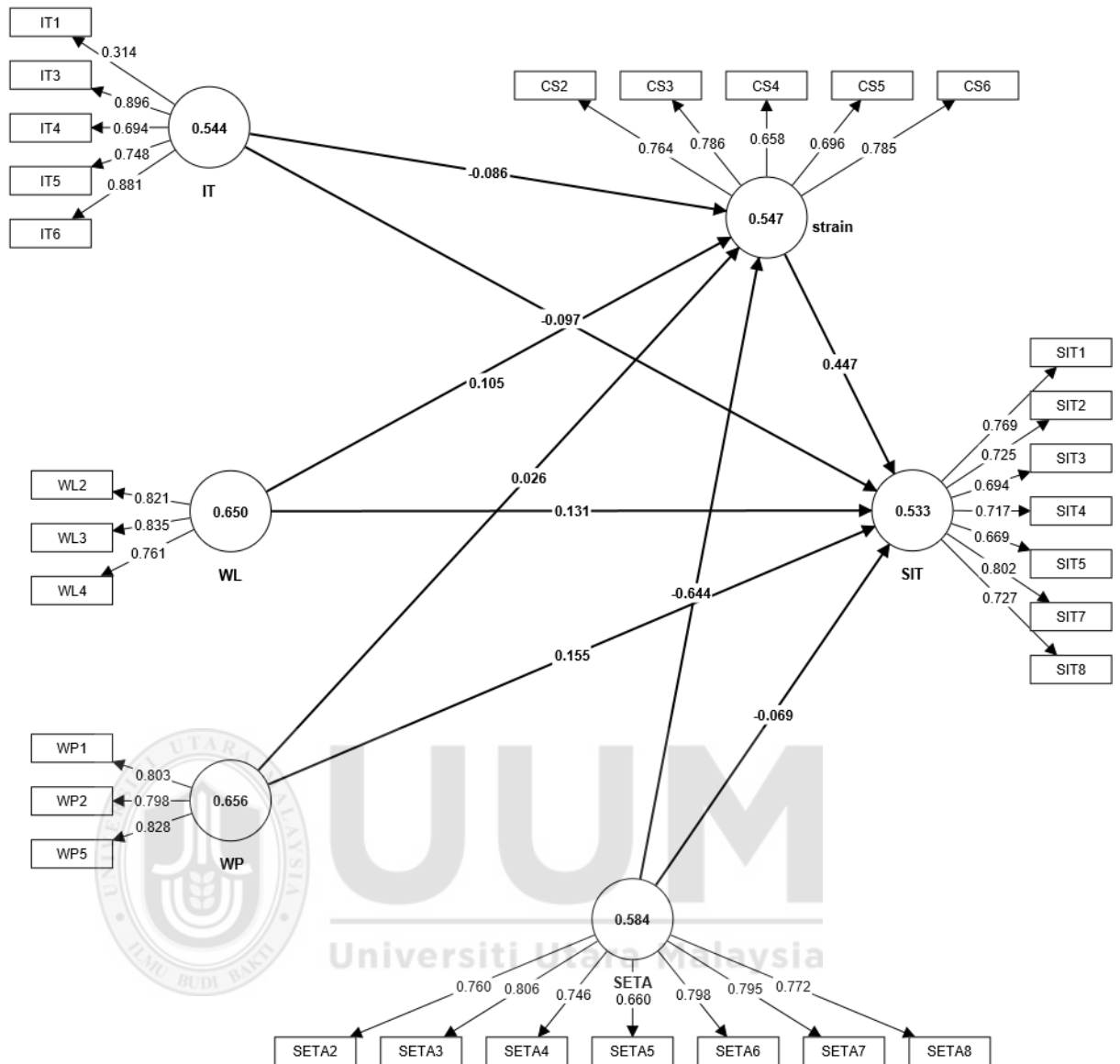


Figure 4.2
Result of the Measurement Model Assessment

Outer model: outer weights/loadings; Inner model: path coefficient; Construct: AVE

Note: SIT = Shadow IT usage, IT = IT Accessibility, SETA = Security Education, Training and Awareness, WL = Work Overload, WP = Work pressure, CR = Composite Reliability, AVE = Average Variance Extracted.

4.6.2 Assessment of Structural Model

After establishing the model's reliability and validity, the next step is assessing the structural model. The structural model is assessed to confirm the theoretical model of

this study. There is a need to determine the significance of the construct relationships and the relevance of the coefficient in the structural model (Hair, 2021; Hair et al., 2012, 2014; Sarstedt, Hair et al., 2022). There is also the need to clarify the independent and dependent variables. The independent variables (IV) are the predictor variables which predict the dependent variables (DV). For this research, the IVs that predict shadow IT usage (DV) are strain, IT accessibility, SETA, work overload, and work pressure. The IVs that predict strain are IT accessibility, SETA, work overload, and work pressure.

In assessing the significance of the construct relationships, applying bootstrapping routine and examining t and p values are considered. Moreover, the relative sizes of the path coefficient are compared, and the total effects, f^2 effect sizes, and Q^2 are also considered to enhance the result interpretation. In addition, the key constructs are relevant to explaining the endogenous latent variables (dependent variable) of shadow IT usage (SIT). According to Hair et al. (2014), five steps are proposed as the procedure of structural model assessment. These steps are (i) the coefficient of determination (R^2), (ii) the assessment of collinearity, (iii) the effect size (f^2), (iv) the predictive relevance (Q^2), (v) the determination of the path co-efficient (β). The collinearity assessment has already been explained.

4.6.2.1 Assessment of Effect Size (F^2)

the f^2 shows the practical contribution effect of each predictor variable (independent variable) to the dependent construct. Cohen (1988) suggested f^2 effect size estimation of > 0.02 = small effect, > 0.15 = medium, and > 0.35 = large effect. The result of this

study presents the evaluation of the predictor variables on the endogenous variables (Shadow IT usage and strain).

For shadow IT usage, the effect size of strain is f^2 (0.187), indicating a medium effect. f^2 of IT accessibility is 0.018, which indicates a small effect. The f^2 of SETA is 0.003, which indicates a small effect. The f^2 effect of work overload is 0.02, which indicates a small effect. The f^2 effect of work pressure is 0.019, indicating a small effect. The f^2 result of this study shows that strain (f^2 0.187) has the most significant practical contribution to shadow IT usage, which is a medium effect. The remaining predictors (IT accessibility, SETA, work pressure, and work overload) each contribute a small contribution to shadow IT usage.

For strain, the f^2 of the predictor variables (IT accessibility, SETA, work overload, and work pressure) were also assessed. IT accessibility has the f^2 of 0.016, which reflects a small effect. SETA f^2 0.444 indicates a large effect. The f^2 of work overload is 0.015, which shows a small effect. For work pressure, the f^2 is 0.005, indicating a small effect. The f^2 effect result shows that while SETA has a medium effect contribution to strain, the rest of the predictors each have a small effect contribution to strain. The f^2 effect sizes for this analysis are presented in Table 5.11.

4.6.2.2 Assessment of the Predictive Relevance (Q^2)

Predictive relevance is an indicator that determines how well the variables predict the model. It also reveals if the construct is well constructed. It is used to support the result of the coefficient of determination (R^2). Q^2 predicts the indicators' points in the dependent variable's reflective measurement model. Hence, it is assessed using the

endogenous construct. For this study, the Q^2 was assessed using PLSPredict. The benchmark for the evaluation of the Q^2 is the value of Q^2 should be > 0 . Whereas f^2 assesses the independent variables (IV), Q^2 assesses the dependent variable (DV).

This study's analysis shows that Q^2 of shadow IT usage is 0.359. This indicates that the factors examined as the IV (predictors) of shadow IT usage (strain, IT accessibility, SETA, work overload and work pressure) predicted shadow IT usage by 35.9%.

In relation, the Q^2 for strain is 0.507. This indicates that the predictors (IT accessibility, SETA, work overload and work pressure) could predict strain by 50.7%. The result is presented in Table 4.9.

Table 4.9

The predictive relevance (Q^2)

Construct	Q^2_{predict}
SIT	0.359
Strain	0.507

Note: SIT = Shadow IT usage.

4.6.2.3 Assessment of coefficient of Determination in the structural model (R^2)

The bootstrapping resampling technique was applied in this analysis (Preacher & Hayes, 2008; Shrout & Bolger, 2002). Bootstrapping creates subsamples from randomly selected data from the original data with replacement. 10,000 subsamples were used to estimate the path coefficient (beta), loadings, and other parameter estimates. Furthermore, bootstrapping provides a standard error. This allows the t-values to be calculated based on the standard errors.

According to Blackwell (2010), R^2 is a static measurement used to measure the research's model goodness of fit and how significantly the fitted line slope differs from zero. The purpose of evaluating the R^2 in a research model is to evaluate the percentage variance between the dependent variables and the independent variable (Henseler & Chin, 2010).

In this research, the R^2 reveals the variance explained by the (1) IVs to shadow IT usage and (2) IVs to strain in the structural model (Chin, 2016; Hair et al., 2020). The result is presented in Table 4.10.

Table 4.10
Coefficient of Determination (R^2)

Construct	R^2
SIT	0.49
Strain	0.53

Note: SIT = Shadow IT usage.

The R^2 effect of the five predictors examined by this study (strain, IT accessibility, work overland, and work pressure) on the dependent construct (Shadow IT usage) indicates the variance explained of shadow IT usage to be 0.480. This reveals that these predictors explained 49% of the variance of shadow IT usage. For strain, the R^2 0.53 reveals that the predictors (IT accessibility, work overland, and work pressure) explained 53% of the strain variance.

4.7 Direct-Effects Hypothesis

For this research, the contribution of each of the independent variables manifests by the path coefficient (beta values or β), T values (t), and P values (p), as suggested by Chin (2016). The p-value should equal or less than 0.05 for a hypothesis to be accepted.

The result is presented in Figure 4.3.

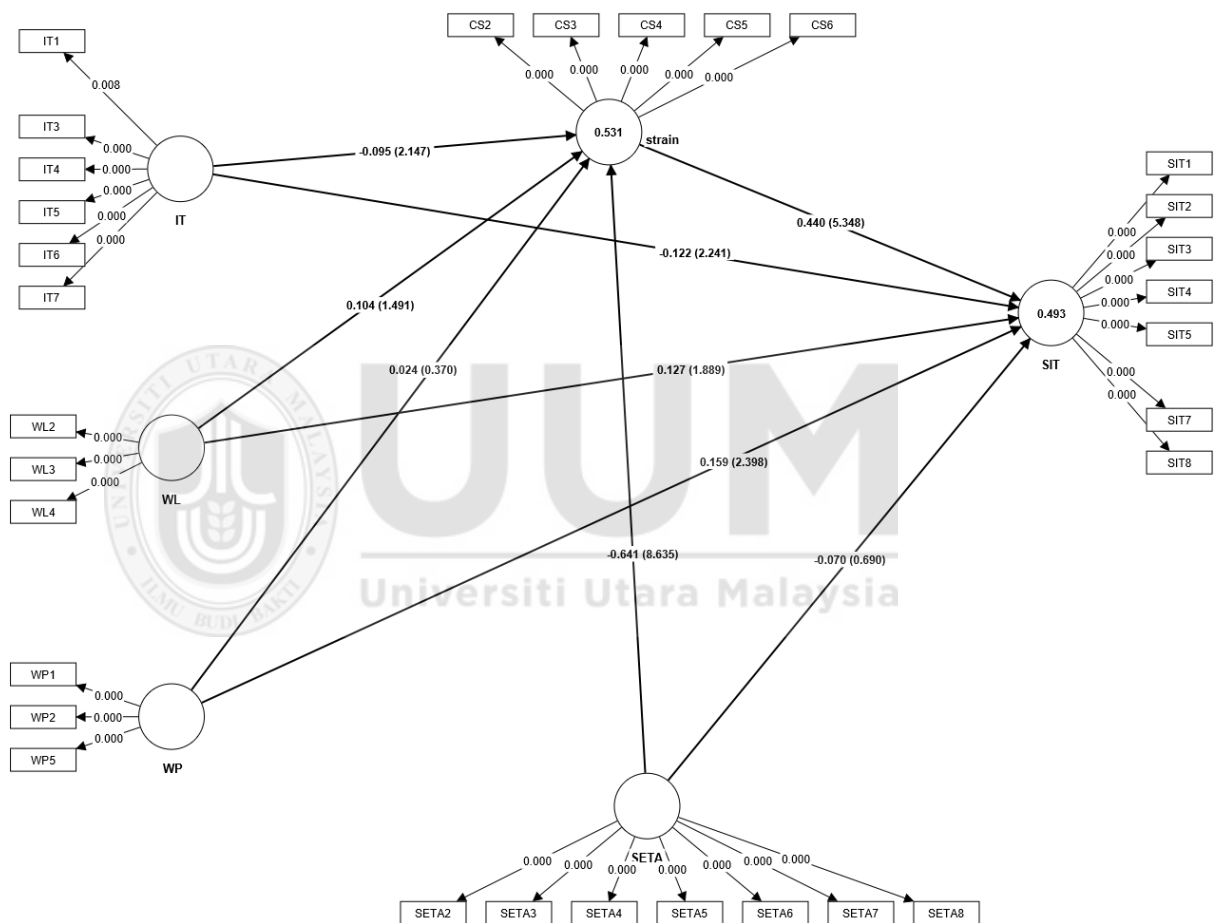


Figure 4.3
Result of the Structural Model

Inner model: Path coefficient and t-values; outer model: P-value; Construct: R-square

Note: SIT = Shadow IT usage, IT = IT Accessibility, SITA = Security Education, Training and Awareness, WL = Work Overload, WP = Work pressure, CR = Composite Reliability, AVE = Average Variance Extracted.

The first hypothesis in this research posits a significant relationship between strain and shadow IT usage. The result reveals a significant relationship between strain and shadow IT usage ($\beta = 0.440$; $t = 5.348$; $p < 0.01$). The direction reveals that strain is positively related to Shadow IT usage. Thus, H1 was supported. This indicates that strain is a significant predictor of shadow IT usage. When strained, employees tend to use shadow IT.

The second hypothesis in this research posits a significant relationship between IT accessibility and shadow IT usage. The result reveals a significant negative relationship between IT accessibility and shadow IT usage ($\beta = -0.095$; $t = 2.147$; $p < 0.05$). This result indicates that IT accessibility is negatively related to shadow IT usage. Thus, H2 was supported.

The third hypothesis posits a significant relationship between SETA and shadow IT usage. The result reveals an insignificant relationship between SETA and shadow IT usage ($\beta = -0.070$; $t = 0.69$; $p > 0.05$). This indicates that SETA is not statistically related to shadow IT usage. Thus, H3 is not supported.

The fourth hypothesis posits a significant relationship between work overload and shadow IT usage. The result reveals a significant relationship between work and shadow IT usage ($\beta = 0.127$; $t = 1.889$; $p < 0.05$). The direction reveals that work overload is positively related to Shadow IT usage. Hence, H4 is supported.

The fifth hypothesis posits a significant relationship between work pressure and shadow IT usage. The result reveals a significant relationship between work pressure

and shadow IT usage ($\beta = 0.159$; $t = 2.398$; $p < 0.01$). The direction reveals that work pressure is positively related to Shadow IT usage. Thus, H5 is supported. This result is presented in Table 4.11.

Table 4.11

The direct relationship between Strain, IT accessibility, SETA, WL, and WP on SIT

Hypothesis	Relationship	path coefficient t	Standard Deviation	t-values	p-values	f^2	Decision
H1	Strain ->SIT	0.437	0.082	5.348	0.005	0.183	Supported
H2	ITA ->SIT	-0.125	0.055	2.241	0.013	0.018	Supported
H3	SETA ->SIT	-0.065	0.102	0.69	0.245	0.003	Not Supported
H4	WL ->SIT	0.129	0.067	1.889	0.029	0.020	Supported
H5	WP ->SIT	0.155	0.099	2.308	0.011	0.019	supported

Note: significant at <0.05 (5% level).

Path coefficient = standard beta (β), SIT = Shadow IT usage, ITA = IT Accessibility, SETA = Security Education, Training and Awareness, WL = Work Overload, WP = Work pressure.

Next is the assessment of the predictive relevance of strain. The predictors of strain examined by this study are IT accessibility, work overland, and work pressure. The R^2 indicates the variance explained of strain is 0.53. This result reveals that these predictors explained 53% of the strain variance.

The sixth hypothesis in this research posits a significant relationship between IT accessibility and strain. the result reveals the existence of a significant relationship ($\beta = -0.091$; $t = 2.147$; $p < 0.05$). The direction reveals that IT accessibility is negatively related to strain. Thus, H6 was supported.

The seventh hypothesis in this research posits a significant relationship between SETA and strain. the result reveals the existence of a significant relationship ($\beta = -0.641$; t

=8.635; $p < 0.01$). The direction indicates that SETA is negatively related to strain. Thus, H7 is supported.

The eighth hypothesis posits a significant relationship between work overload and shadow IT usage. the result reveals an insignificant relationship ($\beta = 0.104$; $t = 1.491$ $p > 0.05$). Hence, H8 is not supported. Hypothesis nine posits a significant relationship between work pressure and strain. the results reveals an insignificant relationship ($\beta = 0.024$; $t = 0.37$; $p > 0.05$). Thus, H9 is not supported. This result is presented in Table 4.12.

Table 4.12

The direct relationship between IT, SETA, WL and WP, and Strain

Hypothesis	Relationship	Path coefficient	Standard Deviation	T statistics	P values	f^2	Decision
H6	ITA -> Strain	-0.095	0.044	2.147	0.016	0.016	Support
H7	SETA -> Strain	-0.641	0.074	8.635	0	0.444	Support
H8	WL -> Strain	0.104	0.069	1.491	0.068	0.015	NS
H9	WP -> Strain	0.024	0.065	0.37	0.356	0.000	NS

Note: significant at < 0.05 (5% level). ITA = IT Accessibility, SETA = Security Education, Training and Awareness, WL = Work Overload, WP = Work pressure, NS = Not Supported.

The result of the direct hypotheses for this study showed that four predictors are statistically significant in shadowing IT (strain, IT accessibility, work overload, and work pressure). In contrast, one predictor (SETA) does not predict shadow IT usage. This result is consistent with the f^2 , which shows that SETA does not affect Shadow IT usage.

In addition, the hypotheses indicating the direct relationship between the dependent variables and strain reveals that two predictors are significant (IT accessibility and SETA). In comparison, two predictors are insignificant (work overload and work pressure).

Moreover, while strain recorded the highest significant contribution to employee shadow IT usage, SETA has no statistically established relationship with shadow IT usage. However, its relationship with strain is the most significant predictor among the constructs.

4.8 Mediating Effects Analysis

The study extends the analysis beyond the direct effect analysis to examine the indirect effects. The indirect effect is when an intervening variable (Mediator) transmits the relationship between an exogenous (IV) and endogenous variable (DV). This analysis was performed by bootstrapping according to the suggestion of Preachers and Hayes (2004). The result was used to assess the mediating hypotheses (Hypotheses 10, 11, 12 and 13).

The tenth hypothesis of this study posits a significant mediating impact of strain on the relationship between IT accessibility and shadow IT usage. the result indicates a significant relationship ($\beta = -0.042$; $t = 1.925$; $p < 0.05$). Thus, hypothesis H10 is supported. The mediation effect is partial.

The result of the eleventh hypothesis reveals that the mediating impact of strain on the relationship between SETA and shadow IT usage is significant ($\beta = -0.282$; $t = 4.251$; $p < 0.01$). Thus, H11 is supported. The mediation effect is partial.

The twelfth hypothesis result showed that the mediating impact of strain on the relationship between work overload and strain is an insignificant relationship ($\beta = 0.046$; $t = 1.472$; $p > 0.05$). Thus, H12 is not supported.

The result of the final hypothesis, H13, indicates an insignificant mediating impact of strain on the relationship between work pressure and shadow IT usage ($\beta = 0.011$; $t = 0.363$; $p > 0.05$). Thus, the hypothesis H13 was not supported. This indirect relationship is presented in Table 4.13.

Table 4.13

Indirect effect of strain

Hypothesis	Relationship	Path Coefficient	Standard deviation	T statistics	P values	Decision
H10	IT -> Strain -> SIT	-0.042	0.022	1.925	0.027	Supported
H11	SETA -> Strain -> SIT	-0.282	0.066	4.251	0	Supported
H12	WL -> Strain -> SIT	0.046	0.031	1.472	0.071	Not Supported
H13	WP -> Strain -> SIT	0.011	0.029	0.363	0.358	Not Supported

Note: significant at <0.05 (5% level). SIT = Shadow IT usage, ITA = IT Accessibility, SETA = Security Education, Training, and Awareness, WL = Work Overload, WP = Work pressure.

Two of the four hypotheses developed for the mediating effect of strain were significant (IT accessibility and SETA). However, the mediation effects for these two significant relationships were partial, while the two were insignificant (work overload

and work pressure). Interestingly, although the direct relationship between SETA and SIT was not significant, the relationship was significant through the mediating effect of strain. Hence, the mediating effect of strain on the relationship between SETA and SIT was established. The result of the proposed study is presented in Figure 4.4.

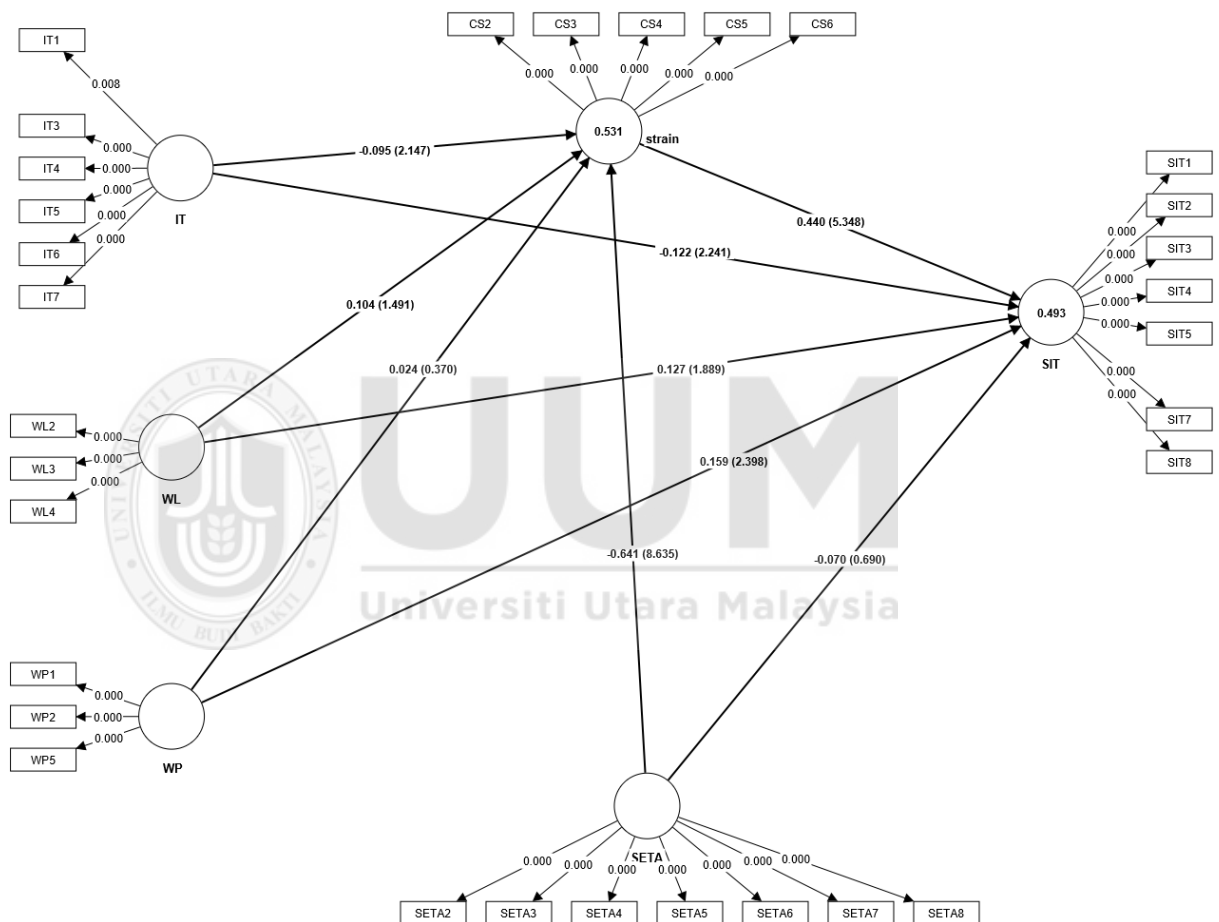


Figure 4.4

Result of the Proposed Model

Note: ** = $p < 0.01$; * = $p < 0.05$.

SETA = Security education, training and awareness; WL = Work overload; WP = Work pressure; SIT = Shadow IT usage.

4.9 Chapter Summary

This chapter focuses on data analysis and is divided into three sections. The first is the preliminary data analysis. This preliminary section is essential to the data analysis as it prepares the data to meet the basic requirements for the PLS-SEM evaluation. This includes data cleaning and screening activities, outliers, and missing values detection.

The second is the descriptive analysis, and the third is the two steps of PLS-SEM evaluation, which include the measurement and the structural model evaluation. Measurement models include data reliability and validity. The structural model evaluation tested the hypotheses developed for this study. The next chapter, Chapter Six, focuses on the discussion about the result, the implication of findings, the limitations of this study, and recommendations for future study.



CHAPTER FIVE

DISCUSSIONS

5.1 Introduction

This chapter discusses the result as it relates to the research objectives and questions, the literature review, and the study hypotheses. This chapter comprises six sections. This first section introduces the chapter. The second section provides an overview of this research. The third section discusses the results and hypotheses, as presented in chapter four. The fourth section concludes this research by discussing the study's conclusion. The fifth section discusses the implications of this research, including the theoretical, methodological, and practical implications. Finally, the sixth section focuses on the limitations of this research and suggestions for future studies.

5.2 Overview of Research

Shadow IT usage is a specific concept of employee behaviour regarding their usage of unauthorised IT structures within the organisation's IS. This empirical study examined the antecedents motivating shadow IT usage among employees. The motivation for this research is based on the IS reports and literature, which have raised concerns about the growing usage of shadow IT among employees and its implications for IS. These implications encompass security breaches, vulnerabilities introduced to the organisation IS due to external infiltrations, and data breaches, including the potential loss of customer data, among other consequences (Castellano et al., 2022; Lemos, 2019; Scalabrin Bianchi et al., 2022). Shadow IT usage has translated into both

financial and non-financial losses for organisations. Such losses manifest as IS disparities, damage to the organisation's reputation, conflicting IS resources, and difficulties in addressing IS issues due to the challenge of identifying their sources (Abbas & Alghail, 2021a; Scalabrin Bianchi et al., 2022; Suer, 2017). The adverse repercussions of shadow IT usage have motivated it to be categorised as an IS deviant behaviour (Haag & Eckhardt, 2014, 2017b; Mallmann, Gastaud, et al., 2018; Raković et al., 2020). Consequently, this study seeks to examine the motivations for shadow IT usage through the lens of strain theory.

Strain theory explains that people within society engage in deviant behaviours due to strain experienced from structural imbalances. In addition to strain being a direct motivation for deviant behaviour, strain theory also theorises strain as a mediator between structural factors and deviant behaviours. Applying this theory in the context of IS, this study examines the influence of structural factors within organisations on employee shadow IT usage. The structural factors examined include IT accessibility, SETA, work overload, and work pressure. Within this framework of strain theory, the construct "strain" is conceptualised as both a direct motivator to shadow IT usage and a mediating factor that serves as an intermediary in the relationship between the structural factors and the employee shadow IT usage.

This perception gave rise to four specific objectives and research questions that serve as the driving force behind this research. The research objectives and questions are presented in Table 5.1. Thirteen hypotheses were formulated to fulfil these objectives and answer the research questions. These hypotheses are designed to facilitate a

structured empirical examination of the interplay between the structural factors, strain, and employee shadow IT usage.

Following these objectives, a conceptual model was built based on strain theory. Four structural factors serve as the independent variables (IT accessibility, SETA, work pressure, and work overload). The structural factors are directly related to strain and shadow IT usage, and strain is directly related to employee shadow IT usage. Strain was posited to mediate the relationship between the structural factors (IT accessibility, SETA, work pressure, and work overload) and employee shadow IT usage.

The conceptual model was accordingly used as a framework to test the thirteen hypotheses formulated to answer the research questions of this study. The result of the data analysis shows the answer to these research questions. The discussions that explain the justification for the perceived reason for the result are conducted in the subsequent sections. The overview of this research is presented in Table 5.1.

Table 5.1

Overview of Research

Research Objectives	Research Questions	Hypotheses	Description	Findings
To examine the influence of structural factors (IT accessibility, SETA, work overload, and work pressure) on the employee shadow IT usage	do the structural factors of IT accessibility, SETA, work overload, and work pressure influence employee shadow IT usage?	H ₁	IT accessibility is negatively related to employee shadow IT usage	Supported
		H ₂	SETA is negatively related to employee shadow IT usage.	Not Supported
		H ₃	Work overload is positively related	Supported

Research Objectives	Research Questions	Hypotheses	Description	Findings
			to employee shadow IT usage	
		H ₄	Work Pressure is positively related to employee shadow IT usage.	Supported
To examine the influence of Strain on employee shadow IT usage.	Does strain influence employee shadow IT usage?	H ₅	Strain is positively related to employee shadow IT usage.	Supported
To examine the influence of structural factors (IT accessibility, SETA, work overload, and work pressure) on Strain.	Do the structural factors of IT accessibility, SETA, work overload, and work pressure influence Strain?	H ₆	IT accessibility is negatively related to strain.	Supported
		H ₇	SETA is negatively related to strain.	Supported
		H ₈	Work overload is positively related to strain.	Not Supported
		H ₉	Work pressure is positively related to strain.	Not Supported
To examine how shadow IT usage is affected by the mediating effect of Strain	How is shadow IT usage affected by the mediating effect of Strain?	H ₁₀	Strain mediates the relationship between IT accessibility and employee shadow IT usage.	Supported
		H ₁₁	Strain mediates the relationship between SETA and employee shadow IT usage.	Supported
		H ₁₂	Strain mediates the relationship between work overload and employee shadow IT usage.	Not Supported
		H ₁₃	Strain mediates the relationship between work pressure and employee shadow IT usage.	Not Supported

5.3 Discussion of Result

This section discusses the results of the analysis in line with the research questions. The first sub-section discusses the relationship between structural factors and shadow IT usage. The second discusses the relationship between strain and shadow IT usage, and the third concerns the relationship between structural factors and strain. The fourth discusses the mediating impact of strain on the relationship between structural factors and shadow IT usage.

5.3.1 Research Question 1: The Relationship between Structural Factors and Employee Shadow IT Usage

The result of this analysis fulfils research objective one, “to examine the influence of structural factors (IT accessibility, SETA, work pressure, and work overload) on the employee shadow IT usage.” Four (H1 to H4) were formulated to address this. The result shows that three structural factors (IT accessibility, work pressure, and work overload) influence employee shadow IT usage. In contrast, one factor (SETA) is not statistically significant in influencing employee shadow IT usage. The relationship between structural factors and shadow IT usage is discussed in this sub-section.

5.3.1.1 Information Technology Accessibility and Employee Shadow IT Usage

This study’s findings provide evidence supporting H1, affirming that “IT accessibility is negatively related to employee shadow IT usage”. The result highlights the correlation between IT accessibility and employee shadow IT usage, which substantiates existing conceptual and empirical research as referenced in previous studies (Huber et al., 2017; Kopper et al., 2018; Kopper & Westner, 2016; Magunduni & Chigona, 2018). Earlier research has expounded on how inadequate IT structures

within organisations contribute to increased errors and mistakes in official activities (Ivancevich et al., 1985; Korunka et al., 2003, 2010). Additionally, the result of the present study aligns with previous research explaining that a deficiency in IT structures leads to IS deviant behaviours (Barki et al., 2001; Keil et al., 2008; Sherer & Alter, 2004). This reinforces the pivotal role of IT accessibility in shaping employee shadow IT usage.

The likely explanation for this is that, in the absence of essential office IT solutions, employees are more likely to resort to shadow IT as an alternative IT solution (Klotz, Kopper, et al., 2019b; Kopper & Westner, 2016). Within the scope of this study, IT accessibility encompasses the managerial investment, provision, and allocation of essential IT infrastructures within organisations (Naldi et al., 2018). IT infrastructures entail establishing IS structures with the requisite components, including hardware, software, and cloud solutions essential for supporting equitable and functional IT in the workplace (Klotz et al., 2019; Shaheen & Lazar, 2018; Silic et al., 2016).

In line with prior studies' classification of IT infrastructures (Klotz, Kopper, et al., 2019; Shaheen & Lazar, 2018; Silic et al., 2016), this discussion section describes how IT accessibility can influence employee shadow IT usage into three categories. These are the employees' need to address deficiencies in 1) Physical IT structures, 2) Software and cloud solutions, and 3) Data repositories. When these IT structures are deficient, employees may seek alternative sources to access them, thus motivating their shadow IT usage. Each of these categories is described in the subsections below.

5.3.1.2 Physical IT Structure

Employees may relate with shadow IT when there is a deficiency in the organisation's investment in physical IT structures such as hardware and tangible IT assets including the provision of computers for employee use (Akman & Mishra, 2017; Kaye & Korbeck, 2016; Viaene, 2008). Additionally, IT investments extend to securing data physically, involving measures such as fortifying power rooms and implementing firewalls (Naldi et al., 2018). When the investment in the physical IT structures is lacking, employees may use their personal IT systems.

For example, when organisations fail to provide computers, employees may feel compelled to bring their personal computers to the workplace. This assertion aligns with previous studies that have examined the bring your own device (BYOD) phenomenon in the context of employee security behaviours in organisations (Giwah, 2018; Hovav & Putri, 2016; Köffer et al., 2015). The inadequacy of the organisation's IT infrastructure influences employees to use personal IT devices for their information systems needs. Similarly, the lack of IT devices such as scanners and printers may lead employees to rely on external IT resources for scanning and printing organisation-related data. This can include using their phones to scan documents or utilising commercial services, such as taking documents to shopping centres for printing, photocopying, or scanning. Therefore, shadow IT usage may be driven by the organisation's failure to provide adequate physical IT infrastructure.

5.3.1.3 Software and Cloud Solutions

Another crucial aspect of an organisation providing IT accessibility involves providing employees access to virtual and electronic systems. Cloud solutions have been

described as providing IT as a service (Sharma et al., 2023). These include software and solutions such as virtual communication platforms. In cases where organisations fail to provide necessary software and cloud services for official use, employees may download random software online, often free, and install it on organisation computers. Also, employees may interact with various cloud solutions to facilitate their tasks, translating to shadow IT. This is consistent with the prior study (Naldi et al., 2018), which explained that the lack of cloud investment in organisations is a negligent security behaviour that exposes sensitive data, such as customer data, to vulnerabilities.

Moreover, a lack of official communication systems can impact employee shadow IT usage. Effective communication is pivotal for workplace interactions and activity dissemination. When organisations do not provide approved communication systems, information decentralisation may occur, leading to the unintentional uploading of sensitive information on unsecured platforms and devices. Insufficient provision of communication tools often results in employees resorting to shadow IT for work-related tasks (Abbas & Alghail, 2023).

Prior research has explained the need to provide communication mechanisms such as emails at work (Dabbish & Kraut, 2006). Aside from being a means of communication, e-mail also handles the flow of messages and serves as a mechanism that aids information archiving and task management (Dabbish & Kraut, 2006). In line with this perception, organisations lacking official communication systems may influence employees to use unofficial emails and other communication platforms for official

matters. Thus, archiving organisation data on platforms outside the formal IT structures translates to shadow IT usage.

Organisations must prioritise establishing equitable and effective IT structures to mitigate shadow IT usage. This involves investing in robust internet services to eliminate the need for personal internet sources and providing essential software tools for efficient work execution. Additionally, organisations should offer legitimate cloud services and designated communication mechanisms, such as company-provided email, to enhance overall IT accessibility and deter shadow IT usage.

5.3.1.4 Data Repositories

When organisations lack data repositories in their IS, employees may resort to various external data repository platforms, which are classified as shadow IT usage. For instance, employees might use personal USB drives, hard drives, and other devices to copy organisational data for external use, impacting shadow IT usage (Abbas & Alghail, 2023). Beyond physical data storage tools, the absence of approved cloud repositories compels employees to save data in various random cloud platforms, including personal cloud devices, which further influences shadow IT usage.

This behaviour can lead to significant security risks, as data stored on personal or unapproved devices and platforms may not adhere to the organisation's security protocols. Consequently, sensitive information could be more vulnerable to breaches and unauthorised access. Moreover, reliance on shadow IT for data storage can result in fragmented data management, where critical organisational data is scattered across multiple, unregulated locations, complicating data retrieval, consistency, and integrity.

Providing official IT data backup and storage structures makes data tracking easier, improves communication, and enhances security measures within the IS. Implementing secure cloud storage tools facilitates seamless data backup and access, irrespective of time or location, reducing the need for employees to rely on personal IT setups for official duties. By adopting these measures, organisations can minimise shadow IT usage, strengthen data security, and foster a more efficient and secure work environment.

5.3.1.5 Security Education Training and Awareness and Employee Shadow IT Usage

This study describes security education, training, and awareness (SETA) in line with the organisational structure focused on knowledge acquisitions, growth, development, skills, and employee training facilities. Improving employees' IT capability through capability development is a way for organisations to enhance their performance and survival (Chae et al., 2014). Hypothesis two was postulated to empirically examine if "SETA is negatively related to employee shadow IT usage". Although this postulation expected a significant relationship between SETA and shadow IT usage, the result reflects an insignificant relationship.

The result of this study contradicts prior studies that have demonstrated that employees' behaviours are affected by their knowledge-related behaviours (Kim et al., 2016; Kim et al., 2013; Oliveira & Martins, 2014). This may be because SETA can predict other behaviours but may not predict employee shadow IT usage. Moreover, SETA is described as a two-edged sword capable of influencing employee

behaviours in both positive and negative ways (Ning et al., 2022). While having the capacity to influence positive behaviours, it can also influence employees negatively, such as their psychological resilience, increasing their psychological distress and perceived role overload (Ning et al., 2022).

While studies suggest that individuals with IT knowledge interact with shadow IT (Haag & Eckhardt, 2015; Hunter & Boersen, 2017; Mallmann, Gastaud, et al., 2018), research on IS compliance highlights the impact of knowledge on the security implications of behaviours (Dincelli & Chengalur-smith, 2020; Yaokumah et al., 2019). Despite SETA potentially fostering psychological resilience and knowledge among employees, an overload of knowledge-inducing strategies may lead to confusion about correct information usage. Moreover, if SETA activities lack structure, their positive impact on employee behaviour may be limited.

To maximise the positive influence of SETA on employee shadow IT usage, organisations should consider restructuring their activities. Regularly scheduled training sessions, such as monthly or weekly, can prevent information overload. Providing advance notice allows employees to prepare mentally and physically. Recordings and program bulletins make SETA activities easily accessible for reference, serving as valuable guidance for employees.

It is crucial to balance the absence and excess of SETA. Lack of SETA can be a stressor, but an overload can overwhelm employees. To mitigate this, management should enhance SETA efficiency and quality. Clear communication strategies, information dissemination about rewards and sanctions, and a comprehensive

understanding of organisational expectations and evaluation criteria can positively influence SETA and impact work behaviours and performance.

When knowledge-impacting systems are tailored clearly and concisely, ambiguity regarding employees' expectations can be reduced. These transformations can shift SETA from an antecedent that undermines employees' behaviours to one that enhances and improves them.

5.3.1.6 Work Overload and Employee's Shadow IT Usage

Based on the expectation that work overload influences shadow IT usage, this study posits, "Work overload (WL) is positively related to employee shadow IT usage". As expected, the results found a significant relationship between work overload and Employee shadow IT usage. This aligns with the broader organisational behaviour literature, suggesting a significant connection between heightened work demands and counterproductive behaviours (Dewangan & Verghese, 2018). Past studies have linked work overload to undesirable outcomes such as heightened conflicts within the workplace, high job turnover, diminished job satisfaction, and a lack of commitment toward organisational goals (Jeon et al., 2022; Mirsim, 2014).

This study, however, found that work overload leads to shadow IT usage. The possible explanation may be rooted in several factors that stem from the beneficial impacts of shadow IT usage as explained by prior studies (Born & Krönung, 2016; Haag & Eckhardt, 2015, 2015; Hulsebosch, 2016; Kopper, 2017; Mallmann & Maçada, 2016). These benefits include the innovation capability of shadow IT and the perceived performance of shadow IT. Also, prior studies used the neutralisation theory to explain

the employee motivation for shadow IT usage ((Haag et al., 2019; Silic et al., 2017). In this study, the perceived unfairness of work overload may influence employees' shadow IT usage. These perceptions of shadow IT were used to explain how work overload influenced shadow IT usage in the sub-sections below.

5.3.1.6.1 Innovation

Shadow IT usage may be initiated as an innovative means of coping with high workload challenges. Employees within the organisation may gravitate towards shadow IT due to its capacity to serve as a conduit for generating innovative solutions, especially when official access to IT resources is limited (Kim et al., 2022). The effectiveness of shadow IT in aiding the completion of work tasks makes it an attractive alternative for employees seeking automation in their activities amid high workloads. This innovative use of shadow IT reflects employees' adaptability. It underscores how they navigate and address organisational challenges to enhance productivity. Prior studies supported this perception, classifying shadow IT as deviant innovative problem-solving mechanisms (Silic et al., 2016). When employees experience a high workload without the necessary IT structures, they may relate with shadow IT to reduce their work overload, aid their work, and automate some tasks. This may account for how work overload influences shadow IT usage.

5.3.1.6.2 Performance

Another reason why work overload has a significant influence on shadow IT usage is the benefits associated with shadow IT as it aids performances (Born & Krönung, 2016; Haag & Eckhardt, 2015, 2015; Hulsebosch, 2016; Kopper, 2017; Mallmann &

Maçada, 2016). When employees observe positive outcomes in terms of performance associated with shadow IT usage, it may reinforce the inclination to engage in such practices, particularly when burdened with work overload. Research has explained that by leveraging shadow IT offerings and solutions, employees can significantly enhance work efficiency, alleviate overload, and effectively improve time management (Britto & Magesh, 2019). Thus, when employees discover the improved work outcomes fostered by their shadow IT usage, especially when they experience the tangible benefits of enhanced productivity and streamlined work processes, their motivation to use such solutions may be increased.

5.3.1.6.3 Perceived Unfairness

Employees may relate with shadow IT due to the feeling of unfairness in workload. When inundated with excessive workloads, employees may perceive the organisation as failing to treat them equitably, contrary to the ethical and moral expectations incumbent upon organisations (Kim et al., 2022), thus influencing shadow IT usage. This perception can be explained using neutralisation theory, as discussed by Silic et al. (2017). This includes giving excuses to justify shadow IT usage and minimising guilt arising from it. Moreover, employees may use defence mechanisms to underestimate the gravity of their unethical behaviour, which is their shadow IT usage.

For instance, shadow IT may cope with workload inadequacies if the employees perceive their workload exceeds reasonable expectations. This may consciously form reasoning in which they justify unethical actions. Also, employees may resort to shadow IT usage when they perceive unfairness in the management's practices and

decisions in workload favouritism, inconsistent policies, or perceived biases in IT resource allocation.

Employees who feel that organisational practices are unjust or not treated fairly may seek alternative solutions, and shadow IT becomes an appealing avenue. It allows them to address their needs or challenges independently, bypassing what they perceive as an unfair or restrictive official IT environment.

5.3.1.7 Work Pressure and Employee's Shadow IT Usage

The result of H5 affirmed the significant relationship between work pressure and shadow IT usage. The findings significantly agree with the previous research, which has established a positive relationship between work pressure and deviant behaviours (Gorter et al., 2019; Sillic, 2019). Moreover, this study result affirms earlier investigations demonstrating that work pressure serves as a motivator for deviant workplace behaviour (Amponsah-Tawiah & Adu, 2016; Bosak et al., 2013; Gulseren et al., 2019; Varonen & Mattila, 2000).

Existing literature has also confirmed the relationship between work pressure and counterproductive work behaviour (Ceschi et al., 2016; Chen et al., 2017). This relationship may arise from the demands imposed on individuals or the reactions these demands may provoke. These reactions include detachment from work, suboptimal task performance and an increased likelihood of engaging in deviant work behaviour (Ceschi et al., 2016; Onwesen et al., 2014). As revealed by this research, the significant relationship between work pressure and shadow IT usage may be due to factors such as peer pressure at work and the relationship with superiors. This perception is

supported by previous shadow IT research using the social presence theory, which explains that peer and supervisory pressure influence employee shadow IT usage (Mallmann, Maçada et al., 2018; Mallmann & Maçada, 2017).

5.3.1.7.1 Peer Pressure

Building upon the premise that interpersonal relationships significantly influence employee shadow IT usage, social dynamics, and the desire for acceptance among peers can lead employees to adopt unconventional approaches, including shadow IT (Mallmann & Maçada, 2021a). Also, some individuals are susceptible to conforming to the behaviours and practices of their peers in the workplace. Employees may be motivated to adopt shadow IT solutions by observing their peers successfully utilising such tools to streamline tasks or enhance productivity.

The tacit approval or acceptance of shadow IT practices within a peer group can create a normative influence, encouraging individuals to align their behaviour with that of their colleagues (Chen et al., 2020). Moreover, the fear of social exclusion or alienation within the workplace can act as a powerful motivator for employees to conform to the prevailing practices, even if these involve the unauthorised use of shadow IT resources. Also, the desire for camaraderie and fitting into the workplace culture can significantly impact an individual's decision-making (Gallani, 2017), thus influencing their shadow IT usage. In line with this, peer pressure may explain why work pressure influences shadow IT usage.

5.3.1.7.2 Superior influence

Hierarchical relationships within the workplace can create an environment where employees feel compelled to conform to their superiors' preferences and expectations (Mallmann & Maçada, 2021). As authority figures, superiors can impact employees directly and behaviour through explicit directives. When superiors ignore some organisation's IT policies or express a preference for or condone the use of specific IT tools, employees may be inclined to align their practices with these preferences, potentially leading to the adoption of shadow IT (Mallmann et al., 2016; Mallmann, Gastaud, et al., 2018; Mallmann & Maçada, 2021). Thus, superiors influence employee shadow IT usage within the organisation.

The expectations set by superiors regarding performance and productivity can indirectly influence shadow IT usage. When employees perceive that shadow IT tools enhance their ability to meet or exceed performance expectations, they may be motivated to incorporate them into their workflow (Alfredo et al., 2020). Moreover, suppose employees believe that utilising shadow IT tools contributes to achieving strategic goals, in that case, they may be more inclined to adopt such tools. Thus, superior influence may contribute to how work pressure influences employee shadow IT usage.

5.3.1.8 Overview of Structural Factors and Shadow IT Usage

To recapitulate, this study found that three structural factors significantly directly affect shadow IT usage: IT accessibility, work overload, and work pressure. This reinforces the position of the research model arched on strain theory as conceptualised by this study. This reveals that structural factors do have a direct influence on shadow

IT usage. Therefore, providing IT structures coupled with balanced work and healthy relationships at work are factors organisations should consider and focus on when attempting to control employee shadow IT usage.

Moreover, organisations should invest in robust IT structures, including cloud offerings and data analytics tools, to support and enhance employee performance (Haag et al., 2019; Hulsebosch, 2016; Ines et al., 2017; Mallmann, Gastaud et al., 2018). Management should also encourage task automation to alleviate work overload, rather than enforcing manual completion strategies. This can be achieved by investing in automated systems that improve employee efficiency, reduce mistakes and errors, and improve employees' ability to complete work faster. This will reduce their reliance on shadow IT solutions for task automation (Kirin, 2017; Silic, 2015).

In addition, organisations should adopt measures to tackle work overload effectively to create a more conducive and productive work environment. Firstly, emphasis should be placed on optimising employee workload by establishing an ideal workforce (Eldor, 2019b; Gulseren et al., 2019). Moreover, proactive steps must be taken to prevent high job turnover, as it can exacerbate the burden on remaining employees, leading to increased work overload. This can improve their mood and relieve them while increasing their positive experiences. It provides external support for managing the intensive work (Brailovskaia et al., 2022).

Furthermore, organisations should actively promote a corporate culture that discourages shadow IT usage among employees (Györy et al., 2012; Lemos, 2019; Sillic, 2019). This proactive approach can effectively mitigate employees' adoption of

shadow IT behaviours from their colleagues. Strategies to achieve this objective include formulating explicit policies addressing the issue. Moreover, organisations may establish structures that discourage shadow IT usage. This includes blocking of ports, blocklisting, and allowlisting of sites. By cultivating an organisational culture that discourages shadow IT usage, the pressure on employees to resort to it will diminish.

5.3.2 Research Question 2: The Relationship between Strain and Shadow IT Usage

Hypothesis H5 addressed the relationship between strain and employee shadow IT usage. This addresses the RO2 “to examine the influence of strain on employee shadow IT usage”. The result shows that strain significantly influences employee shadow IT usage. Hence, the relationship between strain and shadow IT usage is statistically confirmed.

Strain has been described as a predictor of deviant behaviour in society (Farnworth & Leiber, 2019; Moon & Morash, 2017), and shadow IT usage has been described as an IS deviant behaviour (Abbas & Alghail, 2021; De Vargas Pinto et al., 2018; Huber et al., 2018; Suer, 2017). Prior studies have affirmed that strain significantly influences an individual’s compliance with policies, rules, and regulations (Al-Badayneh et al., 2019; Baron, 2004, 2019; Polizzi, 2011; Willits, 2019). This study reinforces this observation by the study’s participants, who confirmed that strain is a predictor for employee shadow IT usage. Thus, there is a need to answer the RQ2 “Does strain influence employee shadow IT usage?”

When strained, employees may relate to shadow IT as a form of coping mechanism. When individuals experience emotional exhaustion, logically aligning their behaviours with organisational expectations and requirements may be challenging. Thus, using shadow IT to ease their strain. This observation aligns with existing research, which posits that the accumulation of stress-inducing emotions such as fatigue, burnout, and tension often leads to counterproductive behaviours (Gould et al., 1999; Meehan et al., 2004; Noblet et al., 2003; Tabei et al., 2012; Wagstaff et al., 2012). These behaviours may encompass lethargy, complaining, avoiding responsibilities, and laziness (Liu et al., 2021). While burnout tends to generate destructive deviant behaviours, positive emotions can catalyst creative thinking and behaviours congruent with organisational structures (Liu et al., 2021).

Secondly, in line with strain theory, individuals experiencing strain as a result of their inability to access legally sanctioned means are more inclined to exhibit deviant behaviour by turning to alternative structures to fulfil their needs (Farnworth & Leiber, 2019; Polizzi, 2011; Willits, 2019). This assertion aligns with the conceptual model developed for this study, which expounds that employees under strain tend to engage in shadow IT usage.

Moreover, when employees are strained, their behaviours may defy conventional logic, prediction, and probability (Albers, 1997; Dabbish & Kraut, 2006; Keller & Weibler, 2015). Consequently, the strained actions may be guided more by their emotional state rather than rational reasoning. The cognitive exhaustion experienced by employees during this period of strain can lead them to seek shadow IT structures as a coping mechanism.

Third, shadow IT usage has been associated with certain perceived benefits, such as facilitating access to resources that boost cognitive capabilities. Employees may interact with shadow IT when strained to augment their cognitive resources, potentially alleviating their emotional exhaustion (Chen et al., 2020). Additionally, strained employees may resort to shadow IT as a beneficial mechanism to expedite tasks and hasten the completion of activities. In doing so, they may rationalise their shadow IT as a pragmatic approach, thereby neutralising the guilt associated with shadow IT being labelled as deviant behaviour (Silic et al., 2017c).

Fourth, employees may resort to shadow IT usage when strained to address perceived injustices arising from organisational imbalances. Strained employees may attribute their distress to the organisation's shortcomings in meeting their needs (Chen et al., 2020; Sulistiawan et al., 2020). For instance, when an organisation faces IT deficiencies, employees compelled to perform manual tasks may experience strain and turn to shadow IT to automate their responsibilities, thereby addressing gaps in the existing IT infrastructure. This reveals how strain can drive employees towards shadow IT usage in response to organisational challenges.

Finally, employees burdened by high job-related stress may contemplate leaving their current jobs for alternative employment opportunities. Once this decision is ingrained, their concern for adhering to organisational and legal structures and regulations may diminish. Consequently, they might engage in deviant activities, such as shadow IT usage, to alleviate job stress without fearing potential repercussions or termination. This dynamic highlights how strain increases the likelihood of employee shadow IT

usage, a finding corroborated by the responses of the study's participants, who confirmed that strain is a predictor for employee shadow IT usage among Nigerian employees.

5.3.3 Research Question 3: Structural Factors and Strain

Based on the theoretical background of this study, strain theory, it is believed that societal imbalances lead to social strain. This is supported by the role stress theory, which posits that external stimuli influence employees' stress, which may lead to factors such as work dissatisfaction and poor performance (Adeoti et al., 2017; Ismail et al., 2019; Peter et al., 2019; Ramayah, 2014). This section discusses the result relating to research object three and answers research question three. RQ3 states, do the structural factors of IT accessibility, SETA, work pressure, and work overload influence strain?" This study postulates four hypotheses (H6 to H9) to test the relationships.

The result shows that two structural factors, IT accessibility, and SETA, have a significant relationship with strain. In comparison, the other two structural factors (work overload and work pressure) do not significantly correlate with strain. Concerning the research question, the result reveals that IT accessibility and SETA are the factors that influence strain. Each of these relationships are discussed below.

5.3.3.1 IT Accessibility and Strain

This study hypothesis H6 postulates that "IT accessibility is negatively related to strain." As expected, the findings of the analysis substantiate the initial posited. The result affirms the body of research explaining that those cognitive activities surpassing

cognitive resources trigger heightened levels of strain (Albers, 1997; Dabbish & Kraut, 2006; Keller & Weibler, 2015). Additionally, studies have consistently shown that access to digital facilities and IT systems contributes to employees overcoming various workplace challenges, thereby alleviating strain (Akman & Mishra, 2017; Kaye & Korbeck, 2016; Viaene, 2008).

Furthermore, this study aligns with theoretical frameworks such as Hooke's law, suggesting that disparities in structural IT systems, characterised by labour-intensive and manual documentation of activities that could be automated, contribute to strain (Albers, 1995, 1997). The absence of access to sound IT systems has been identified as an IT-related stressor, leading to complex workflows and intricacies in task execution (Ivancevich et al., 1985; Klotz et al., 2019; Korunka et al., 2003, 2010; Setor & Joseph, 2015). For this study, the significant relationship between IT accessibility and strain highlights that sound IT structures enhance employees' mental well-being.

The reason could be that providing sound IT structures can alleviate the strain by streamlining and automating routine tasks. For instance, office assistance tools illustrate how technology can ensure data consistency, reducing the need for employees to engage in repetitive manual verifications. By automating such activities, organisations mitigate the cognitive drain associated with tasks that technology could handle more efficiently. This saves time and frees employees to focus on higher-order cognitive functions, ultimately augmenting their cognitive resources.

The trans-reflective potential of technology in the workplace, such as access to advanced and user-friendly IT tools, empowers employees to navigate complex tasks with greater ease and efficiency, contributing to a positive work environment and enhancing overall well-being.

5.3.3.2 Security Education Training and Awareness (SETA) and Strain

SETA represents an integral component of the structural system for fostering employee capacity development. The organisation's commitment to providing an accessible and equitable IT system remains insufficient if employees are not adequately educated using IT assistive technologies. In essence, the synergy between IT infrastructure and comprehensive SETA initiatives forms the bedrock of a holistic approach toward optimising employees' cognitive resources and reducing strain. Implementing robust IT systems, while undoubtedly beneficial, becomes truly efficacious when coupled with a concerted effort to educate employees on the proficient and secure use of these technologies. This is the motivation for the hypothesis H7, which postulates that SETA is negatively related to strain.

This study's empirical findings show a negative relationship between SETA and strain. This result reveals that when the efficacy of SETA programs in an organisation increases, the corresponding strain level exhibits a downward trend. Consequently, the investments in fostering a robust SETA structure within an organisation contribute to bolstering the workforce knowledge and proficiency and act as a significant mitigating factor against strain. Thus, this finding highlights the pivotal role of SETA in the psychological well-being of employees in the workplace.

While prior studies have established a positive relationship between SETA and various factors, such as compliance, there is a conspicuous gap in the literature concerning elucidating the relationship between SETA and strain (Yaokumah et al., 2019; Yoo et al., 2018). Existing studies have, however, explained that obsolescent knowledge affects the employee's capacity to keep pace with contemporary technological trends in the workplace, consequently leading to issues such as redundancy (Chae et al., 2014; Kim & Kim, 2017; Mallmann et al., 2016; Ping-Ju Wu et al., 2014).

The result of this study may be justified by the perception that the lack of necessary training and requisite development activities leads to employees being ill-prepared for IS functions, diminished capability, and precipitating mental strain (Ping-Ju Wu et al., 2014). Also, SETA elements such as training and awareness reduce employee workplace strain (Creswell et al., 2018; Ifinedo, 2018; Lane et al., 2007; Rajna et al., 2009). These past studies reiterated that an organisation's provision of knowledge-enhancing structures exerts a beneficial effect in reducing the strain experienced by employees.

In addition, a well-informed workforce is better equipped to navigate the complexities of IS. It may be less prone to cognitive overload, mitigating the strain associated with information-intensive tasks. Therefore, the dearth of essential information can confuse job responsibilities and expectations, exacerbating strain levels (Creswell et al., 2014; Ifinedo, 2018; Lane et al., 2007; Rajna et al., 2009). Based on the perceptions of the previous studies on the capability of SETA elements, which include 1) cognitive enhancement, 2) psychological well-being and competitive performance, 3) proficiency, job performance, and career progression, 4) knowledge-enriching

initiatives and overall well-being (Barlow et al., 2018; Bauer et al., 2017; Chae et al., 2014; Chang & Yang, 2023; Kim & Kim, 2017; Mallmann et al., 2016; Melo et al., 2020; Ping-Ju Wu et al., 2014), it can be explained that SETA may influence strain due to these capabilities. These may explain the significant relationship existing between SETA and strain. Each of these perceptions is discussed below.

5.3.3.2.1 Cognitive Enhancement

SETA's influence in reducing strain can be attributed to the effectiveness of instructional materials and training mechanisms in enhancing cognitive resources (Chae et al., 2014; Kim & Kim, 2017; Mallmann et al., 2016; Ping-Ju Wu et al., 2014). Acquiring IT knowledge and security education enables employees to navigate cognitively demanding tasks more effectively, ultimately diminishing strain during execution. This speaks to the power of education and training in empowering employees to handle complex IT-related activities with excellent proficiency, positively impacting their mental well-being. Thus, by enhancing the employee's cognition, SETA may justify the negative relationship with strain.

5.3.3.2.2 Psychological Well-being and Competitive Performance

The interconnectedness of knowledge enrichment and psychological health may explain how SETA influences strain (Barlow et al., 2018; Bauer et al., 2017; Chae et al., 2014; Chang & Yang, 2023; Kim & Kim, 2017; Mallmann et al., 2016; Melo et al., 2020; Ping-Ju Wu et al., 2014). Implementing SETA structures within organisations may improve the psychological well-being of employees. This is supported by the perception that a psychologically healthy employee may experience reduced strain

(Barlow et al., 2018; Bauer et al., 2017a). Moreover, employees well-versed in IT systems operation, having undergone security education and training on task-facilitation applications, are cognizant of security implications and, thus, exhibit enhanced psychological well-being (Barlow et al., 2018; Bauer et al., 2017). This, in turn, influences employee's competitive performance within and outside the industry. The increased competitive capability and boosted morale contribute to overall mental well-being, fostering professional competence and psychological equilibrium in the workplace (Barlow et al., 2018; Bauer et al., 2017; Chae et al., 2014; Chang & Yang, 2023; Kim & Kim, 2017; Mallmann et al., 2016; Melo et al., 2020; Ping-Ju Wu et al., 2014). The finding thus, justifies the negative relationship between SETA and strain.

5.3.3.2.3 Proficiency, Job Performance, and Career Progression

A knowledgeable and experienced employee may experience reduced strain at work (Chang & Yang, 2023; Chen et al., 2018). A skilled employee with comprehensive education may competently demonstrate enhanced job performance. In contrast, an employee with obsolete knowledge may feel incapable. This assertion is consistent with the cognitive load theory, which explains that an individual with limited cognitive resources becomes strained (Chang & Yang, 2023; Chen et al., 2018).

The proficiency gained through education and training catalyses career progression, leading to access to promotions and organisational benefits. The cumulative effect of this upward trajectory in the career path is a heightened sense of job satisfaction. Consequently, the enhanced sense of contentment reduces mental strain, creating a favourable psychological condition within the workforce (Barlow et al., 2018; Bauer et al., 2017; Chae et al., 2014; Chang & Yang, 2023; Kim & Kim, 2017; Mallmann et

al., 2016; Melo et al., 2020; Ping-Ju Wu et al., 2014). Thus, the significant relationship between SETA and strain can be justified.

5.3.3.2.4 Knowledge-Enriching Initiatives and Overall Well-being

Since SETA is a means of knowledge-enriching initiatives, organisations with knowledge-impacting initiatives may experience reduced employee strain. This perception aligns with studies that explained the nexus between knowledge-enriching initiatives and employees' well-being (Chae et al., 2014; Kim & Kim, 2017; Mallmann et al., 2016; Ping-Ju Wu et al., 2014). Knowledge-impacting initiatives include IT and security education, increased awareness of security impacts, and comprehensive training, which may significantly improve employees' mental well-being (Chae et al., 2014; Kim & Kim, 2017; Mallmann et al., 2016; Ping-Ju Wu et al., 2014). In addition, education and skills development foster a climate of contentment and professional growth. The organisational investment in such knowledge-enhancing structures is highlighted as having the potential to yield benefits regarding employee well-being, cognitive strength, and overall organisational success. Thus, an employee in such a knowledge-enriching environment may experience reduced strain. This may also explain the relationship existing between SETA and strain among Nigerian employees.

5.3.3.3 Work Overload and Strain

In contrast to the initial posited by this study, the result has unveiled a noteworthy revelation: the relationship between work overload and strain, while intuitively expected, was not statistically significant. Workload, as explained by prior studies, has been categorised as an antecedent to an array of adverse psychological states, including fatigue, stress and burnout (Alaminos-Torres et al., 2023; Diestel & Schmidt, 2009;

Jeon et al., 2022). Increased workloads can influence emotional feelings, which have the potential to impede performance significantly (Alghnimi et al., 2020; Bakker & Demerouti, 2007; Ghosh et al., 2020; Mirsim, 2014; Schaufeli, 2017). These outcomes are often not solely attributable to work-related demands but also emanate from the psychological distress experienced by employees encapsulated in phenomena such as emotional exhaustion and disengagement from their tasks (Alghnimi et al., 2020; Ghosh et al., 2020).

While these previous studies have linked work overload to heightened strain, this present research does not generate a similar perception. This unexpected outcome prompts a deeper exploration of this relationship's nuanced dynamics. The plausible explanation for this unexpected finding is rooted in prior studies (Alaminos-Torres et al., 2023; Yean et al., 2022; Bhagat et al., 2018; Suárez et al., 2017; Wei & Yan, 2010), which describe possible factors that may reduce strain in the organisation. These include 1) working environment, 2) institutionalisation of rest, 3) flexibility in work arrangements, 4) remote working structure, and 5) staffing. Each of these perceptions may explain why the relationship between work overload and strain was insignificant and is discussed below.

5.3.3.3.1 Organisation Environment

The presence of work overload-reducing facilities such as job assistive technologies within organisations may reduce strain. This may explain the reason for the insignificant relationship between work overload and strain. This perception aligns with studies that explained that employees in improved work environments may experience decreased cognitive impairment (Yean et al., 2022). Also, providing a

structured system and balanced work shifts among workers may reduce their strain (Alaminos-Torres et al., 2023), thus explaining the justification for the insignificant relationship.

5.3.3.3.2 Institutionalisation of Rest

The institutionalisation of rest for employees may reduce workload-related stress. Rest reduces psychological strain (Alaminos-Torres et al., 2023), thus may explain the reason for the insignificant relationship between work overload and strain. Adequate restorative sleep allows employees to replenish their cognitive reservoirs and effectively counter strain from work overload. For example, an organisation with a break period between long work hours may experience reduced strain compared to those working long hours without breaks. Employees with time for personal rest may also enjoy better sleep and rest patterns, thus explaining the insignificant relationship.

5.3.3.3.3 Flexibility in Work Arrangements

Flexibility in work arrangements may contribute to a more manageable workload, thereby may explain the insignificant relationship between work overload and strain. Employees who work average hours may experience reduced strain compared to long shifts daily. Also, employees who benefit from flexible deadlines and those with full weekends off may experience a notable reduction in work overload compared to those with no or reduced weekly off days (Alaminos-Torres et al., 2023; Yean et al., 2022). Flexible work arrangements may, therefore, account for respondents' perception of work overload and strain.

5.3.3.3.4 Remote Working Structure

The rise of remote work accelerated by the Covid-19 pandemic has introduced a novel dimension to this discourse, which may influence workload-related strains (Goswami & Geetha, 2020; Jordan & McKnight, 2020; Lawrence, 2020; Naeem et al., 2022). Some organisations have embraced various degrees of remote work structures. While some organisations instituted complete remote working structures for some employees, some others opted for a partial remote working system in which employees were required to attend the physical workplace at stipulated times (Couto & Sayers, 2022; Ghali-Zinoubi et al., 2021; Sharma et al., 2023). This flexible work structure is intermixed by remote and physical work structures (Muomah et al., 2023; Vinters, 2020). Employees may be required to be physically present at the workplace a few times in a designated period while completing most of their responsibilities remotely and vice versa (Muomah et al., 2023; Vinters, 2020). This hybrid model of a mixture of remote and physical work patterns seeks to balance physical and remote work structures.

Employees working remotely from the comfort of their homes may encounter reduced work overload due to the various advantages of this work mode. These advantages include reduced transportation-related stress, elimination of commute-related strain, and possibly improvement of meeting resumption at work, as the virtual work environment mitigated some of the strains associated with traditional office-based work, such as increased communication and collaboration processes (Couto & Sayers, 2022; Ghali-Zinoubi et al., 2021; Sharma et al., 2023). This perception may, therefore, explain the insignificant relationship between work overload and strain.

5.3.3.3.5 Staffing

Another justification for the insignificant relationship between work overload and strain is the organisation's workforce. Staffing plays an essential role in shaping employee well-being. Studies have shown that organisations that maintain a balanced workforce sometimes exhibit decreased strain (Bhagat et al., 2018; Suárez et al., 2017; Wei & Yan, 2010). The rationale behind this phenomenon lies in the equitable distribution of job responsibilities among the workforce, which lightens the load placed on individual employees.

In contrast, organisations grappling with a low workforce often encounter challenges that can increase Strain (Bhagat et al., 2018; Suárez et al., 2017; Wei & Yan, 2010). The shortage of personnel may necessitate excessive overtime work, reducing the rest periods and recuperation time available to individual employees. Organisations that invest in workforce planning, adequate staffing levels, and workload distribution strategies are better positioned to mitigate the detrimental effect of excessive work demands and promote a more sustainable work culture. Therefore, the equilibrium achieved through a balanced workforce can serve as a potent buffer against strain.

While the significant relationship between workload and stress, as evidenced in prior research, reveals that burnout is a psychological syndrome that arises from prolonged exposure to work-related demands (De Beer & Bianchi, 2019; Maslach & Leiter, 2016), this study reveals this relationship is not statistically significant possibly to the above reasons. Organisations can, therefore, address strain by providing structures that reduce work overload, such as reduced functional expectations from employees, rest structure for employees, flexibility in work arrangement, balancing between the

physical and remote working conditions, and a balanced workforce to produce a resilient and productive employee instead of emotionally exhausted ones (Legg & Cafasso, 2023; Wullur & Werang, 2022)

5.3.3.4 Work Pressure and Strain

The premise of this section posited that imbalances within interpersonal relationships could lead to strain. This preposition motivates H9, which postulates that work pressure (WP) is positively related to strain.

Contrary to initial expectations, the findings of this study do not affirm the expected relationship between the exogenous variable of work pressure and the endogenous variable of strain. The outcome contrasts prior research that has established relationships between work pressure and outcomes such as burnout and emotional exhaustion (Demerouti et al., 2010; Smith et al., 2019).

Since this study described work pressure as the imbalances in the relationship factors at work, which include the employees' relationship with co-workers, superiors, and management, the plausible reason for the insignificant relationship between work pressure and strain may be due to the facts that the relationship factors at work may translate to social support instead of serving as pressure to employees. Another reason may be the reduced physical interactions among the workforce, which might be influenced by virtual or hybrid work structures (Muomah et al., 2023; Sakpere et al., 2023; Taylor Vinters, 2020). Another possible reason may be the employee's perception of work meaningfulness (Chaudhary, 2019; Kaur & Mittal, 2020; Sulistiawan et al., 2020). Furthermore, the relationship between work pressure and

strain may be insignificant due to the organisational structural implementation of employee welfare (Torsvik et al., 2022; Won, Chun, 2018). Each of these perceptions and how they may explain the insignificant relationship between work pressure and strain are discussed in this section.

5.3.3.4.1 Interpersonal relationships translating to social supports

Although peers may influence employees to engage in deviant behaviours, while those behaviours may be unethical, they may also improve employees' emotional state (Ibrahim et al., 2020; Pate & Bolin, 2019). For example, shadow IT structures may help alleviate work tasks and improve performance. Thus, strain may not be induced. Therefore, work pressure may be a better antecedent of deviant behaviour than strain.

Moreover, although the relationship factors at work, such as peer pressure, may be tailored towards deviant behaviours, they may also manifest as social support among workers. Thus, employees may gain emotional support from their co-workers without strain (Nisar et al., 2021). A robust social support network can engender a positive cycle that tends to mitigate employees' experiences of depression, anxiety, and elements of strain (Nisar et al., 2021). Therefore, social, cognitive, and psychological support can be pivotal in providing essential employee connections. This may justify the insignificant relationship between work pressure and strain.

5.3.3.4.2 Reduced Physical Interactions

The remote working structures might be plausible for the insignificant relationship between work pressure and strain. Some employees may face reduced work pressure

due to reduced face-to-face interpersonal relationships (Camacho & Barrios, 2022; Sharma et al., 2023; Sudarsono et al., 2020). Thus, their psychological strain may not be reduced. The nature of remote work, characterised by altered communication patterns, reduced immediate supervisory oversights, and the boundaries between work and personal life during the pandemic, may have altered how employees perceived and experienced work pressure. The remote working structure might have influenced employees' work dynamics and perceptions.

Aside from this, the physical disconnection resulting from the virtual work arrangement might have diminished the impact of work pressure on employees. With limited face-to-face interactions, the typical socio-dynamics contributing to peer pressure could have been attenuated, thus reducing its effect on individual stress levels.

5.3.3.4.3 Work Meaningfulness

Another plausible reason why work pressure may be insignificant to strain may be the employee's intrinsic perception of work meaningfulness. This perception is based on previous studies that explain how work meaningfulness influences employees' work engagement and affective commitment (Kaur & Mittal, 2020; Sulistiawan et al., 2020). Employees who perceive their work as meaningful may have personal drive, which may reduce their interpretation of activities and relationships. Thus, their psychological strain may not be induced (Sulistiawan et al., 2020). Also, employees who work with specific goals and aims may not become strained even when pressured by the socio-dynamics of relationships at work. This may further justify the insignificant relationship between work pressure and strain.

5.3.3.4.4 Employee Welfare

Organisations that implement structures aimed at improving employees' welfare, such as providing holidays, weekend breaks, vacations, and leaves, offer opportunities for employees' cognitive recharge. These measures can significantly reduce the work pressure experienced by employees, subsequently diminishing the impact of work pressure on Strain (Jung & Yoon, 2020). In addition, organisations promoting psychological detachment, particularly concerning employees' interpersonal relationships and personal lives, may experience reduced work pressure. Thus, this may provide another justification for why work pressure is insignificant with strain.

In summary, the relationship between work pressure and strain may be insignificant due to social support, remote work, employees' drive, and organisational prioritisation of employee welfare. These factors may reduce organisational work pressure, leading to an insignificant relationship between work pressure and strain.

5.3.3.4.5 Overview of the Relationship Between the Structural Factors and Strain

Out of the relationships between the four structural factors and strain, two were significant, namely, IT accessibility and SETA. The other two, namely work overload and work pressure, were insignificant. This shows a compelling need for organisations to proactively establish IT structures and knowledge-impacting systems that prioritise the cognitive well-being of their workforce. Adopting equitable IT structures, as advocated, emerges as a proactive strategy to mitigate strain, enhance cognitive resources, and contribute to the overall psychological well-being of employees. This

approach benefits the workforce and positions the organisation positively in the competitive landscape.

Moreover, organisations should implement comprehensive education programs that cover IT skills, security implications, and task-facilitation applications. This holistic approach ensures employees are well-equipped to handle diverse challenges, reducing strain and fostering well-being.

Recognising the dynamic nature of technology, organisations should invest in ongoing training to keep employees abreast of the latest developments. Continuous learning contributes not only to reducing strain, but, organisations can also foster a positive psychological environment by actively promoting career development opportunities. This includes providing pathways for skill enhancement, certifications, and career progression, contributing to employee satisfaction and reduced mental strain.

Establishing a culture of knowledge-sharing within the organisation can further enhance workplace relationships. This promotes a collaborative environment where employees benefit from each other's expertise, contributing to overall well-being. It also serves as a support community that boosts knowledge acquisition and utilisation. This aligns with studies that have demonstrated how shared community ideas foster positive attitudes and experiences among members (Plaatjies & Mitrovic, 2014; Dos et al., 2019). By creating an atmosphere that encourages the open exchange of information and resources, organisations can enhance employee engagement and satisfaction. This collaborative spirit can lead to innovative problem-solving and a more agile response to challenges. Furthermore, a strong culture of knowledge-sharing

can help bridge gaps between different departments, fostering a sense of unity and common purpose.

Encouraging knowledge-sharing also supports professional development. Employees are more likely to feel valued and motivated when they can contribute to and benefit from a collective pool of knowledge. This not only improves individual performance but also enhances the overall effectiveness of the organisation.

Robust support systems within the workplace can serve as a buffer against the detrimental effects of work pressure. These support systems may improve psychological well-being and contribute to increased performance by workers (Plaatjies & Mitrovic, 2014). Organisations' knowledge dissemination can result in employees being categorised into various groups that may serve as support groups in the long term. These findings, therefore, demonstrated the importance of structural factors in mitigating work-related strain.

5.3.4 Research Question 4: The Mediating Effect of Strain

The mediating result contributes significantly to this study, aligning with fulfilling the fourth research objective and providing insight into research question four, which inquires, "How is shadow IT usage affected by the mediating effect of strain?"

This study applies the strain theory within organisational IS, empirically substantiating the mediating impact of strain on two structures, namely, IT accessibility and SETA, and their relationship with employee shadow IT usage. The result shows that strain

does not mediate the relationship between work overload, work pressure, and shadow IT usage.

In alignment with the perspective presented by this study, strain can be construed as a psychological phenomenon that emerges from the structural imbalances within an organisation. In this context, these imbalances emanate from the organisation's deficiencies in providing employees with conducive working systems and conditions (Thatte et al., 2014). Consequently, these structural imbalances can lead to increased psychological stress among employees. Due to strain, employees may exhibit deviant behaviours that elucidate their shadow IT usage. The result of the mediating impact of this study is discussed in the sub-sections below.

5.3.4.1 Mediating impact of strain on the relationship between IT accessibility and shadow IT usage

This study provides empirical validation supporting the assertion that strain is an intermediary in the relationship between IT accessibility and employee shadow IT usage. While it is evident that a direct relationship exists between IT accessibility and shadow IT usage, the findings demonstrate that the influence of strain further bridges this relationship. This result aligns with the strain theory proposition that strain mediates structural factors and deviant behaviours (Farnworth & Leiber, 2019; Merton, 1938; Merton & Ashley-Montagu, 1940; Piquero et al., 2016). Hence, it is recommended that organisations implement structures that enable employees to perform their job tasks effectively and efficiently, thus reducing strain and, consequently, curtailing shadow IT usage. Such measures may mitigate the negative impacts of shadow IT usage in organisation IS.

Employees are subjected to heightened mental stress when confronted with poor IT infrastructures such as outdated computer systems, unreliable internet access, and poor office assistance IT structures, prompting them to resort to personal IT systems to complete their job tasks, even though such actions may jeopardise the organisation's information security (Alfredo et al., 2020; Date, 2018; Shaheen & Lazar, 2018; Shaheen & Lohnes Watulak, 2019; Yao & Giannoumis, 2017). Therefore, it is expedient for organisations to invest in updated and reliable IT infrastructure such as high-speed internet structures, software needed to automate employee tasks, hardware, and cloud structures. The IT structures should be available for employees to dispense their official duties. This will reduce the strain caused by technology limitations, thus reducing employee shadow IT usage.

5.3.4.2 Mediating influence of strain on the relationship between SETA and Shadow IT

Although this study did not establish a direct causal relationship between SETA and shadow IT usage, it reveals a significant mediating impact of strain, indicating a meaningful relationship between SETA and shadow IT usage. SETA elements include security-related education, IS training, and Awareness creation. The result reveals that individuals with IT education, exposure, and training tend to use shadow IT more in stressful situations. This result interpretation is consistent with the positive statistical value of the mediating relationship.

However, this result deviates from the prior research that explained that individuals with SETA tend to exhibit increased IS compliance behaviours (Firsty Arisya et al., 2020). However, this study is focused on IT behaviour, which may explain the variance from the previous assumption. Education has consistently emerged as a potent means

of enhancing knowledge. While IT knowledge may boost IS compliance (Choi & Lee, 2015), this study reveals that IT-knowledgeable employees are likelier to engage with shadow IT in stressful situations.

This finding supports the idea that an individual with IT inclinations is more likely to relate to shadow IT mechanisms. Conversely, individuals lacking IT proficiency may lack interest in automation tasks while having a preference for 'manual methods. Hence, employees with IT knowledge are more prone to using shadow IT during stressful circumstances.

Consequently, it can be deduced that employees who are not under strain and possess IT knowledge might not extensively utilise shadow IT. Similarly, employees lacking IT knowledge may not effectively engage with IT during stressful situations. This reaffirms the study's proposition that individuals inclined towards shadow IT are likelier to interact with shadow IT than those without IT expertise. For example, access to comprehensive instructional materials will augment employees' knowledge. As a result, employees who are knowledgeable in IT are more likely to engage with shadow IT mechanisms compared to their counterparts with limited IT expertise.

Studies have shown that stress causes reduced motivation. Employees with low job efficacy are highly likely to be exhausted (Broeck et al., 2010). When highly trained and knowledgeable employees are in situations where they lack the means to achieve their job goals and aspirations, they may perceive job stress. To deal with the negative emotions that limit their capacity to fulfil their goals and progress, innovating ways of achieving the means of dealing with work stress may become the solution. This can

explain their usage of shadow IT. Thus, it justifies the mediating impact of strain as an intermediary in the relationship between SETA and employee shadow IT usage.

5.3.4.3 The mediating influence of strain on work overload and shadow IT usage

The result of this study did not confirm the mediating impact of strain on the relationship between work overload and shadow IT usage. Although there is a positive relationship between work overload and shadow IT usage, this study reveals that strain is not an intermediary. It is, therefore, imperative to examine the potential reasons for this lack of mediation effect of strain in this relationship.

One plausible explanation for the insignificant mediating role of strain could be other intervening factors that influence the relationship between work overload and shadow IT usage. It is conceivable that additional variables not considered in this study may contribute to employees' decision to shadow IT practices independently of the strain induced by work overload.

The diverse ways individuals cope with work overload may contribute to the lack of significance of mediation. While some employees may experience strain and subsequently turn to shadow IT as a coping mechanism, others may have alternative coping strategies that do not involve shadow IT tools. Individual differences in coping mechanisms could mitigate the mediating role of strain in this context.

5.3.4.4 Mediating influence of strain on work pressure and Shadow IT usage

The result of this study did not confirm the mediating impact of strain on work pressure and shadow IT usage. Hence, the hypothesis is not accepted. Despite initial expectations that work pressure would lead to strain, which would mediate the relationship with shadow IT usage, the statistical analysis indicates an insignificance

in this mediating process. This warrants understanding the potential reason behind the lack of mediation.

The organisation's support and the IT infrastructure's effectiveness could also influence the relationship. Suppose the organisation has adequate resources and supportive measures to help employees cope with work pressure. In that case, the strain induced by such pressure might be mitigated, reducing the perceived need for shadow IT usage.

5.3.4.5 Overview of the Mediating Impact of Strain

While strain mediates the relationship between two structural factors (IT accessibility and SETA) and shadow IT usage, its mediating impact on two factors (work overload and work pressure) was not confirmed. In addition, IT structures should be user-friendly. User-friendly interfaces can minimise employee distress. Employees become stressed with the system when IT structures are too complicated. Thus, they can become strained. Consequently, they may look for alternatives that are easier to work with. Thus, predicting their shadow IT usage.

Strain may be reduced if organisations establish suitable IT structures, such as a responsive IT helpdesk that can promptly address technical issues relating to IT services (Chittibabu Govindarajulu, 2002; Wang et al., 2011). While a poor IT helpdesk and troubleshooting system can cause increased strain, quickly resolving IT-related problems can boost employees' moods. When employees' frustration with the IT structures is promptly resolved, their propensity to seek alternative shadow IT may be reduced. This may explain the justification for the mediating impact of strain on IT accessibility and shadow IT usage.

This implies that organisations should implement structures for employee feedback on their IT structures and IS systems (Carpentieri et al., 2016; Peng et al., 2011; Tungjitnob et al., 2020). Regular surveys on IT usability and accessibility will help organisations identify loopholes in the IS. When there are unaddressed loopholes in IT structures, employees become strained. An unaddressed IT problem may become a stress-inducing factor in the organisation. When left unfixed, employees may innovate ways to avoid loopholes, and the answer may lie in their usage of shadow IT. Thus, justifying the significant mediating impact of strain on IT accessibility and employee shadow IT usage.

Organisations should also endeavour to upgrade their IT systems to the latest, thus reducing IT obsolescence (Setor & Joseph, 2015). Employees working with outdated IT structures may become strained. A slow and weak system frustrates employees by increasing their stress levels. The need to cope with the backlog of IT-related tasks may also influence employees to use shadow IT. This may also be a plausible justification for the significant mediating impact of strain on the relationship between structural factors and employee shadow IT usage.

Finally, organisations should institute a collaborative structure. Fostering collaborations between the various departments within the organisation and the IT department will assist in aligning the goals of the various departments with the organisation's goals (Ahmed et al., 2020; Newswire, 2014; Pateman et al., 2016). In addition, the collaboration will empower the IT department with information on the IT needs of the various departments. Hence, IT structures tailored towards the specific

needs of each of the departments can be provided by the IT department. Employees with legal access to means of achieving their work tasks may have reduced strain. Also, IT structure is a form of increasing cognitive resources. Employees with high cognitive resources may have reduced mental strain. Thus reducing their propensity to relate to shadow IT mechanisms. Thus, eliminating shadow IT usage in organisations will translate to improved IS security, reduced IS threats, and stronger IS. This will reduce financial and non-financial losses that might be incurred due to a vulnerable IS structure.

5.4 Conclusion

Based on strain theory, this study examined the relationships between organisational structural factors, strain, and employee shadow IT usage. Strain theory is a sociology and psychology-based theory used to examine the effects of societal imbalances on social strain and societal deviant behaviours. Hence, this study replicated the strain theory in the organisation IS by developing an extended strain theory model and empirically testing the model.

The structural factors examined by this study are IT accessibility, security education, training and awareness (SETA), work overload, and work pressure. Four research objectives have been set for this study. The first objective examined the influence of the structural factors on employee shadow IT usage. The second objective examines impact of strain on employee shadow IT usage. The third objective investigated the structural factors' impact on employees' strain. The fourth objective examined how

strain mediates the relationships between the structural factors and employee shadow IT usage.

The result of the proposed model is presented in Figure 5.1. The result reveals that strain and three structural factors directly influence employee shadow IT usage. These structural factors include IT accessibility, work overload, and work pressure. This result is consistent with prior studies on the extrinsic and intrinsic factors influencing employee IS compliance behaviour and studies examining employees' deviant behaviours.

The result also shows a significant relationship between the structural (IT accessibility and SETA) and strain. Moreover, strain mediates the relationship between two structural factors (IT accessibility and SETA) and shadow IT usage. In essence, employees may become frustrated and mentally drained when the structures within the IS are lacking. This is reflected in frustration with the system, inability to manage their cognitive resources, and waste of cognitive resources on mechanical activities. The result of the converging model of strain theory in the shadow IT context is presented in Figure 5.1.

All the expected relationships developed for this study were tested using PLS-SEM. The result was based on the data collected from employees in Nigeria. The result reveals that employees tend to use shadow IT to complete their tasks in certain circumstances. By establishing the usage of the strain theory in IS literature, this study adds to the existing studies on shadow IT. Studies on shadow IT are at their emerging and growth stage.

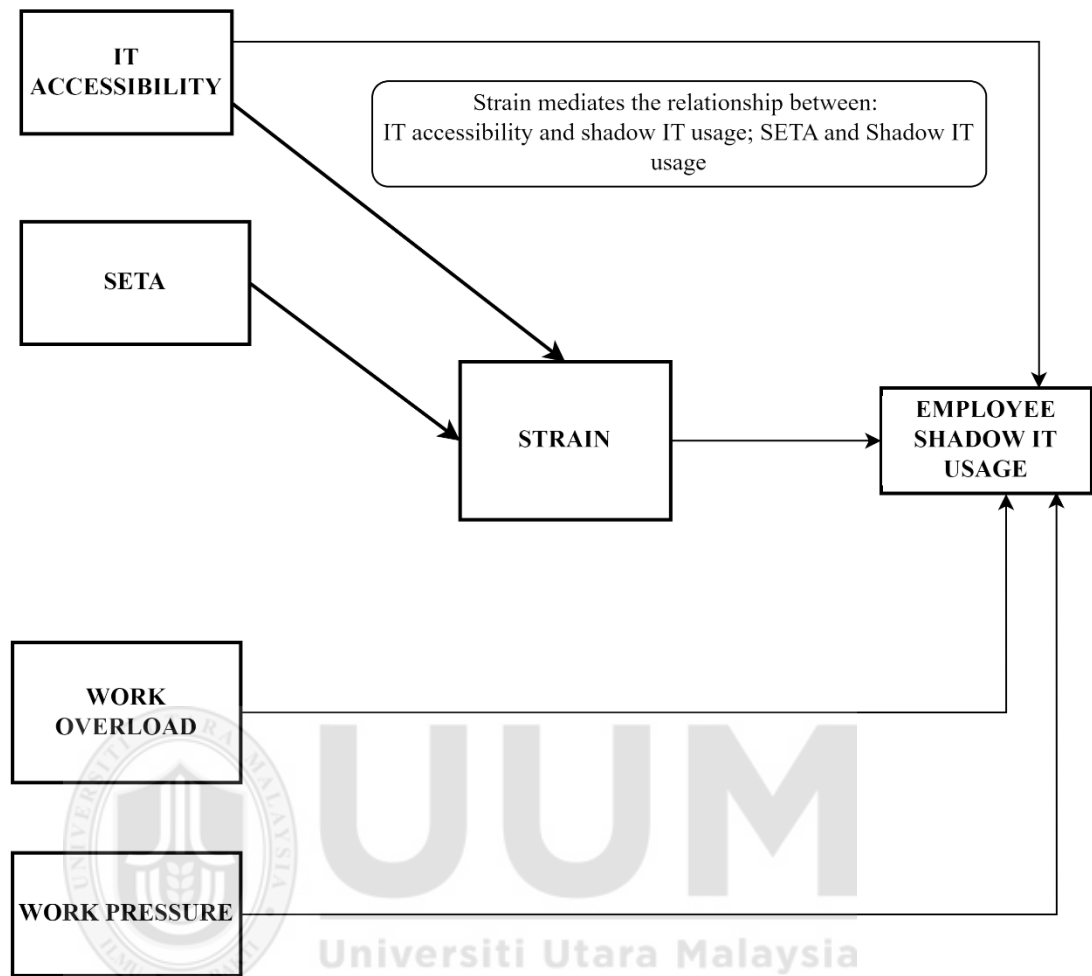


Figure 5.1
Extended strain theory model in shadow IT usage context.

Therefore, this study established the importance of IT structural factors in organisations, including physical structures, knowledge impartation structures, and human relationship structures. The imbalances in these may affect the mental and psychological well-being of employees. Moreover, structural factors and employees' psychological state directly influence their deviant behaviours.

Organisations are therefore encouraged to provide IT structures that will aid employee activities. This will reduce the employee usage of shadow IT. Some of these structures

include providing internet access within the organisation and employees' knowledge and developmental capabilities. In addition, organisations should establish SETA structures guiding organisation IT usage among employees, encourage healthy work relationships among their workforce, and have a balanced workload structure. These structures will reduce the work-related strain and employee shadow IT usage.

5.5 Implications of this Research

This study examines the effects of structural factor imbalances on employee shadow IT usage in organisations based on strain theory. This study has many implications regarding its theoretical, methodological, practical, or managerial aspects. This section discusses the three implications as they relate to this study. These implications are discussed in the sub-sections.

5.5.1 Theoretical Implication

The findings of this study have made significant contributions to the existing literature and theoretical framework in several ways. Although previous research has extensively examined the factors motivating employee deviant behaviours within an organisational context, this study specifically focuses on a deviant behaviour known as "shadow IT." While there are limited empirical studies on shadow IT, these existing studies are currently insufficient to comprehensively understand shadow IT behaviour. Consequently, previous research has called for more empirical investigations into this phenomenon. This study responds to this call by adding to the available empirical research, enriching the literature, and enhancing the understanding of shadow IT.

Moreover, this study makes a significant theoretical contribution to the literature on shadow IT by examining its usage through the lens of strain theory, addressing a notable gap in understanding IS deviant behaviour. While prior research has predominantly utilised theoretical perspectives such as neutralisation, deterrence (Haag & Eckhardt, 2015; Silic et al., 2017), and social presence theory (Mallmann & Maçada, 2017), this study uniquely integrates both structural/social and psychological factors into the analysis of shadow IT usage. Strain theory is particularly suitable for this investigation as it comprehensively examines socio-structural and psychological dimensions, explicitly focusing on the concept of "strain."

By applying strain theory, this study offers a nuanced understanding of how imbalances within organisational factors and individual psychological pressures contribute to shadow IT usage. This dual perspective enriches the existing literature on shadow IT by incorporating the interplay between structural influences and psychological motivations, paving the way for a more holistic approach to understanding shadow IT within organisations.

In addition, this study contributes to the existing knowledge by expounding on the theoretical understanding of general strain theory. This research conceptualised strain theory within the context of shadow IT by developing a theoretical model and empirically testing it. Based on the strain theory model, the conceptual framework used in this study identifies shadow IT as the deviant behaviour and strain as the mediator. Structural imbalances are represented by exogenous constructs specific to organisations' IT systems. Antecedents, including IT accessibility, Security Education Training and Awareness (SETA), work overload, and work pressure, were

incorporated into the model to enhance employee shadow IT usage's understanding and explanatory power. This approach provides a more comprehensive insight into the factors driving shadow IT behaviours within organisations.

Furthermore, this study established the relationships between the constructs. Firstly, the research confirmed the connections between the exogenous variables (IT accessibility, work overload, and work pressure) and the endogenous construct (shadow IT usage). The findings revealed that these structural factors directly influence shadow IT usage. Additionally, the study demonstrated the relationships between the structural factors (IT accessibility and SETA) and strain, providing insights into the interplay between organisational structural factors and strain. Hence, this study highlights how external factors can become stressors, directly affecting an individual's mental state.

Also, the research establishes the direct relationship between strain and the endogenous construct (shadow IT usage). It identifies the mediating role of strain as an intermediary between the exogenous and endogenous constructs. This comprehensive analysis enriches understanding of how structural imbalances within organisations contribute to shadow IT behaviours through the mediation of strain, offering a nuanced perspective on understanding shadow IT usage in organisational settings.

Finally, the results of this empirical research confirm the relationships among the various constructs. The exogenous construct of IT accessibility is shown to have a direct negative relationship with shadow IT usage. This finding aligns with previous

studies that have identified IT accessibility as a motivating factor influencing employee shadow IT usage. Additionally, IT accessibility is established as an antecedent for strain. When mediated by strain, the relationship between IT accessibility and shadow IT was also confirmed.

These results support the idea that improving IT accessibility within an organisation can reduce the incidence of shadow IT by alleviating the strain experienced by employees. By understanding and addressing the factors contributing to shadow IT, organisations can develop more effective strategies to manage and mitigate its occurrence, ultimately fostering a more secure and compliant IT environment.

Regarding SETA, although SETA does not exhibit a significant direct relationship with shadow IT, its influence becomes significant when mediated by the presence of strain. Moreover, according to these findings, SETA is established as an antecedent of strain. This finding suggests that inadequate security education and training can contribute to the stress experienced by employees, which in turn influences their usage of shadow IT.

Additionally, although work overload and work pressure were established to directly influence employee shadow IT usage, both had no significant relationship with strain. Moreover, when mediated by strain was present, the relationship remained unaffected.

By extending strain theory to include organisational structural factors and empirically testing the model with primary data collected from Nigerian employees, this research confirms the applicability of strain theory in understanding employee shadow IT

usage. The findings underscore that organisational structural factors, mediated by strain, significantly influence shadow IT behaviours. This extension of strain theory provides a more comprehensive framework for addressing the challenges of shadow IT within organisations. It highlights the necessity of considering structural and psychological factors to develop effective management strategies. From the findings of this study, it can be confirmed that strain theory offers a valuable lens for understanding and managing employee shadow IT usage, paving the way for future research and practical applications in organisational settings.

5.5.2 Managerial/practical Implication

This study provides managerial and practical contributions to stakeholders, including organisations, policymakers, and individuals. Managerially, this study reveals the importance of the imbalances within an organisation's structural factors on employees' mental state and behaviour. This study shows the importance of the organisation's IT accessibility to employees' well-being. This study indicates that management has a role in providing a conducive environment for employees, and once the environment is not conducive, employees become stressed, and their behaviours are influenced.

This study highlights that IT accessibility significantly influences employee shadow IT usage. By examining previous literature on the risks associated with shadow IT, the study underscores the necessity for organisations to be cognisant of how the provision of IT structures affects employee behaviour. Inadequate IT structures can lead employees to resort to shadow IT, which poses security risks and other threats to the organisation. Therefore, organisations should ensure the availability of official IT infrastructures, such as organisational email systems, to facilitate secure

communication and data archiving, thereby mitigating the risks associated with shadow IT usage.

Organisations must, therefore, be mindful of the risks associated with employees transmitting organisational data through individual platforms such as personal emails and social media. These platforms often have weaker security and privacy configurations than the organisation's IT systems, potentially exposing sensitive information to security breaches.

Investing in robust IT structures such as cloud information systems, office assistive technologies, and effective task-oriented software can significantly mitigate shadow IT usage within organisations. By providing employees with secure and efficient tools that meet their operational needs, organisations can reduce the motivation and necessity for employees to resort to unauthorised IT solutions. These proactive measures enhance organizational efficiency and strengthen security protocols, safeguarding sensitive data from potential vulnerabilities associated with unauthorised IT practices.

In addition, this study shows the impact of security education, training, and awareness on Strain and behaviour. This implies that organisations should provide development materials and training for employees. Once there is obsolete knowledge, employees may be limited in competing fairly with colleagues from within or outside, causing strain. There is, therefore, the need for updated training and other knowledge-impacting structures for employees in the organisations.

Moreover, these knowledge-impacting structures should be structured so employees can benefit maximally from them and prevent knowledge overload, which may also lead to mental strain. Some ways SETA can be structured include having a structured plan for SETA activities. Employees should be aware of such programs to be physically and mentally prepared. Also, the hours of SETA activities should be controlled; hands-on activities can help employees learn better. Also, organisations can implement the use of IT devices in learning. This includes providing access to SETA brochures, videos, and materials so employees can refer to them when they need to relearn. These will assist the organisations in maximising the benefits associated with the SETA structural investments.

In addition, the study shows that work pressure is an imbalance that influences employees' usage of shadow IT. This implies that organisations should discourage employee's usage of shadow IT. Moreover, the organisation may implement a structure that will prevent the usage of shadow IT. This includes blocking some ports in organisation IS, whitelisting, and blacklisting of some sites, among others. This may reduce employee shadow IT usage. In cases where management is neutral concerning employee shadow IT usage, there is a high chance that employees will interact with it since this study reveals that work pressure is a factor that influences employee shadow IT usage.

This study has implications for management on how structural factors impact employee strain. The imbalances caused by an organisation's structural systems may affect the employees negatively, causing them mental strain. Furthermore, this study

shows that employees' mental and psychological strain leads to their deviant behaviours.

Hence, this study has policy-wise implications by empirically contributing to materials those saddled with the responsibility of creating policies can refer to when making policies regarding organisation IS and employees' welfare. Policymakers may consider referring to this research when the need for promoting employees' physical and psychological welfare arises. Furthermore, policies on IT investment, accessibility and usage should be encouraged. Employees should have access to good and fast internet which will eliminate spending their income on purchasing data when doing official tasks. Also, this will save employees the stress of searching for the most effective and efficient applications and systems such as cloud repositories to use while carrying out official tasks.

In addition, policies on employees' developmental structures should be implemented. This consists of education, training, and awareness creation. Once employees accept technology, their technology affinity increases. Once an IT-inclined employee lacks access to IT, their strain increases, and their usage of shadow IT will be fostered. Therefore, organisations should be proactive regarding their IS data protection by instituting structures to discourage shadow IT usage. This will improve IS security and mitigate losses.

5.6 Limitations of the Study and Suggestions for Future Research

Despite the contributions and findings of this research, it also has limitations. First, this study collected data from Nigeria, a developing economy. Hence, although individual technology acceptance is high, there is still a deficiency in organisational investment in IT structures. Therefore, shadow IT usage, as shown in this study, may differ in the perceptions of countries with high corporate investments in IT structures. Also, the willingness to report may distort the findings of this research. Therefore, future research can examine this study based on different countries, economies, and organisation IT investment contexts.

Also, this study is not based on a specific industry or professional level at work. This study focused on the general public's (employees') perception of their shadow IT usage at work. Hence, future studies may examine employees' shadow IT usage in specific sectors, such as private and public sectors. In addition, future studies may examine shadow IT usage in specific professions, such as Accounting. Also, shadow IT usage may be examined at specific organisational and professional levels, including administrative and managerial. This will broaden the shadow IT literature base and contribute to the growth of its studies. This will assist future studies by providing more references and empirical studies. Also, this will increase the awareness of the shadow IT phenomenon in organisations.

Due to the nature of this study, stratified sampling technique was employed in data collection to enhance the generalisability of the findings (Albert et al., 2010; Baxter et al., 2015). However, within each stratum, a convenience sampling method was utilized, which may reduce the overall generalizability of the study. Convenience

sampling, while efficient and cost-effective, is subject to several limitations that can impact the validity and reliability of the results. It often leads to sample bias, as the sample may not accurately represent the entire population, limiting the extent to which findings can be generalized (Etikan, Musa, & Alkassim, 2016).

Future research should consider using alternative data collection techniques that do not compromise the study's generalisability, such as random or systematic sampling methods. Moreover, the results may vary significantly if respondents are selected from specific industries or professional levels. Therefore, future studies should explore this topic within distinct sectors and professional groups to ensure a more comprehensive understanding (Cheah & Ramayah, 2015; Hair et al., 2010). By acknowledging these limitations and suggesting directions for future research, this study aims to provide a foundation for more robust and generalisable findings in subsequent investigations.

In addition, the independent variables for this study are based on the review of previous literature. Hence, this study extended the strain theory by examining constructs based on the literature review, not those already discussed and constructed by the existing strain theory models. Future studies can examine the extended model of strain theory as theorised by this study. This includes the four exogenous variables of IT accessibility, SETA, work pressure, and work overload. The strain and endogenous variable of shadow IT may be examined in different contexts. This will make this study comparable. Future studies may also incorporate other structural factors which were not examined by this research.

Moreover, future studies may examine shadow IT through other theoretical lenses beyond those assessed in this study or prior research. By exploring alternative theories, researchers can gain a more comprehensive understanding of the factors driving shadow IT behaviour and develop more effective management strategies. Integrating various theoretical perspectives will enrich the existing literature, offering more profound insights into the complex dynamics of shadow IT within organisations.

Finally, this study employed a cross-sectional design, collecting data at a single time without follow-ups due to privacy concerns and the COVID-19 movement control order. Data was gathered from Nigeria's six geopolitical zones, where regional insecurities made longitudinal studies difficult. Additionally, the study was designed to be completed within a specified timeframe, unlike longitudinal research. Future studies with better support structures might consider longitudinal approaches to observe the evolution of shadow IT behaviours over time and the long-term effects of organisational interventions.

REFERENCES

- Abbas, M., & Alghail, A. (2021). The impact of mobile shadow IT usage on knowledge protection: an exploratory study. *VINE Journal of Information and Knowledge Management System*. *VINE Journal of Information and Knowledge Management Systems*, 51(1), 150–165.
- Abdi, H., Chin, W. W., Vinzi, V. E., Russolillo, G., & Trinchera, L. . (Eds.). (2013). *New perspectives in partial least squares and related methods* (Vol. 56). Springer Proceedings in Mathematics and Statistics. Springer.
- Abdul Talib, Y., & Dhillon, G. (2015). Employee ISP compliance intentions: an empirical test of empowerment. In *Proceedings of the Thirty Sixth International Conference on Information Systems* (ICIS 2015), Fort Worth, TX.
- Abubakre, M., Zhou, Y., & Zhou, Z. (2022). The impact of information technology culture and personal innovativeness in information technology on digital entrepreneurship success. *Information Technology and People*, 35(1), 204–231.
- Adenekan, T. E., & Okuonghae, N. (2023). Copyright laws and information technology usage as factors influencing information services delivery in university libraries in Edo State, Nigeria. *Folia Toruniensia*, 23, 119–138.
- Adenuga, K. I., Mbarika, V. W., & Omogbadegun, Z. O. (2019). Technical Support: Towards Mitigating Effects of Computer Anxiety on Acceptance of E-Assessment Amongst University Students in Sub-Saharan African Countries. *IFIP Advances in Information and Communication Technology*, 558, 48–72.

- Adeoti, M. O., Shamsudin, F. M., & Yen Wan, C. (2017). Workload, work pressure and interpersonal deviance in academia: The mediating role of neutralisation. *International Journal of Human Resource Studies*, 7(4), 1.
- Adetayo, A. J. (2021). Leveraging bring your own device for mobility of library reference services: The Nigerian perspective. *Reference Librarian*, 62(2), 106–125.
- Agapito, G., & Cannataro, M. (2023). An overview on the challenges and limitations using cloud computing in healthcare corporations. *Big Data and Cognitive Computing*, 7(2).
- Agnew, R. (1992). Foundation for a general strain theory of crime and delinquency. *Criminology*, 30(1), 47–88.
- Agnew, R. (2015a). Strain theories. In G. Ritzer (Ed.), *The Blackwell Encyclopedia of Sociology* (pp. 1938–1942). John Wiley & Sons.
- Agnew, R. (2015b). Using general strain theory to explain crime in Asian societies. *Asian Journal of Criminology*, 10(2), 131–147.
- Agnew, R., & Agnew, R. (2013). When criminal coping is likely: An extension of general strain theory. *Asian Journal of Criminology*, 8(1), 37–41.
- Agnew, R., Cullen, F. T., Burton, V. S. Jr., Evans, T. D., & Dunaway, R. G. (1996). A new test of classic strain theory. *Justice Quarterly*, 13(4), 681–704.
- Ahmed, R. R., Streimikiene, D., Channar, Z. A., Soomro, R. H., & Streimikis, J. (2021). E-Banking Customer Satisfaction and Loyalty: Evidence from Serial Mediation through Modified E-S-QUAL Model and Second-Order PLS-SEM. *Engineering Economics*, 32(5), 407–421.

- Ahmed, U., Petri, I., Rana, O., Raza, I., & Hussain, S. A. (2020). Federating cloud systems for collaborative construction and engineering. *IEEE Access*, 8, 79908–79919.
- Ajani, O. A., & Oyekola, I. A. (2019). Reasons for public sector jobs preference in Nigeria. *African Research Review*, 13(1), 114.
- Akello, P., Beebe, N. L., & Choo, K.-K. R. (2021). The volitional insider threat at the intersection of the COVID-19 pandemic, the new work from home (nWFH) and cloud based applications. In *Proceedings of the 27th Annual Americas Conference on Information Systems (AMCIS)*.
- Akman, I., & Mishra, A. (2017). Factors influencing consumer intention in social commerce adoption. *Information Technology & People*, 30(2), 356–370.
- Alaminos-Torres, A., Martínez-Álvarez, J. R., Martínez-Lorca, M., López-Ejeda, N., & Marrodán Serrano, M. D. (2023). Fatigue, work overload, and sleepiness in a sample of Spanish commercial airline pilots. *Behavioural Sciences*, 13(4).
- Al-Badayneh, D. M., Alkrimeen, A. A., & Mesmar, M. (2019). Testing Agnew's general strain theory on drug use among college students in Jordan. *European Journal of Science and Theology*, 15(4), 71–85.
- Albers, M. J. (1995). Cognitive strain as a factor in effective document design. *Texas Tech University*.
- Albers, M. J. (1997). Cognitive strain as a factor in effective document design. In *Proceedings of the 15th Annual International Conference on Computer Documentation* (pp. 1–6).

- Albert, B., Tullis, T., & Tedesco, D. (2010). Chapter 2 - Planning the study. In B. Albert, T. Tullis, & D. Tedesco (Eds.), *Beyond the usability lab* (pp. 17–47). Morgan Kaufmann.
- Alfredo, G., Martín, G., Pablo, C. J., Nicolás, C., André, A., Néstor, T., & Falavigna, A. (2020). Access to technology and education for the development of minimally invasive spine surgery techniques in Latin America. *World Neurosurgery*.
- Alghnimi, A. A. W. M., Habeeb, L. M., & Kadhim, R. I. (2020). The mediating effect of employee engagement between sustainable HRM practices and job performance. *International Journal of Innovation, Creativity and Change*, 13(6), 643–659.
- Ali, M. I., & Kaur, S. (2019). BYOD secured solution framework. *International Journal of Engineering and Advanced Technology*, 8(6), 1602–1606.
- Allen, D., Burton, F. G., Smith, S. D., & Wood, D. A. (2017). Shadow IT use, outcome effects, and subjective performance evaluation. [Publication details needed].
- Alshaikh, M., Maynard, S. B., & Ahmad, A. (2020). Applying social marketing to evaluate current security education training and awareness programs in organisations. *Computers & Security*.
- Alsmadi, D., & Prybutok, V. (2018). Sharing and storage behaviour via cloud computing: Security and privacy in research and practice. *Computers in Human Behaviour*, 85, 218–226.
- Amponsah-Tawaih, K., & Adu, M. A. (2016). Work pressure and safety behaviours among health workers in Ghana: The moderating role of management commitment to safety. *Safety and Health at Work*, 7(4), 340–346.

- Anderson, J. C., Kellogg, J. L., & Gerbing, D. W. (1988). Structural equation modeling in practice: A review and recommended two-step approach. *Psychological Bulletin*, 103(3).
- Antonaccio, O., Smith, W. R., & Gostjev, F. A. (2015). Anomic strain and external constraints: A reassessment of Merton's anomie/strain theory using data from Ukraine. *International Journal of Offender Therapy and Comparative Criminology*, 59(10), 1079–1103.
- Appelbaum, S. H., Iaconi, G. D., & Matousek, A. (2007). Positive and negative deviant workplace behaviours: Causes, impacts, and solutions. *Corporate Governance: The International Journal of Business in Society*, 7(5), 586–598.
- Arnold, R., Edwards, T., & Rees, T. (2018). High-level sport. *Psychology of Sport & Exercise*.
- Arnold, R., Fletcher, D., & Daniels, K. (2016). Organisational stressors, coping, and outcomes in competitive sport. *Journal of Sports Sciences* 35(7), 1-1
- Asiya, S., Kazmi, Z., & Naarananoja, M. (2013). Collection of change management models: An opportunity to make the best choice from the various organisational transformational techniques. *Journal of Business & Economics*, 2(4), 44–57.
- Askew, O. A., Beisler, J. M., & Keel, J. (2015). Current trends of unethical behaviour within organisations. *International Journal of Management & Information Systems (IJMIS)*, 19(3), 107.
- Awang, Z. (2015). *SEM made simple: A gentle approach to learning structural equation modelling*. MPWS Rich Publication.

- Bakker, A. B., & Demerouti, E. (2007). The Job Demands-Resources model: State of the art. *Journal of Managerial Psychology*, 22(3), 309–328.
- Balkin, D. B., & Gomez-Mejia, L. R. (2002). Explaining the gender effects on faculty pay increases: Do the squeaky wheels get the grease? *Group & Organization Management*, 27(3), 352–373.
- Barki, H., Rivard, S., & Talbot, J. (2001). An integrative contingency model of software project risk management. *Journal of Management Information Systems*, 17(4), 37–69.
- Barlett, C. P., Madison, C. S., Heath, J. B., Dewitt, C. C., & Barlett, C. P. (2018). Please browse responsibly: A correlational examination of technology access and time spent online in the Barlett Gentile Cyberbullying model. *Computers in Human Behavior*.
- Barlow, J. B., Warkentin, M., Ormond, D., & Dennis, A. R. (2018). Don't even think about it! The effects of antineutralisation, informational, and normative communication on information security compliance. *Journal of the Association for Information Systems*, 19(8), 689–715.
- Baron, S. W. (2004). General strain, street youth, and crime: A test of Agnew's revised theory. *Criminology*, 42(2), 457–484.
- Baron, S. W. (2019). Strain, criminal propensity, and violence: Examining the role of the composite moderator in Agnew's extension to GST. *Crime & Delinquency*, 65(6), 801–821.
- Bauer, S., & Bernroider, E. W. N. (2017). From information security awareness to reasoned compliant action: Analyzing information security policy compliance in a large banking

- organisation. *ACM SIGMIS Database: The DATABASE for Advances in Information Systems*, 48(3), 44–68.
- Bauer, S., Bernroider, E. W. N., & Chudzikowski, K. (2017). Prevention is better than cure! Designing information security awareness programs to overcome users' non-compliance with information security policies in banks. *Computers & Security*, 68, 145–159.
- Baxter, K., Courage, C., & Caine, K. (2015). Chapter 5 - Choosing a user experience research activity. In K. Baxter, C. Courage, & K. Caine (Eds.), *Understanding your users* (2nd ed., pp. 96–112). Morgan Kaufmann.
- Becker, J. M., Cheah, J. H., Gholamzade, R., Ringle, C. M., & Sarstedt, M. (2023). PLS-SEM's most wanted guidance. *International Journal of Contemporary Hospitality Management*, 35(1), 321–346. Emerald Publishing.
- Beehr, T. A., & Bhagat, R. S. (1985). *Human stress and cognition in organisations: An integrated perspective*. Wiley-Interscience.
- Bhagat, K. B., Nelson, T. A., Moustafa, K., Ford Jr., D. L., & Billing, T. K. (2010). Organisational stress, psychological strain, and work outcomes in six national contexts: A closer look at the moderating influences of coping styles and decision latitude. *Cross Cultural Management: An International Journal*, 17(1), 10–29.
- Bhagat, V., Haque, M., & Jaalam, K. (2018). Excessive work pressure in universities often hampers the motivation of academic staff to work at their optimal level. *Journal of Datta Meghe Institute of Medical Sciences University*, 13(4), 220.

- Bhagat, V., Yasrul, I., Jayaraj, J., Husain, R., Khairi, C. H. E., & Aung, M. M. T. (2017). Emotional maturity among medical students and its impact on their academic performance. *Transactions on Science and Technology*, 4(1), 48–54.
- Bhutta, C. B. (2012). Not by the book: Facebook as a sampling frame. *Sociological Methods & Research*, 40(1), 57–88.
- Biocca, F., & Harms, C. (2002). Defining and measuring social presence: Contribution to the networked minds theory and measure. *Proceedings of the 5th Annual International Workshop on Presence*, 1–36.
- Biocca, F., Harms, C., & Gregg, J. (2001). The Networked Minds measure of social presence: Pilot test of the factor structure and concurrent validity. Paper presented at the 4th Annual International Workshop on Presence, Philadelphia, PA.
- Boateng, G. O., Neilands, T. B., Frongillo, E. A., Melgar-Quinonez, H. R., & Young, S. L. (2018). Best practices for developing and validating scales for health, social, and behavioural research: A primer. *Frontiers in Public Health*, 6, 149.
- Bock, G.-W., Zmud, R. W., Kim, Y.-G., & Lee, J.-N. (2005). Behavioral intention formation in knowledge sharing: Examining the roles of extrinsic motivators, social-psychological factors, and organizational climate. *MIS Quarterly*, 29(1), 87–111.
- Bonacchi, M., Marra, A., & Zarowin, P. (2019). Organisational structure and earnings quality of private and public firms. *Review of Accounting Studies*, 24(3), 1066–1113.
- Born, F., & Krönung, J. (2016). Deviant cloud usage in public institutions: A matter of personal innovativeness? Paper presented at the 24th European Conference on Information Systems, ECIS 2016.

- Bornstein, M. H., Jager, J., & Putnick, D. L. (2013). Sampling in developmental science: Situations, shortcomings, solutions, and standards. *Developmental Review*, 33(4), 357–370.
- Bosak, J., Coetsee, W. J., & Cullinane, S.-J. (2013). Safety climate dimensions as predictors for risk behaviour. *Accident Analysis & Prevention*, 55, 256–264.
- Bour, R., Soule-Dupuy, C., & Valles-Parlangeau, N. (2019). DEMOS: A design method for democratic information systems. In M. J., S. L. H., & V. N. T. Q. (Eds.), *11th International Conference on Knowledge and Systems Engineering, KSE 2019*. Institute of Electrical and Electronics Engineers Inc.
- Bourne, J. (2020). China cloud infrastructure services grew 67% in Q4 2019 says Canalys – As COVID-19 response praised. *TechForge Media*.
- Brailovskaia, J., Frahsek, M., & Margraf, J. (2022). Work overload and addictive social media use: A relationship with depression symptoms and life satisfaction. *Journal of Technology in Behavioral Science*, 7(3), 358–367.
- Broidy, L., & Santoro, W. A. (2017). General strain theory and racial insurgency: Assessing the role of legitimate coping. *Justice Quarterly*, 34(4), 1–28.
- Brown, S. (2010). Likert scale examples for surveys. *Iowa State University*, 1–4.
- Burns, A. J., Roberts, T. L., Posey, C., Bennett, R. J., & Courtney, J. F. (2018). Intentions to comply versus intentions to protect: A VIE theory approach to understanding the influence of insiders' awareness of organisational SETA efforts. *Decision Sciences*, 49(6), 1187–1228.

- Burt, J. (2016). Cisco helps businesses deal with shadow IT. *EWeek*, 1.
- Buttigieg, A. C. (2007). Work stressors, strains and hospital unit performance. *September*.
- Büyüközkan, G., Uztürk, D., & Maden, A. (2023). Influential factor analysis for cloud computing technology service provider. *Technological Forecasting and Social Change*, 192.
- Camacho, S., & Barrios, A. (2022). Teleworking and technostress: Early consequences of a COVID-19 lockdown. *Cognition, Technology & Work*, 24(3), 441–457.
- Carpentieri, M., Cerrato, A., Baldassarre, I., & Matarazzo, O. (2016). Effects of cognitive feedback, emotional induction, and social pressure on decisions related to cognitive performance with economic reward. In *Proceedings - International Conference on Tools with Artificial Intelligence, ICTAI 2016* (pp. 737–743).
- Castellano, N., Felden, C., & Pinsker, R. (2022b). Shadow IT behaviour of financial executives in Germany and Italy as an antecedent to internal data security breaches. *Proceedings of the Annual Hawaii International Conference on System Sciences*, 2022-Janua, 6312–6322. IEEE Computer Society.
- Cavana, R., Delahaye, B., & Sekaran, U. (2001). *Applied business research: Qualitative and quantitative methods*. John Wiley & Sons.
- Chae, H. C., Koh, C. E., & Prybutok, V. R. (2014). Information technology capability and firm performance: Contradictory findings and their possible causes. *MIS Quarterly: Management Information Systems*, 38(1), 305–326.

- Chamlin, M. B., & Cochran, J. K. (2007). An evaluation of the assumptions that underlie institutional anomie theory. *Theoretical Criminology*, 11(1), 39–61.
- Chang, C. C., & Yang, S. T. (2023). Interactive effects of scaffolding digital game-based learning and cognitive style on adult learners' emotion, cognitive load, and learning performance. *International Journal of Educational Technology in Higher Education*, 20(1).
- Chang, Y.-P., Lee, D.-C., Lee, Y.-H., & Chiu, M.-H. (2024). Nurses' perceived health and occupational burnout: A focus on sleep quality, workplace violence, and organisational culture. *International Nursing Review*.
- Chaudhary, R. (2019). Corporate social responsibility perceptions and employee engagement: Role of psychological meaningfulness, safety, and availability. *Corporate Governance (Bingley)*, 19(4), 631–647.
- Cheah, J. H., Roldán, J. L., Ciavolino, E., Ting, H., & Ramayah, T. (2021). Sampling weight adjustments in partial least squares structural equation modeling: Guidelines and illustrations. *Total Quality Management and Business Excellence*, 32(13–14), 1594–1613.
- Cheah, J.-H., Ali Memon, M., Chuah, F., Ting, H., & Ramayah, T. (2018). Assessing reflective models in marketing research: A comparison between PLS and PLSC estimates. *International Journal of Business and Society*, 19(1).
- Cheah, J.-H., Chuah, F., & Ting, H. (2016). *Partial least squares structural equation modeling (PLS-SEM) using SmartPLS 3.0: An updated and practical guide to statistical analysis* (1st ed.). Pearson Malaysia Sdn Bhd.

- Chen, O., Castro-Alonso, J. C., Paas, F., & Sweller, J. (2018). Extending cognitive load theory to incorporate working memory resource depletion: Evidence from the spacing effect. *Educational Psychology Review*, 30(2), 483–501.
- Chen, Y., Zhang, F., Wang, Y., & Zheng, J. (2020). Work–family conflict, emotional responses, workplace deviance, and well-being among construction professionals: A sequential mediation model. *International Journal of Environmental Research and Public Health*, 17(18), 1–19.
- Chilton, M. A., Hardgrave, B. C., & Armstrong, D. J. (2010). Performance and strain levels of IT workers engaged in rapidly changing environments: A person-job fit perspective. *Information Technology and Management*, 41(1), 8–35.
- Chin, W. W. (1998). *The partial least squares approach to structural equation modeling* (1st ed.). Psychology Press.
- Chin, W. W., Marcolin, B. L., & Newsted, P. R. (2003). A partial least squares latent variable modeling approach for measuring interaction effects: Results from a Monte Carlo simulation study and an electronic-mail emotion/adoption study.
- Chittibabu, G. (2002). The status of helpdesk support. *Communications of the ACM*, 45(1), 97–100.
- Choi, W. J., & Winterich, K. P. (2013). Can brands move in from the outside? How moral identity enhances out-group brand attitudes. *Journal of Marketing*, 77(2), 96–111.
- Chua, C. E. H., Storey, V. C., & Chen, L. (2014). Central IT or shadow IT? Factors shaping users' decision to go rogue with IT. In *Proceedings of the 35th International*

Conference on Information Systems: Building a Better World Through Information Systems.

Chua, Y. P. (2022). *A step-by-step guide: PLS-SEM data analysis using SmartPLS 4.*

Chuan, C. L. (2006). Sample size estimation using Krejcie and Morgan and Cohen statistical power analysis: A comparison. *Jurnal Penyelidikan IPBL*, 7(1), 78–86.

Churchill, G. A. (1999). *Marketing research: Methodological foundations*. Dryden Press.

Cousins, R., Mackay, C. J., Clarke, S. D., Kelly, C., Kelly, P. J., & McCaig, R. H. (2004). “Management standards” and work-related stress in the UK: Practical development. *Work & Stress*, 18(2), 113–136.

Couto, B. P., & Sayers, M. G. L. (2022). Crowd social pressure in the Brazilian soccer league: Testing home advantage and referees’ bias during the COVID-19 pandemic. *International Journal of Sport and Exercise Psychology*.

Cox, G. (2019). Managing the risks of shadow IoT. *Network Security*, 2019(1), 14–17.

Creswell, J. W., & Creswell, J. D. (2017). *Research design: Qualitative, quantitative, and mixed methods approaches* (4th ed.). Sage.

Creswell, J. D., Pacilio, L. E., Lindsay, E. K., & Warren, K. (2018). Brief mindfulness meditation training alters psychological and neuroendocrine responses to social evaluative stress. *Psychoneuroendocrinology*, 44, 1–12.

Cummings, S., Bridgman, T., & Brown, K. G. (2015). Unfreezing change as three steps: Rethinking Kurt Lewin’s legacy for change management.

- Dabbish, L. A., & Kraut, R. E. (2006). Email overload at work: An analysis of factors associated with email strain. In *Proceedings of the 2006 20th Anniversary Conference on Computer Supported Cooperative Work* (pp. 431–440).
- Date, P. E. (2018). *Electronic and information technology (EIT) accessibility policy* (Policy No. 4). Policy, 5.
- Davies, C., & Fisher, M. (2018). Understanding research paradigms. *Journal of the Australasian Rehabilitation Nurses Association*, 21(3), 21–25.
- De Vargas Pinto, A., Beerepoot, I., & Maçada, A. C. G. (2023). Encourage autonomy to increase individual work performance: The impact of job characteristics on workaround behavior and shadow IT usage. *Information Technology and Management*, 24(3), 233–246. Springer.
- De Vargas Pinto, A., Gastaud Maçada, A. C., & Labres Mallmann, G. (2018). Workaround behaviour in information systems research. *Revista de Gestão*, 25(4). Universidade de São Paulo.
- Demerouti, E., Bakker, A. B., & Bulters, A. J. (2004). The loss spiral of work pressure, work–home interference and exhaustion: Reciprocal relations in a three-wave study. *Journal of Vocational Behaviour*, 64(1), 131–149.
- Demerouti, E., Mostert, K., & Bakker, A. B. (2010). Burnout and Work Engagement: A Thorough Investigation of the Independency of Both Constructs. *Journal of Occupational Health Psychology*, 15(3), 209–222.
- Dewangan, R., & Verghese, M. (2018). Predictors of workplace deviant behaviour. *International Journal of Academic Research and Development*, 3(2), 974–977.

- Diestel, S., & Schmidt, K.-H. (2009). Mediator and moderator effects of demands on self-control in the relationship between work load and indicators of job strain. *Work & Stress*, 23(1), 60–79.
- Dincelli, E., & Chengalur-smith, I. (2020). Choose your own training adventure : designing a gamified SETA artefact for improving information security and privacy through interactive storytelling. *European Journal of Information Systems*, 29(6), 669–687.
- Dirgantari, P. (2023). Does Individual IT Experience Affect Shadow IT Usage? Empirical Evidence from Universities with Legal Entities in Indonesia. *Organizacija*, 56(3), 265–277.
- Dulock, H. L. (1993). Research Design: Descriptive Research. *Journal of Pediatric Oncology Nursing*, 10, 154–157.
- Durkheim, E. (1897). *Le suicide: Étude de sociologie*. Paris: Alcan.
- Dusek, G. A., Yurova, Y. V., & Ruppel, C. P. (2015). Using social media and targeted snowball sampling to survey a hard-to-reach population: A case study. *International Journal of Doctoral Studies*, 10, 279–299.
- Eldor, L. (2019). Erratum: Public Service Sector: The Compassionate Workplace-The Effect of Compassion and Stress on Employee Engagement, Burnout, and Performance. *Journal of Public Administration Research and Theory*, 29(4), 662.
- Etikan, I., Musa, S. A., & Alkassim, R. S. (2016). Comparison of Convenience Sampling and Purposive Sampling. *American Journal of Theoretical and Applied Statistics*, 5, 1-4.

- Farnworth, M., & Leiber, M. J. (2019). Strain theory revisited: Economic goals, educational means, and delinquency. *American Sociological Review*, 54(2), 263–274.
- Field, A. P. (2009). *Discovering statistics using SPSS: (And sex and drugs and rock 'n' roll)*. SAGE Publications.
- Firsty Arisya, K., Ruldeviyani, Y., Prakoso, R., & Lailatul Fadhilah, A. (2020). Measurement of information security awareness level: A case study of mobile banking (m-banking) users. In *Proceedings of the 5th International Conference on Informatics and Computing (ICIC 2020)*.
- Franchina, L., Inzerilli, G., Scatto, E., Calabrese, A., Lucariello, A., Brutti, G., & Roscioli, P. (2021). Passive and active training approaches for critical infrastructure protection. *International Journal of Disaster Risk Reduction*, 63, 102421.
- Francisco, A., Jack, S., Joana, A., & Juan, M. (2017). Innovation through shadow IT. *Journal of Information Technology*, 32(3), 202–217.
- Fürstenau, D., & Rothe, H. (2014). Shadow IT systems: Discerning the good and the evil. In *Proceedings of the 22nd European Conference on Information Systems (ECIS 2014)*.
- Fürstenau, D., Rothe, H., & Sandner, M. (2021). Leaving the shadow: A configurational approach to explain post-identification outcomes of shadow IT systems. *Business & Information Systems Engineering*, 63(2), 97–111.
- Gallani, S. (2017). Incentives, peer pressure, and behavior persistence. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.2897572>

- Ge, X., Turk, M., & Hung, W. (2019). Revisiting cognitive tools from a social and motivational perspective background: computers as cognitive tools. *Australasian Journal of Educational Technology*, 35(2), 39–51.
- Ghali-Zinoubi, Z., Amari, A., & Jaoua, F. (2021). E-learning in the era of COVID-19 pandemic: Impact of flexible working arrangements on work pressure, work–life conflict, and academics' satisfaction. *Vision: The Journal of Business Perspective*, 25(4), 489–501.
- Ghasemi, F., Kalatpour, O., Moghimbeigi, A., & Mohhamadfam, I. (2018). A path analysis model for explaining unsafe behavior in workplaces: The effect of perceived work pressure. *International Journal of Occupational Safety and Ergonomics*, 24(2), 303–310.
- Ghosh, D., Sekiguchi, T., & Fujimoto, Y. (2020). Psychological detachment: A creativity perspective on the link between intrinsic motivation and employee engagement. *Personnel Review*.
- Gill, R. (2010). Change management—or change leadership? *Journal of Change Management*, 10(1), 37–41.
- Giwah, A. D. (2018). User information security behavior towards data breach in Bring Your Own Device (BYOD) enabled organizations leveraging protection motivation theory. In *Proceedings of SoutheastCon 2018* (pp. 1–5).
- Gorter, R., Centrum, A., & Amsterdam, T. (2019). Work stress and burnout among dental hygienists. *Journal of Occupational Health Psychology*.

- Goswami, S., & Geetha, N. (2020). Addressing Shadow IT Issues During COVID-19 Crisis. *Bank Info Security*. <https://www.bankinfosecurity.com/addressing-shadow-issues-during-covid-19-crisis-a-14137>
- Gould, D., Guinan, D., Greenleaf, C., Medbery, R., & Peterson, K. (1999). Factors affecting Olympic performance: Perceptions of athletes and coaches from more and less successful teams. *The Sport Psychologist*, 13(4), 371–394.
- Gozman, D., & Willcocks, L. (2018). The emerging Cloud Dilemma: Balancing innovation with cross-border privacy and outsourcing regulations. *Journal of Business Research*, 97, 235–256.
- Grassegger, T., & Nedbal, D. (2021). The role of employees' information security awareness on the intention to resist social engineering. *Procedia Computer Science*, 181(2019), 59–66.
- Gulseren, D. B., Thibault, T., & Kelloway, E. K. (2019). The role and importance of leadership in creating psychologically healthy workplaces. In S. L. L. & K. L. (Eds.), *Creating psychologically healthy workplaces* (pp. 197–214). Springer.
- Guo, K. H. (2013). Security-related behaviour in using information systems in the workplace: A review and synthesis. *Computers & Security*, 32, 242–251.
- Güven-Lisaniler, F., Tuna, G., & Nwaka, I. D. (2018). Sectoral choices and wage differences among Nigerian public, private and self-employees. *International Journal of Manpower*, 39(1), 2–24.

- Györy, A., Cleven, A., Uebernickel, F., & Brenner, W. (2012). Exploring the shadows: IT governance approaches to user-driven innovation. In *ECIS 2012 - Proceedings of the 20th European Conference on Information Systems*.
- Haag, S., & Eckhardt, A. (2014). Normalizing the shadows: The role of symbolic models for individuals' shadow IT usage. In *35th International Conference on Information Systems: Building a Better World Through Information Systems (ICIS 2014)*.
- Haag, S., & Eckhardt, A. (2015). Justifying shadow IT usage. In *Pacific Asia Conference on Information Systems (PACIS) 2015 - Proceedings*.
- Haag, S., & Eckhardt, A. (2017). Shadow IT. *Business and Information Systems Engineering*, 59(6), 469–473.
- Haag, S., Eckhardt, A., & Schwarz, A. (2019). The acceptance of justifications among shadow IT users and nonusers: An empirical analysis. *Information and Management*, 56(5), 731–741.
- Haag, S., Eckhardt, A., & Venkatesh, V. (2022). Deviant affordances: When tensions, deadlocks, and nonconformance generate performance. *MIS Quarterly: Management Information Systems*, 46(4), 2111–2162.
- Hadzibajramovic, E., Ahlborg, G., Grimby-Ekman, A., & Lundgren-Nilsson, Å. (2015). Internal construct validity of the stress-energy questionnaire in a working population: A cohort study. *BMC Public Health*, 15(1), 1–9.
- Hair, J. F. (2021). Next-generation prediction metrics for composite-based PLS-SEM. *Industrial Management and Data Systems*, 121(1), 5–11.

- Hair, J. F., Howard, M. C., & Nitzl, C. (2020). Assessing measurement model quality in PLS-SEM using confirmatory composite analysis. *Journal of Business Research*, 109, 101–110.
- Hair, J. F., Hult, G. T. M., Ringle, C. M., Sarstedt, M., Danks, N. P., & Ray, S. (2021). *An introduction to structural equation modeling*. Sage Publications.
- Hair, J. F., Gabriel, M. L. D. S., da Silva, D., & Braga Junior, S. (2019). Development and validation of attitudes measurement scales: Fundamental and practical aspects. *RAUSP Management Journal*, 54(4), 490–507.
- Hair, J. F., Ringle, C. M., & Sarstedt, M. (2013). Partial least squares structural equation modeling: Rigorous applications, better results, and higher acceptance. *Long Range Planning*, 46(1–2), 1–12. Elsevier Ltd.
- Hair, J. F., Sarstedt, M., Hopkins, L., & Kuppelwieser, V. G. (2014). Partial least squares structural equation modeling with R. *European Business Review*, 26(2), 106–121.
- Hair, J. F., Sarstedt, M., Ringle, C. M., & Mena, J. A. (2012). An assessment of the use of partial least squares structural equation modeling in marketing research. *Journal of the Academy of Marketing Science*, 40(3), 414–433.
- Hamizah, N., Ramli, H., Alavi, M., & Mehrinezhad, S. A. (2018). Academic stress and self-regulation among university students in Malaysia: Mediator role of mindfulness. *Behavioural Sciences*, 8(12).
- Han, J.-Y., & Kim, Y.-J. (2015). Investigating psychological factors affecting information security compliance intention: A convergent approach to information security and organizational citizenship behavior. *Journal of Digital Convergence*, 13(8), 133–144.

- Hanaysha, J. (2016). Examining the Effects of Employee Empowerment, Teamwork, and Employee Training on Organisational Commitment. *Procedia - Social and Behavioural Sciences*, 229, 298–306.
- Hasnat, R., & Philbin, S. P. (2021). Understanding the communication and collaboration challenges encountered by technology managers. *International Journal of Knowledge Management Studies*, 12(1), 80–100.
- Hatashima, T., & Sakamoto, Y. (2017). Study on the effect of company rules and regulations in telework involving personal devices. *IEICE Transactions on Information and Systems*, E100-D(10), 2458–2461.
- Henseler, J. (2017). Partial least squares path modeling. In *Handbook of partial least squares* (pp. 361–381). Springer.
- Hinduja, S., & Patchin, J. W. (2013). Social influences on cyberbullying behaviors among middle and high school students. *Journal of Youth and Adolescence*, 42(5), 711–722.
- Horton, R. (2020). Offline: COVID-19—bewilderment and candour. *The Lancet*, 395(10231), 1178.
- Hovav, A., & Putri, F. F. (2016). This is my device! Why should I follow your rules? Employees' compliance with BYOD security policy. *Pervasive and Mobile Computing*, 32, 35–49.
- Hu, S., Hsu, C., & Zhou, Z. (2024). Understanding employees' perceptions of SETA events: The role of pedagogical and communication approaches. *Internet Research*, 34(2), 294–319.

- Huber, M., Zimmermann, S., Rentrop, C., & Felden, C. (2017). The influence of shadow IT systems on enterprise architecture management concerns. In *Lecture Notes in Business Information Processing* (Vol. 299, pp. 461–477). Springer.
- Huber, M., Zimmermann, S., Rentrop, C., & Felden, C. (2018a). Conceptualizing shadow IT integration drawbacks from a systemic viewpoint. *Systems*, 6(4), 42.
- Huber, M., Zimmermann, S., Rentrop, C., & Felden, C. (2018b). Toward a conceptual decision framework for shadow IT integration. *Proceedings of the Americas Conference on Information Systems 2018: Digital Disruption*.
- Hulsebosch, M. A. C. (2016). *Cloud strife: An analysis of cloud-based shadow IT and a framework for managing its risks and opportunities*. University of Twente.
- Hunter, A., & Boersen, R. (2017). Out from the shadows: Encouraging girls in New Zealand into IT careers. *Proceedings of the 2017 ACM Conference on Innovation and Technology in Computer Science Education, ITiCSE 2017* (pp. 257–262). ACM.
- Hussain, S. T., Lei, S., Akram, T., Haider, M. J., Hussain, S. H., & Ali, M. (2016). Kurt Lewin's process model for organizational change: The role of leadership and employee involvement: A critical review. *Suma de Negocios*, 7, 1–7.
- Ibrahim, F., Zakaria, E., Nen, S., Sarnon, N., Hassan, N., & Mursidan, S. M. (2020). Social pressure among former drug addicts after discharge from drug rehabilitation centre. *International Journal of Psychosocial Rehabilitation*, 24(4), 4517–4525.
- Ifinedo, P. (2018). Effects of organisation insiders' self-control and relevant knowledge on participation in information systems security deviant behaviour. In *Proceedings of the*

2017 ACM SIGMIS Conference on Computers and People Research (pp. 79–86).
ACM.

In, J. (2017). Introduction of a pilot study. *Korean Journal of Anesthesiology*, 70(6), 601–605.

Ines, K., Filip, M., Dino, D., Kirin, I., Ines, K., Filip, M., Dino, D., & Kirin, I. (2017).
Shadow IT: data protection and cloud security.

International Trade Administration. (2023). Nigeria-Country Commercial Guide:
Information and Communications Technology. <https://www.trade.gov/country-commercial-guides/nigeria-information-and-communications-technology>

Ismail, H. N., Iqbal, A., & Nasr, L. (2019). Employee engagement and job performance in
Lebanon: the mediating role of creativity. *International Journal of Productivity and
Performance Management*, 68(3), 506–523.

Ivancevich, J. M., Matteson, M. T., & Richards, E. P. (1985). Who's liable for stress on the
job? *Harvard Business Review*, 63(2), 60.

Iwedi, M. (2023). Digital Banking Technology and Financial Inclusion in Nigeria. *DS
Journal of Digital Science and Technology*, 2, 9–16.

Jang, H., Song, J., & Kim, R. (2014). Does the offline bully-victimisation influence
cyberbullying behaviour among youths? Application of general strain theory.
Computers in Human Behaviour, 31, 85–93.

- Jarrahi, M. H., Reynolds, R., & Eshraghi, A. (2020). Personal knowledge management and enactment of personal knowledge infrastructures as shadow IT. *Information and Learning Science*, 122(1–2), 17–44.
- Jenkins, C. R., & Dillman, D. A. (1997). Towards a theory of self-administered questionnaire design. In L. Lyberg, P. Biemer, M. Collins, E. de Leeuw, N. Schwartz, & D. Trewin (Eds.), *Survey measurement and process quality* (pp. 165–196). Wiley.
- Jeon, M. K., Yoon, H., & Yang, Y. (2022). Emotional Dissonance, Job Stress, and Intrinsic Motivation of Married Women Working in Call Centers: The Roles of Work Overload and Work-Family Conflict. *Administrative Sciences*, 12(1).
- John Britto, M., & Magesh, R. (2019). Workplace wellness and employee engagement in information technology services. *International Journal of Management and Business Research*, 9(2), 110–119.
- Johnson, C. (2017). IT & shadow IT (embrace or squash). Internet, Mobile, Performance and Capacity, Cloud and Technology Conference, *ImPACt 2017*, 2017-Novem.
- Johnson, P. R., & Indvik, J. (2001). Slings and arrows of rudeness: Incivility in the workplace. *Journal of Management Development*, 20(8), 705–714.
- Jordan, J., & McKnight, L. (2020). Suddenly essential infrastructure: Cloud computing resources at the forefront of the COVID-19 crisis. *Infospace*. Retrieved April 1, 2020, from <https://ischool.syr.edu/infospace/2020/04/01/suddenly-essential-infrastructure-cloud-computing-resources-at-the-forefront-of-the-covid-19-crisis/>.

- Jung, H. S., & Yoon, H. H. (2020). How does sexual harassment influence the female employee's negative response in a deluxe hotel? *International Journal of Environmental Research and Public Health*, 17(24), 1–13.
- Junglas, I., Goel, L., Ives, B., & Harris, J. (2019). Innovation at work: The relative advantage of using consumer IT in the workplace. *Information Systems Journal*, 29(2), 317–339.
- Kanter, R. M. (1977). Some effects of proportions on group life. In M. R. Walsh (Ed.), *The gender gap in psychotherapy* (pp. 53–78). Springer.
- Kapepo, M. I., Van Belle, J. P., & Weimann, E. (2021). Towards a theoretical understanding of workarounds emerging from use of a referral mobile application: A developing country context. *Procedia Computer Science*, 196, 533–541.
- Kaplan, R. (1975). *Some methods and strategies in the prediction of preference*. Dowden, Hutchinson and Ross.
- Kaur, P., & Mittal, A. (2020). Meaningfulness of work and employee engagement: The role of affective commitment. *Open Psychology Journal*, 13(1), 115–122.
- Kaye, P. J., & Korbeck, R. G. (2016). Cloud computing. *Pennsylvania CPA Journal*, 87(1), 30–33.
- Keil, M., Li, L., Mathiassen, L., & Zheng, G. (2008). The influence of checklists and roles on software practitioner risk perception and decision-making. *Journal of Systems and Software*, 81(6), 908–919.

- Keller, T., & Weibler, J. (2015). What it takes and costs to be an ambidextrous manager: Linking leadership and cognitive strain to balancing exploration and exploitation. *Journal of Leadership & Organisational Studies*, 22(1), 54–71.
- Keskin, B., Ozkan, N., Bulut, K. N., Gok, M. S., & Ozer, G. (2021). Domesticating a Treasury Shadow IT application in a Turkish bank. *2nd International Informatics and Software Engineering Conference, IISEC 2021*.
- Khalil, S., & Samhan, B. (2024). The impact of cloud adoption on talent management: An exploratory study from the “learning organisation” perspective. *Learning Organisation*.
- Khan, N., & Al-Yasiri, A. (2018). Cloud security threats and techniques to strengthen cloud computing adoption framework. In *Cyber Security and Threats: Concepts, Methodologies, Tools, and Applications* (pp. 268–285). IGI Global.
- Khidir, A., Asad, H., Abdelrahim, H., Elnashar, M., Killawi, A., Hammoud, M., Al-Khal, A. L., Haddad, P., & Feters, M. D. (2016). Patient responses to research recruitment and follow-up surveys: Findings from a diverse multicultural health care setting in Qatar. *BMC Medical Research Methodology*, 16(1).
- Kim, B. J., Jung, S. Y., & Jung, J. (2022). Does a good firm diminish the bad behaviour of its employees? The sequential mediation effect of organisational trust and organisational commitment, and the moderation effect of work overload. *International Journal of Environmental Research and Public Health*, 19(11).

- Kim, D.-J., Hwang, I.-H., & Kim, J.-S. (2016). A study on employees compliance behaviour towards information security policy: A modified Triandis model. *Journal of Digital Convergence, 14*(4), 209–220.
- Kim, S.B., Sun, K.-A., & Kim, D.Y. (2013). The Influence of Consumer Value-Based Factors on Attitude-Behavioural Intention in Social Commerce: The Differences between High- and Low-Technology Experience Groups. *Journal of Travel & Tourism Marketing, 30*(1/2), 108–125.
- Kim, S. S., & Kim, Y. J. (2017). The effect of compliance knowledge and compliance support systems on information security compliance behaviour. *Journal of Knowledge Management, 21*(4), 986–1010.
- Kimura, T., Bande, B., & Fernandez-Ferrín, P. (2018). Work overload and intimidation: The moderating role of resilience. *Personnel Review, 36*, 736–745.
- Kirin, I. (2017). Shadow IT: Data protection and cloud security. In *Zagreb School of Economics and Management, Students thesis*.
- Klotz, S. (2019). Shadow IT and business-managed IT: Where is the theory? In B. J. & N. D. (Eds.), *21st IEEE Conference on Business Informatics, CBI 2019* (Vol. 1, pp. 286–295). Institute of Electrical and Electronics Engineers Inc.
- Klotz, S., Kopper, A., Westner, M., & Strahringer, S. (2019). Causing factors, outcomes, and governance of Shadow IT and business-managed IT: A systematic literature review. *SciKA - Association for Promotion and Dissemination of Scientific Knowledge*.

- Klotz, S., Westner, M., Strahringer, S., & Schieder, C. (2019). Transformed knowledge sharing through business-managed IT and Shadow IT. *25th Americas Conference on Information Systems, AMCIS 2019*.
- Kock, N., & Hadaya, P. (2018). Minimum sample size estimation in PLS-SEM: The inverse square root and gamma-exponential methods. *Information Systems Journal*, 28(1), 227–261.
- Kock, N., & Lynn, G. S. (2012). Lateral collinearity and misleading results in variance-based SEM: An illustration and recommendations. *Journal of the Association for Information Systems*, 13(7).
- Köffer, S., Ortbach, K., Junglas, I., Niehaves, B., & Harris, J. (2015). Innovation through BYOD? *Business & Information Systems Engineering*, 57(6), 363–375.
- Kopper, A. (2017). Perceptions of IT managers on shadow IT. *AMCIS 2017 - America's Conference on Information Systems: A Tradition of Innovation, 2017*.
- Kopper, A., & Westner, M. (2016a). Deriving a framework for causes, consequences, and governance of shadow IT from literature. *MKWI 2016 Proceedings*, 1687–1698.
- Kopper, A., & Westner, M. (2016b). Towards a taxonomy for shadow IT. *AMCIS 2016: Surfing the IT Innovation Wave - 22nd Americas Conference on Information Systems*.
- Kopper, A., Fürstenau, D., Zimmermann, S., Klotz, S., Rentrop, C., Rothe, H., Strahringer, S., & Westner, M. (2018). Shadow IT and business-managed IT: A conceptual framework and empirical illustration. *International Journal of IT/Business Alignment and Governance (IJITBAG)*, 9(2), 53–71.

- Kopper, A., Westner, M., & Strahringer, S. (2020). From shadow IT to business-managed IT: A qualitative comparative analysis to determine configurations for successful management of IT by business entities. *Information Systems and E-Business Management*, 18(2), 209–257.
- Korunka, C., Scharitzer, D., & Carayon, P. (2010). Employee strain and job satisfaction related to an implementation of quality in a public service organisation: A longitudinal study. *Work & Stress: An International Journal of Work, Health & Organisations*, 24(2), 166–181.
- Korunka, C., Scharitzer, D., Carayon, P., & Sainfort, F. (2003). Employee strain and job satisfaction related to an implementation of quality in a public service organisation: A longitudinal study. *Work & Stress*, 17(1), 52–72.
- Krassen, C., & Aupers, S. (2022). Pressure to play: Social pressure in online multiplayer games. *Information Society*, 38(1), 13–24.
- Krejcie, R. V., & Morgan, D. W. (1970). Determining sample size for research activities. *Educational and Psychological Measurement*, 30(3), 607–610.
- Lane, J. D., Seskevich, J. E., & Pieper, C. F. (2007). Brief meditation training can improve perceived stress and negative mood. *Alternative Therapies in Health and Medicine*, 13(1), 38–44.
- Lawrence, C. (2020). Is cloud computing the superhero of COVID-19? *Codemotion Magazine*.

- Le Roux, Y. (2007). Information security governance for executive management. In *ISSE/SECURE 2007 - Securing Electronic Business Processes: Highlights of the Information Security Solutions Europe/SECURE 2007 Conference* (pp. 136–146).
- Legate, A. E., Hair, J. F., Chretien, J. L., & Risher, J. J. (2023). PLS-SEM: Prediction-oriented solutions for HRD researchers. *Human Resource Development Quarterly*, 34(1), 91–109.
- Legg, T. J., & Cafasso, J. (2023). Emotional Exhaustion: What It Is and How to Treat It. *Medically reviewed*. <https://www.healthline.com/health/emotional-exhaustion>
- Lemos, R. (2019). Shadow Cloud IT Keeps Rising With Cloud App Adoption, Netskope Finds Modernizing Enterprise IT: Motivators and Challenges Securing Your Organisation's Network on a Shoestring. *Netskope*.
- Leung, S. O. (2011). A comparison of psychometric properties and normality in 4-, 5-, 6-, and 11-point likert scales. *Journal of Social Service Research*, 37(4), 412–421.
- Leys, C., Klein, O., Dominicy, Y., & Ley, C. (2018). Detecting multivariate outliers: Use a robust variant of the Mahalanobis distance. *Journal of Experimental Social Psychology*, 74, 150–156.
- Lianos, H., & McGrath, A. (2018). Can the general theory of crime and general strain theory explain cyberbullying perpetration? *Crime & Delinquency*, 64(5), 674–700.
- Lim, S., Cortina, L. M., & Magley, V. J. (2008). Personal and workgroup incivility: Impact on work and health outcomes. *Journal of Applied Psychology*, 93(1), 95.

- Lindell, M. K., & Whitney, D. J. (2001). Accounting for common method variance in cross-sectional research designs. *Journal of Applied Psychology, 86*(1), 114.
- Liu, C., E Spector, P., & M Jex, S. (2005). The relation of job control with job strains: A comparison of multiple data sources. *Journal of Occupational and Organisational Psychology, 78*(3), 325–336.
- Liu, Y., Zhang, Z., & Zhao, H. (2021). The influence of the COVID-19 event on deviant workplace behaviour taking Tianjin, Beijing and Hebei as an example. *International Journal of Environmental Research and Public Health, 18*(1), 1–16.
- Lowry, P. B., Posey, C., Bennett, R. (B. J., & Roberts, T. L. (2015). Leveraging fairness and reactance theories to deter reactive computer abuse following enhanced organisational information security policies: An empirical study of the influence of counterfactual reasoning and organisational trust. *Information Systems Journal, 25*(3), 193–273.
- Lv, D., & Zhou, Q. (2014). Development model of agricultural E-commerce in the context of social commerce. *Journal of Chemical and Pharmaceutical Research, 6*(7), 1341–1345.
- MacKenzie, S. B., & Podsakoff, P. M. (2012). Common Method Bias in Marketing: Causes, Mechanisms, and Procedural Remedies. *Journal of Retailing, 88*(4), 542–555.
- Mady, A., Gupta, S., & Warkentin, M. (2023). The effects of knowledge mechanisms on employees' information security threat construal. *Information Systems Journal, 33*(4), 790–841.

- Magno, F., Cassia, F., & Ringle, C. M. (2022). A brief review of partial least squares structural equation modeling (PLS-SEM) use in quality management studies. *TQM Journal*, 34(3), 567–585.
- Magunduni, J., & Chigona, W. (2018). Revisiting shadow IT research: What we already know, what we still need to know, and how do we get there? In *Proceedings of the 2018 Conference on Information Communications Technology and Society (ICTAS 2018)* (pp. 1–6).
- Mahfuz, M. A., Khanam, L., & Mutharasu, S. A. (2016). The influence of website quality on m-banking services adoption in Bangladesh: Applying the UTAUT2 model using PLS. In *Proceedings of the 2016 International Conference on Electrical, Electronics, and Optimisation Techniques (ICEEOT 2016)* (pp. 2329–2335).
- Mainemelis, C. (2010). Stealing fire: Creative deviance in the evolution of new ideas. *Academy of Management Review*, 35(4), 558–578.
- Mallmann, G. L., & Maçada, A. C. G. (2016). Behavioural drivers behind Shadow IT and its outcomes in terms of individual performance. In *Proceedings of AMCIS 2016: Surfing the IT Innovation Wave - 22nd Americas Conference on Information Systems*.
- Mallmann, G. L., & Maçada, A. C. G. (2017). The mediating role of social presence in the relationship between shadow IT usage and individual performance: A social presence theory perspective. In *Proceedings of EnADI 2017* (May).
- Mallmann, G. L., & Maçada, A. C. G. (2021). The mediating role of social presence in the relationship between shadow IT usage and individual performance: A social presence theory perspective. *Behaviour and Information Technology*, 40(4), 427–441.

- Mallmann, G. L., De Vargas Pinto, A., & Maçada, A. C. G. (2019). Shedding light on shadow IT: Definition, related concepts, and consequences. In *Lecture Notes in Information Systems and Organisation (Vol. 31, pp. 63–79)*.
- Mallmann, G. L., Gastaud, M. A. C., & Mirian, O. (2018). The influence of shadow IT usage on knowledge sharing. *Business Information Review*, 35(1), 17–28.
- Mallmann, G. L., Maçada, A. C. G., & Eckhardt, A. (2018). We are social: A social influence perspective to investigate shadow IT usage. In *Proceedings of the Twenty-Sixth European Conference on Information Systems (ECIS 2018)* (pp. 23–28). Portsmouth, UK.
- Mallmann, G. L., Maçada, A. C. G., & Montesdioca, G. P. Z. (2019). The social side of shadow IT and its impacts: Investigating the relationship with social influence and social presence. In B. T. X. (Ed.), *Proceedings of the 52nd Annual Hawaii International Conference on System Sciences (HICSS 2019)* (Vols. 2019-Janua, pp. 6460–6469). IEEE Computer Society.
- Mallmann, G. L., Maçada, A. C. G., & Oliveira, M. (2016). Can shadow IT facilitate knowledge sharing in organisations? An exploratory study. In *Proceedings of the European Conference on Knowledge Management (ECKM 2016)* (pp. 550–558).
- Mallmann, G. L., Maçada, A. C. G., & Oliveira, M. (2018). The influence of shadow IT usage on knowledge sharing: An exploratory study with IT users. *Business Information Review*, 35(1), 17–28.
- Marcano Belisario, J. S., Jamsek, J., Huckvale, K., O'Donoghue, J., Morrison, C. P., & Car, J. (2015). Comparison of self-administered survey questionnaire responses collected

- using mobile apps versus other methods. In *Cochrane Database of Systematic Reviews* (Vol. 2017, Issue 12). John Wiley and Sons Ltd.
- Marcoulides, G. A., & Chin, W. W. (2013). You write, but others read: Common methodological misunderstandings in PLS and related methods. In *Springer Proceedings in Mathematics and Statistics* (Vol. 56).
- Mayr, S., Erdfelder, E., & Buchner, A. (2017). G Power 3.1 manual. *Tutorials in Quantitative Methods for Psychology*, 76, 1–80.
- Meehan, H. L., Bull, S. J., Wood, D. M., & James, D. V. B. (2004). The overtraining syndrome: A multicontextual assessment. *The Sport Psychologist*, 18(2), 154–171.
- Melo, C., Madariaga, L., Nussbaum, M., Heller, R., Bennett, S., Tsai, C.-C., & van Braak, J. (2020). Editorial: Educational technology and addictions. *Computers & Education*, 145, 103730.
- Merton, R. K. (1938). Social structure and anomie. *American Sociological Review*, 3(5), 672–682.
- Merton, R. K., & Ashley-Montagu, M. F. (1940). Crime and the anthropologist. *American Anthropologist*, 42(3), 384–408.
- Ministry of Foreign Affairs Nigeria. (2022). Economy – Ministry of Foreign Affairs, Nigeria. Retrieved from <https://foreignaffairs.gov.ng/nigeria/nigeria-economy/>
- Mintzberg, H. (1983). The case for corporate social responsibility. *Journal of Business Strategy*, 4(2), 3–15.

- Mirsim, G. (2014). The influence of work overload and autonomy on job satisfaction, organisational commitment and turnover intent: The case of Kosovo (Master's thesis). Human Resource Studies.
- Molok, N. N. A., Ahmad, A., & Chang, S. (2010). Understanding the factors of information leakage through online social networking to safeguard organisational information. In *ACIS 2010 Proceedings - 21st Australasian Conference on Information Systems*.
- Moon, B., & Morash, M. (2017). Gender and general strain theory: A comparison of strains, mediating, and moderating effects explaining three types of delinquency. *Youth & Society*, 49(4), 484–504.
- Moon, B., Morash, M., & McCluskey, J. D. (2012). General strain theory and school bullying: An empirical test in South Korea. *Crime & Delinquency*, 58(6), 827–855.
- Moore, C., Detert, J., Trevino, L. K., Baker, V. L., & Mayer, D. M. (2012). Why employees do bad things: Moral disengagement and unethical behavior. *Personnel Psychology*, 65(1), 1–48.
- Moyle, P. (1995). The role of negative affectivity in the stress process: Tests of alternative models. *Journal of Organizational Behavior*, 16(6), 647–668.
- Muomah, R. C., Chukwuorji, J. B. C., Nwonyi, S. K., Tay, D. A., Joachim, D., Malet, L., Adamba, C., Nyawornota, V. K., Nyanyonofio, O., Donkor, S. K., & Ocansey, R. (2023). Physical activity and depression during the COVID-19 pandemic in Nigeria: Does age and gender make a difference? *Discover Social Science and Health*, 3(1).

- Musa, U., Jaafar, M., & Raslim, F. M. (2023). E-procurement adoption in Nigeria: Perceptions from the public sector employees. *Arab Gulf Journal of Scientific Research*.
- Myers, N., Starliper, M. W., Summers, S. L., & Wood, D. A. (2017). The impact of shadow IT systems on perceived information credibility and managerial decision making. *Accounting Horizons*, 31(3), 105–123.
- Naeem, M., Ozuem, W., & Ward, P. (2022). Understanding the accessibility of retail mobile banking during the COVID-19 pandemic. *International Journal of Retail and Distribution Management*, 50(7), 860–879.
- Naldi, M., Flamini, M., & D'Acquisto, G. (2018). Negligence and sanctions in information security investments in a cloud environment. *Electronic Markets*, 28(1), 39–52.
- Nassar, R., Elhadj, I., Kayssi, A., & Salam, S. (2021). Identifying NAT devices to detect shadow IT: A machine learning approach. *Proceedings of IEEE/ACS International Conference on Computer Systems and Applications, AICCSA*.
- Nasurdin, A. M., Ramayah, T., & Kumaresan, S. (2005). Organisational stressors and job stress among managers: The moderating role of neuroticism. *Singapore Management Review*, 27(2), 63–79.
- National Bureau of Statistics. (2020). Labor force statistics: Unemployment and underemployment report. *Abridged Labour Force Survey under COVID-19*, 19(August).

- National Information Technology Development Agency (NITDA). (2019). Homepage. *National Information Technology Development Agency*. Retrieved from <https://nitda.gov.ng/>
- Netskope. (2016). Netskope report reveals 75 percent of cloud apps not ready for EU General Data Protection Regulation. *Netskope*, 1–3.
- Newsire. (2014). Turning shadow IT into collaborative IT: Discuss on Interop Radio. *PR Newsire*.
- Nguyen, T. (2023). Understanding shadow IT usage intention: A view of the dual-factor model. *Online Information Review*.
- Ning, X., Huang, J., Wu, C., Liu, T., & Wang, C. (2022). The double-edged sword of safety training for safety behaviour: The critical role of psychological factors during COVID-19. *International Journal of Environmental Research and Public Health*, 19(17).
- Nisar, Q. A., Haider, S., Ali, F., Naz, S., & Ryu, K. (2021). Depletion of psychological, financial, and social resources in the hospitality sector during the pandemic. *International Journal of Hospitality Management*, 93.
- Nnam, M. U., Ugwuoke, C. O., Njemanze, V. C., & Akwara, F. A. (2020). Boko Haram terrorism and human security in Nigeria: Matters arising. *Journal of Aggression, Maltreatment and Trauma*, 29(10), 1257–1278.
- Noblet, A., Rodwell, J., & McWilliams, J. (2003). Predictors of the strain experienced by professional Australian footballers. *Journal of Applied Sport Psychology*, 15(2), 184–193.

- NTT. (2016, June 8). The people versus the Ministry of No: Enterprises must embrace shadow IT or lose their competitive edge. *PR Newswire*.
- Ofusori, L. O., & Subramaniam, P. R. (2022). A study on e-commuting: Alleviating technical and mobility threats in a BYOD-enabled banking environment in Nigeria. *African Journal of Science, Technology, Innovation and Development*, 14(2), 489–503.
- Ogedengbe, F. A. (2024). Investigating the influence of IT inaccessibility and social pressure on employees' shadow cloud IT usage during the COVID-19 pandemic MCO period. *Journal of Business Information Systems*. Advance online publication.
- Ogedengbe, F. A., Abdul Talib, Y. Y., & Rusly, F. H. (2024). Influence of structural factors on employee cloud shadow IT usage during COVID-19 lockdown: A strain theory perspective. *Cognition, Technology & Work*, 26(1), 63–81.
- Ogedengbe, F., Yakimin, Y., Talib, A., & Rusly, F. H. (2024). The impact of training and awareness on employee shadow IT usage in developing economies. *International Journal of Business Innovation and Research*. Advance online publication.
- Oh, C. S., Bailenson, J. N., & Welch, G. F. (2018). A systematic review of social presence: Definition, antecedents, and implications. *Frontiers in Robotics and AI*, 5, Article 150. <https://doi.org/10.3389/frobt.2018.00150>
- Oke, A. E., Kineber, A. F., Alsolami, B., & Kingsley, C. (2023). Adoption of cloud computing tools for sustainable construction: A structural equation modelling approach. *Journal of Facilities Management*, 21(3), 334–351.
- Oliveira, T., & Martins, M. F. (2014). Literature review of information technology adoption models at firm level. *January 2011*.

- Ostermann, U. (2018). How experience with private IS affects employees' satisfaction with organisational IS. In D. P., F. B., N. P., & X. L. (Eds.), *Multikonferenz Wirtschaftsinformatik, MKWI 2018 - Multiconference on Business Informatics* (pp. 157–168). Leuphana Universität Lüneburg.
- Ostermann, U., Holten, R., & Franzmann, D. (2020). The influence of private alternatives on employees' acceptance of organisational IS. *Communications of the Association for Information Systems*, 47, 63.
- Oyetunde, O. O., Ogidan, O., Akinyemi, M. I., Ogunbameru, A. A., & Asaolu, O. F. (2019). Mobile authentication service in Nigeria: An assessment of community pharmacists' acceptance and providers' views of successes and challenges of deployment. *Pharmacy Practice*, 17(2).
- Oyewo, B., Ajibola, O., & Ajape, M. (2021). Characteristics of consulting firms associated with the diffusion of big data analytics. *Journal of Asian Business and Economic Studies*, 28(4), 281–302.
- Oyewole, O., & Onaolapo, S. (2023). COVID-19 pandemic and the use of emergency remote teaching (ERT) platforms: Lessons from a Nigerian university. *Journal of Information Technology Education: Innovations in Practice*, 22, 133–158.
- Ozkan, N., Bulut, K. N., Gök, M. Ş., & Özer, G. (2021). Controlling shadow IT: Case study from a Turkish bank. In *Proceedings - 6th International Conference on Computer Science and Engineering, UBMK 2021* (pp. 281–286). IEEE.
- Paez, G. R. (2018). Cyberbullying among adolescents: A general strain theory perspective. *Journal of School Violence*, 17(1), 74–85.

- Pan, K., Xu, W., Kalpouzos, G., Bäckman, L., Mangialasche, F., Fratiglioni, L., & Wang, H. (2017). Association of psychosocial work stress with cognitive decline and brain structure differences. *Innovation in Aging, 1*(Suppl 1), 432.
- Patchin, J. W., & Hinduja, S. (2011). Traditional and nontraditional bullying among youth: A test of general strain theory. *Youth & Society, 43*(2), 727–751.
- Pate, M. C., & Bolin, R. M. (2019). Examining the relationship between strain and the use of nonmedical prescription drugs among college students. *Journal of Drug Issues, 49*(1), 163–182.
- Pateman, H., Cahoon, S., & Chen, S.-L. (2016). The role and value of collaboration in the logistics industry: An empirical study in Australia. *Asian Journal of Shipping and Logistics, 32*(1), 33–40.
- Peng, J., Guo, M., & Quan, J. (2019). Software vulnerability and application security risk. *Information Resources Management Journal, 32*(1), 48.
- Peng, J.-C., Tseng, M.-M., & Lee, Y.-L. (2011). Relationships among supervisor feedback environment, work-related stressors, and employee deviance. *Journal of Nursing Research, 19*(1), 13–24.
- Peter, M., Kavitha, F., & Susmita. (2019). Employee engagement at Victory Visions Software Development, Chennai. *International Journal of Recent Technology and Engineering, 8*(2 Special Issue 8), 221–223.
- Ping-Ju Wu, S., Straub, D. W., & Liang, T.-P. (2014). Training solutions for business and industry business and information technology. *Business and Information Technology, 39*(2), 497–518.

- Piquero, N. L., Sealock, M. D., & Piquero, N. L. (2016). Gender and general strain theory: A preliminary test of Broidy and Agnew's gender/GST hypotheses. *Justice Quarterly*, 33(6), 953–975.
- Polizzi, D. (2011a). Agnew's general strain theory reconsidered: A phenomenological perspective. *International Journal of Offender Therapy and Comparative Criminology*, 55(7), 1051–1071.
- Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behaviour Research Methods*, 40(3), 879–891.
- Preimesberger, C. (2017a). Floqast uses robotics to connect accounting systems to cloud. *eWeek*, 3.
- Preimesberger, C. (2017b). Forcepoint fights shadow IT with cybersecurity analytics functions. *eWeek*, 1.
- Preimesberger, C. (2018). Why shadow IT must be considered in securing an enterprise. *eWeek*, 3–7.
- Radzali, F. M., Ahmad, A., & Omar, Z. (2013). Workload, job stress, family-to-work conflict and deviant workplace behaviour. *International Journal of Academic Research in Business and Social Sciences*, 3(12), 109–115.
- Ragu-Nathan, T. S., Tarafdar, M., & Tu, Q. (2008). The consequences of technostress for end users in organisations: Conceptual development and empirical validation. *December*.

- Rains, J. (2015). Shadow IT: The impact on technical support and the opportunities for IT. *HDI Research Brief*.
- Rajna, G., Milan, M., Bojana, K., & Jadranka, M. (2009). Work-related stress, education and work ability among hospital nurses. *Journal of Advanced Nursing*, 65(10), 2056–2066.
- Rakovic, L., Duc, T. A., & Vukovic, V. (2020). Shadow IT and ERP: Multiple case study in German and Serbian companies. *Journal of East European Management Studies*, 25(4), 730–752.
- Raković, L., Sakal, M., Matković, P., & Marić, M. (2020). Shadow IT – A systematic literature review. *Information Technology and Control*, 49(1), 144–160.
- Ramayah, T. (2014). Organisational stressors and job stress among managers: The moderating role of neuroticism. *June*.
- Raut, R. D., Priyadarshinee, P., Gardas, B. B., & Jha, M. K. (2018). Analyzing the factors influencing cloud computing adoption using three-stage hybrid SEM-ANN-ISM (SEANIS) approach. *Technological Forecasting and Social Change*, 134, 98–123.
- Reder, S., & Schwab, R. G. (1988). The communicative economy of the workgroup: Multi-channel genres of communication. In *Proceedings of the 1988 ACM Conference on Computer-Supported Cooperative Work* (pp. 354–368).
- Rehman, A. A., & Alharthi, K. (2016). An introduction to research paradigms. *International Journal of Educational Investigations*, 3(8), 51–59.

- Richter, S., Waizenegger, L., Steinhueser, M., & Richter, A. (2019). Knowledge management in the dark: The role of shadow IT in practices in manufacturing. *International Journal of Knowledge Management*, 15(2), 1–19.
- Rubington, E. (1965). Organisational strains and key roles. *Administrative Science Quarterly*, 9(4), 350–369.
- Rubington, E. (2014). *Earl Rubington Organisational strains and key roles*. Sage Publications, 9(4), 350–369.
- Sabherwal, R. (2015). Information technology impacts on firm performance: An extension of Kohli and Devaraj (2003). *MIS Quarterly*, 39(4), 1–30.
- Sabi, H. M., Uzoka, F.-M. E., & Mlay, S. V. (2018). Staff perception towards cloud computing adoption at universities in a developing country. *Education and Information Technologies*, 23(5), 1825–1848.
- Sakpere, W., Sakpere, A. B., Olanipekun, I., & Yaya, O. O. S. (2023). Impact analysis of COVID-19 on Nigerian workers' productivity using multiple correspondence analysis. *Scientific African*, 21.
- Salkind, N. J., & Rainwater, T. (2003). *Exploring research* (p. 407). Pearson.
- Sarfraz, A., Sarfraz, Z., Camacho-Leon, G., Alvarado-Villa, G. E., Andrade-Molina, D. M., Fernandez-Cadena, J. C., Agolli, A., Yukselen, Z., Felix, M., Gallardo Bastidas, J. C., Espinoza-Fuentes, F., Michel, J., & Cherrez-Ojeda, I. (2022). Impact of biosecurity measures, social pressure and bullying on attitudes, perceptions, and job satisfaction levels among healthcare workers during the COVID-19 pandemic: A cross-sectional survey. *BMJ Open*, 12(7).

- Sarstedt, M., Hair, J. F., & Ringle, C. M. (2023). "PLS-SEM: indeed, a silver bullet"—retrospective observations and recent advances. *Journal of Marketing Theory and Practice*, 31(3), 261–275.
- Sarstedt, M., Hair, J. F., Pick, M., Liengaard, B. D., Radomir, L., & Ringle, C. M. (2022). Progress in partial least squares structural equation modeling use in marketing research in the last decade. *Psychology and Marketing*, 39(5), 1035–1064.
- Sarstedt, M., Radomir, L., Moisescu, O. I., & Ringle, C. M. (2022). Latent class analysis in PLS-SEM: A review and recommendations for future applications. *Journal of Business Research*, 138, 398–407.
- Sauerwein, C., Sillaber, C., & Breu, R. (2018). Shadow cyber threat intelligence and its use in information security and risk management processes. In *MKWI 2018 - Multikonferenz Wirtschaftsinformatik* (pp. 1333–1344).
- Scalabrin Bianchi, I., Vaquina, A., Pereira, R., Dinis Sousa, R., & Dávila, G. A. (2022). A benefit dependency network for shadow information technology adoption, based on practitioners' viewpoints. *Informatics*, 9(4).
- Schafer, J. L., & Graham, J. W. (2002). Missing data: Our view of the state of the art. *Psychological Methods*, 7(2), 147–177.
- Schaufeli, W. B. (2017). Applying the job demands-resources model: A 'how to' guide to measuring and tackling work engagement and burnout. *Organisational Dynamics*, 46(2), 120–132.
- Schierhorn, C. (2016). Finding, fixing, and foiling shadow IT problems. *CAP Today*, 30(4), 72–73.

- Šedivcová (Nesvedová), L., & Potančok, M. (2019). Shadow IT management concept for public sector. In D. P., B. J., P. A., T. A. M., D. K., & R. M. (Eds.), *13th IFIP WG 8.9 Working Conference on Research and Practical Issues of Enterprise Information Systems, CONFENIS 2019* (Vol. 375, pp. 65–73). Springer.
- Sekaran, U., & Bougie, R. (2016). *Research methods for business: A skill-building approach* (7th ed.). John Wiley & Sons Ltd.
- Setor, T., & Joseph, D. (2015). Professional obsolescence in IT: The relationships between the threat of professional obsolescence, coping and psychological strain. *SIGMIS-CPR '15: Proceedings of the 2015 ACM SIGMIS Conference on Computers and People Research*, 117–122.
- Shah, A. L. (2018). An analysis of the technology acceptance model in understanding retailer's behavioural intention to use Paytm - A digital wallet. *Sankalpa*, 8(1), 78–84.
- Shaheen, N. L., & Lazar, J. (2018). K–12 technology accessibility: The message from state governments. *Journal of Special Education Technology*, 33(2), 83–97.
- Shaheen, N. L., & Lohnes Watulak, S. (2019). Bringing disability into the discussion: Examining technology accessibility as an equity concern in the field of instructional technology. *Journal of Research on Technology in Education*, 51(2), 187–201.
- Shaikh, A. (2018). Shadow-IT system and insider threat: An assessment of an opportunity dimension for the identity theft. *International Conference on Human-Computer Interaction*, 314–317.
- Sharma, M., Singh, A., & Daim, T. (2023). Exploring cloud computing adoption: COVID era in academic institutions. *Technological Forecasting and Social Change*, 193.

- Sharma, S. K., & Govindaluri, S. M. (2014). Internet banking adoption in India: Structural equation modeling approach. *Journal of Indian Business Research*, 6(2), 155–169.
- Sherer, S. A., & Alter, S. (2004). Information systems risks and risk factors: Are they mostly about information systems? *Communications of the Association for Information Systems*, 14(1), 2.
- Shmueli, G., Sarstedt, M., Hair, J. F., Cheah, J. H., Ting, H., Vaithilingam, S., & Ringle, C. M. (2019). Predictive model assessment in PLS-SEM: Guidelines for using PLSpredict. *European Journal of Marketing*, 53(11), 2322–2347.
- Shrout, P. E., & Bolger, N. (2002). Mediation in experimental and nonexperimental studies: New procedures and recommendations. *Psychological Methods*, 7(4), 422–445.
- Sigfusdottir, I. D., Gudjonsson, G. H., & Sigurdsson, J. F. (2010). Bullying and delinquency: The mediating role of anger. *Personality and Individual Differences*, 48(4), 391–396.
- Silic, M. (2015). Influence of shadow IT on innovation. *SSRN*.
- Silic, M., Barlow, J. B., & Back, A. (2017a). A new perspective on neutralisation and deterrence: Predicting shadow IT usage. *Information and Management*, 54(8), 1023–1037.
- Silic, M., Barlow, J. B., & Back, A. (2017b). A new perspective on neutralisation and deterrence: Predicting shadow IT usage. *Information and Management*, 54(8), 1023–1037.

- Silic, M., Silic, D., & Oblakovic, G. (2016a). Influence of shadow IT on innovation in organisations.
- Silic, M., Silic, D., & Oblakovic, G. (2016b). Shadow IT: Steroids for innovation. *CEUR Workshop Proceedings, 1612*, 113–120.
- Silic, M. (2019a). Critical impact of organisational and individual inertia in explaining non-compliant security behaviour in the shadow IT context. *Computers and Security, 80*, 108–119.
- Silic, M. (2019b). Critical impact of organisational and individual inertia in explaining non-compliant security behaviour in the shadow IT context. *Computers & Security, 80*, 108–119.
- Silic, M. (2019c). Critical impact of organisational and individual inertia in explaining non-compliant security behaviour in the shadow IT context. *Computers & Security, 80*(1), 108–119.
- SMEDAN/NBS. (2017). *National survey of micro small & medium enterprises (MSMEs) 2017*. Small & Medium Enterprises Development Agency of Nigeria/National Bureau of Statistics, 1–148.
- Smith, T. D., DeJoy, D. M., Dyal, M.-A., & Huang, G. (2019). Impact of work pressure, work stress and work–family conflict on firefighter burnout. *Archives of Environmental & Occupational Health, 74*(4), 215–222.
- Spector, P. E. (1998). A control theory of the job stress process. In *Theories of organisational stress* (pp. 153–169).

- Spector, P. E. (2012). Negative and positive coworker exchanges: An integration. In *Personal Relationships* (pp. 191–206). Routledge.
- Spector, P. E. (2019). Do not cross me: Optimizing the use of cross-sectional designs. *Journal of Business and Psychology*, 34(2), 125–137.
- Spielberger, C. D., & Reheiser, E. C. (1994). The job stress survey: Measuring gender differences in occupational stress. *Journal of Social Behaviour and Personality*, 9(2), 199.
- Steinhueser, M., Waizenegger, L., Vodanovich, S., & Richter, A. (2017). Knowledge management without management - Shadow IT in knowledge-intensive manufacturing practices. *Proceedings of the 25th European Conference on Information Systems, ECIS 2017*, 1647–1662.
- Stevano, S., & Deane, K. (2017). The role of research assistants in qualitative and cross-cultural social science research. In *Handbook of Research Methods in Health Social Sciences* (pp. 1–16). Springer Singapore.
- Suárez, M., Asenjo, M., & Sánchez, M. (2017). Job satisfaction among emergency department staff. *Australasian Emergency Nursing Journal*, 20(1), 31–36.
- Sudarsono, H., Nugrohowati, R. N. I., & Tumewang, Y. K. (2020). The effect of COVID-19 pandemic on the adoption of internet banking in Indonesia: Islamic bank and conventional bank. *Journal of Asian Finance, Economics and Business*, 7(11), 789–800.
- Suer, M. F. (2017). Is shadow IT something CIOs should worry about? *CIO*.

- Sule, B., Sambo, U., & Yusuf, M. (2023). Countering cybercrimes as the strategy of enhancing sustainable digital economy in Nigeria. *Journal of Financial Crime*, 30(6), 1557–1574.
- Sulistiawan, J., Ekowati, D., & Alfirdaus, Z. (2020). The antecedents of salesperson deviant behaviour: The role of work meaningfulness. *Problems and Perspectives in Management*, 18(1), 254–262.
- Tabachnick, B. G., & Fidell, L. S. (2007). *Multivariate statistics*. Pearson.
- Tabei, Y., Fletcher, D., & Goodger, K. (2012). The relationship between organisational stressors and athlete burnout in soccer players. *Journal of Clinical Sport Psychology*, 6(2), 146–165.
- Taofeeq, Y. O., Ayotunde Olayinka, O., & Kayode Samuel, O. (2023). Extension practitioners' perception and constraints on ICT use in Southwestern Nigeria. *SAGE Open*, 13(4).
- Tews, M. J., & Stafford, K. (2019). The relationship between tattoos and employee workplace deviance. *Journal of Hospitality & Tourism Research*, 43(7), 1025–1043.
- Taylor Vinters. (2020). *Nigeria: COVID-19 pandemic and its effect on the Nigerian workplace*. Taylor Vinters.
- Thales. (2020). *COVID-19: A new weapon for cyber attackers*
<https://www.thalesgroup.com/en/market-specific/critical-information-systems-and-cybersecurity/news/covid-19-new-weapon-cyber>

- Thatte, S., Grainger, N., & McKay, J. (2014). Understanding feral IT practices as deviance: The contribution of Merton's theory of anomie. In *Feral Information Systems Development: Managerial Implications* (pp. 189–208). IGI Global.
- Tome, J. D. S., & Vaart, L. (2020). Work pressure, emotional demands and work performance among information technology professionals in South Africa: The role of exhaustion and depersonalisation. *SA Journal of Human Resource Management*, 18, 1–12.
- Torsvik, G., Molander, A., & Terum, L. I. (2022). The will to sanction: How sensitive are caseworkers to recipients' responsibility when imposing sanctions on non-compliance in a welfare-to-work programme? *International Journal of Social Welfare*, 31(1), 77–85.
- Tungjitnob, S., Pasupa, K., Thamwiwatthana, E., & Suntisrivaraporn, B. (2020). SME user classification from click feedback on mobile banking apps. In Y. H., P. K., L. A. C., K. J. T., C. J. H., & K. I. (Eds.), *27th International Conference on Neural Information Processing, ICONIP 2020* (Vol. 1332, pp. 256–264). Springer Science and Business Media Deutschland GmbH.
- Varonen, U., & Mattila, M. (2000). The safety climate and its relationship to safety practices, safety of the work environment and occupational accidents in eight wood-processing companies. *Accident Analysis & Prevention*, 32(6), 761–769.
- Velki, T., & Milić, M. (2021). Stress as a mediator between risk and protective factors and online risky behaviours in adolescents. *Primenjena Psihologija*, 14(2), 149–171.

- Verjee, A., & Kwaja, C. M. A. (2021). An epidemic of kidnapping: Interpreting school abductions and insecurity in Nigeria. *African Studies Quarterly*, 20(3).
- Verma, A., & Bharadwaj, K. K. (2017). Identifying community structure in a multi-relational network employing non-negative tensor factorisation and GA k-means clustering. *Wiley Interdisciplinary Reviews: Data Mining and Knowledge Discovery*, 7(1).
- Verschoor, C. C. (2013). Ethical behaviour differs among generations: A new study shows that the ethical behaviour of younger workers differs from that of older generations. Business leaders should strengthen their ethics and compliance programs to address these differences. *Strategic Finance*, 95(2), 11–14.
- Viaene, S. (2008). Linking business intelligence into your business. *IT Professional Magazine*, 10(6), 28–34.
- Vignoli, M., Guglielmi, D., Balducci, C., & Bonfiglioli, R. (2015). Workplace bullying as a risk factor for musculoskeletal disorders: The mediating role of job-related psychological strain. *Journal of Occupational Health Psychology*, 20(4), 423–434.
- Wagstaff, C. R. D., Fletcher, D., & Hanton, S. (2012). Exploring emotion abilities and regulation strategies in sport organisations. *Sport, Exercise, and Performance Psychology*, 1(4), 268–283.
- Walterbusch, M., Fietz, A., & Teuteberg, F. (2017). Missing cloud security awareness: Investigating risk exposure in shadow IT. *Journal of Enterprise Information Management*, 30(4), 644–665.

- Wan Nor, A. (2015). The graphical assessment of multivariate normality using SPSS. *Education in Medicine Journal*, 7(2), 1–9.
- Wang, D., Li, T., Zhu, S., & Gong, Y. (2011). IHelp: An intelligent online helpdesk system. *IEEE Transactions on Systems, Man, and Cybernetics, Part B: Cybernetics*, 41(1), 173–182.
- Wei, Y., & Yan, Z. (2010). Study on the influence of job pressure on staffs' study orientation in the service industry. *Proceedings - 3rd International Conference on Information Management, Innovation Management and Industrial Engineering, ICIII 2010*, 4, 493–495.
- Weijters, B., Baumgartner, H., & Schillewaert, N. (2013). Reversed item bias: An integrative model. *Psychological Methods*, 18(3), 320–334.
- Wibisono, A., Alhassan, I., Sammon, D., Heavin, C., Kiely, G., & Suryani, E. (2019). Understanding theory of workarounds in practice. In Y. A. (Ed.), *5th Information Systems International Conference, ISICO 2019* (Vol. 161, pp. 187–194). Elsevier B.V.
- Willison, R., Warkentin, M., & Johnston, A. C. (2018). Examining employee computer abuse intentions: Insights from justice, deterrence and neutralisation perspectives. *Information Systems Journal*, 28(2), 266–293.
- Willits, D. (2019). Violent propensity, strain, and violent intentions: A test of Agnew's revised conditioning hypothesis. *Deviant Behavior*, 40(1), 122–137.
- Won, Chun, N. (2018). The effect of leadership styles, social capital, and entrepreneurial orientation on organisational effectiveness of social welfare organisations in Malaysia. *Journal of Social Welfare and Human Rights*, 6(1), 45–62.

- Wright, K. A., Lam, D. H., & Brown, R. G. (2009). Reduced approach motivation following nonreward: Extension of the BIS/BAS scales. *Personality and Individual Differences*, 47(7), 753–757.
- Wullur, M. M., & Werang, B. R. (2022). Emotional exhaustion and organisational commitment: Primary school teachers' perspective. *International Journal of Evaluation and Research in Education*, 9(4), 912–919.
- Yang, H., Lv, J., Zhou, X., Liu, H., & Mi, B. (2017). Validation of work pressure and associated factors influencing hospital nurse turnover: A cross-sectional investigation in Shaanxi Province, China. *BMC Health Services Research*, 17(1).
- Yao, D., & Giannoumis, G. A. (2017). Information and communications technology and social media accessibility in China. *Information Technology & People*, 30(4), 759–775.
- Yaokumah, W., Walker, D. O., & Kumah, P. (2019). SETA and security behaviour: Mediating role of employee relations. *Journal of Information Security*, 27(2), 102–121.
- Yau Yeung, P. Y. D. (2017). An exploration of risks in using cloud accounting information systems in Australia (Doctoral dissertation). Queensland University of Technology.
- Yean, T. F., Johari, J., Yahya, K. K., & Chin, T. L. (2022). Determinants of job dissatisfaction and its impact on the counterproductive work behaviour of university staff. *SAGE Open*, 12(3).

- Yekinni, O. T., Adeniyi, R. T., & Ibikunle, O. O. (2024). Utilisation of information communication technologies among male and female rural dwellers of southwestern Nigeria. *Journal of Agricultural Extension*, 28(1), 92–102.
- Yoo, C. W., Sanders, G. L., & Cervený, R. P. (2018). Exploring the influence of flow and psychological ownership on security education, training and awareness effectiveness and security compliance. *Decision Support Systems*, 108, 107–118.
- Young-McLear, K., Wyman, G., Benin, J., & Young-McLear, Y. (2016). A white hat approach to identifying gaps between cybersecurity education and training: A social engineering case study. In D. Nicholson (Ed.), *Advances in Intelligent Systems and Computing* (Vol. 501, pp. 229–237). Springer.
- Zikmund, W. G., Carr, J. C., Babin, B., & Griffin, M. (2013). *Business research methods*. Nelson Education.
- Zimmermann, S., Rentrop, C., & Felden, C. (2017). A multiple case study on the nature and management of shadow information technology. *Journal of Information Systems*, 31(1), 79–105.

APPENDIX

Appendix A: Existing articles (published in journals) on shadow IT

	Author	Title of Paper	Objective of Study	Methodology/How Research was Conducted	Findings	discourse
1	Ogedengbe F.A.; Abdul Talib Y.Y.; Rusly F.H.	Influence of structural factors on employee cloud shadow IT usage during COVID-19 lockdown: a strain theory perspective	Examines the influence of structural factors (work pressure and work overload) on cloud shadow IT usage during COVID-19 lockdown, using strain theory.	Survey method of data collection from employees in Nigeria, analyzed using SPSS for demographics and structural equation modeling with SmartPLS.	Work overload and cognitive strain significantly impact cloud shadow IT usage, while work pressure is insignificant. Findings suggest organizations need to restructure IT systems to reduce exhaustion and discourage unauthorized cloud IT usage.	antecedents
2	Nurfitrianiyah; Munir; Disman; Dirgantari P.	Does Individual IT Experience Affect Shadow IT Usage? Empirical Evidence from Universities with Legal Entities in Indonesia	Examines the relationship between individual IT experience and shadow IT usage in Indonesian higher education institutions.	Quantitative methodology with data collected from 301 respondents at Indonesian universities, analyzed using Smart-PLS data analysis.	Individual IT experience strongly supports shadow IT usage through task identity and job autonomy. Organizations should prioritize employee IT experience and involve them in IT development to increase satisfaction and compliance.	antecedents
3	Nguyen T.	Understanding Shadow IT usage intention: a view of the dual-factor model	Examine facilitating and deterring factors of Shadow IT usage intention using dual-factor theory, UTAUT, and social control theory.	Online survey targeting LinkedIn users to investigate the behavior of organizational insiders.	Performance expectancy, effort expectancy, and subjective norms significantly impact Shadow IT usage intention, while personal norms and sanctions-related factors do not. Ethical work climate significantly increases individual perceptions of informal and formal controls.	antecedents
4	Abbas M.; Alghail A.	The impact of mobile shadow IT usage on knowledge protection: an exploratory study	Provide insight on how mobile shadow IT could impact knowledge protection (KP) in organizations.	Qualitative study with interviews of 11 IT users. Interview guidelines focused on types of mobile shadow IT, occurrence, KP nature in the workplace, and impact on KP.	Most interviewees use mobile shadow IT without IT department notice or permission, negatively impacting KP. Common applications include Dropbox, Google Drive, and WhatsApp, used due to lack of suitable organizational tools. Mobile shadow IT harms KP by being unmonitored.	impact
5	Jayanthiladevi A.; Ayoobkhan M.U.A.; Thamaraiselvi R.; Jimmy L.; Mishra P.	Implementation of multicloud strategies for healthcare organisations to avoid cloud sprawl	Address cloud sprawl and unauthorized cloud use (shadow IT) in healthcare organizations by implementing multicloud strategies.	Discusses organizational challenges and benefits of multicloud strategies in healthcare, focusing on data, devices, apps, and cloud services.	Multicloud provides unified control and scalability, reducing costs and managing digital healthcare information. Organizations plan to use multiple cloud vendors, requiring strategies to avoid cloud sprawl and unauthorized use.	solution

	Author	Title of Paper	Objective of Study	Methodology/How Research was Conducted	Findings	discourse
	Robert N.R.					
6	Fürstenau D.; Rothe H.; Sandner M. 2021	Leaving the Shadow: A Configurational Approach to Explain Post-identification Outcomes of Shadow IT Systems	To explain outcomes of shadow IT system identification using a configurational perspective, and to identify mechanisms and contextual conditions influencing these outcomes.	27 profiles of shadow IT systems were compiled through 35 interviews with respondents from different positions and industries. The study analyzes context-mechanism-outcome configurations explaining outcomes after shadow IT system identification.	Identifies six distinct context-mechanism-outcome configurations explaining four outcomes: phase-out, replacement, continuing as IT-managed system, and continuing as business-managed system. The results contribute to the shadow IT literature and inform IT managers on decision options for identified shadow IT systems given different contextual conditions.	solution
7	Mallmann G.L.; Maçada A.C.G.	The mediating role of social presence in the relationship between shadow IT usage and individual performance: a social presence theory perspective	To examine the mediating role of social presence on the relationship between shadow IT usage and individual performance.	Survey among 286 employees from three large companies. The relationship between shadow IT usage and social presence was analyzed, and the mediating role of social presence on individual performance was examined.	Shadow IT usage positively influences social presence, enhancing aspects like perceived sensitivity and comprehension. Social presence mediates the relationship between shadow IT usage and individual performance, partially explaining the impact of shadow IT on employee performance. Highlights the importance of social presence in technology-mediated communication within organizations.	impact
8	Hasnat R.; Philbin S.P.	Understanding the communication and collaboration challenges encountered by technology managers	Enhance understanding of communication and collaboration challenges in knowledge management, eradication of 'shadow IT', and project success.	Qualitative analysis using a deductive-inductive approach, involving semi-structured interviews of practitioners engaged in knowledge management across different industrial sectors.	Identified primary factors impacting effective collaboration and communication: culture conflict, visibility, demand resource balance, change management, effective leadership, and motivation. Secondary factors include management training, occupational culture differences, autonomy, communication strategy, competence, lack of common goals, incentive, and relatedness.	antecedents
9	Kopper A.; Westner M.; Strahringer S.	From Shadow IT to Business-managed IT: a qualitative comparative analysis to determine configurations for successful management of IT by business entities	To better understand Shadow IT and Business-managed IT and determine configurations for their successful management.	Interviewed 29 executive IT managers about positive and negative cases of Shadow IT and Business-managed IT, and applied qualitative comparative analysis (QCA).	Identified three sufficient configurations of conditions leading to positive outcomes for IT systems managed by business entities, emphasizing the importance of alignment with the IT department and limitation to local requirements.	impact
10	Rakovic L.; Duc T.A.; Vukovic V.	Shadow IT and ERP: Multiple case study in German and Serbian companies	Determines factors for shadow IT use in connection with ERP systems in German and Serbian companies.	Multiple case studies and surveys of experts from European companies.	Identifies a trend towards the use of certain auxiliary software due to the complexity and gaps in knowledge of ERP systems, highlighting strengths and weaknesses of shadow IT and standardized information systems.	overview

	Author	Title of Paper	Objective of Study	Methodology/How Research was Conducted	Findings	discourse
11	Ostermann U.; Holten R.; Franzmann D.	The influence of private alternatives on employees' acceptance of organizational IS	Investigate how private technology usage influences satisfaction with organizational IS.	Empirical study with a research model separating the impact of organizational IS performance and private technology use on satisfaction with organizational IS.	Familiarity with superior private technological alternatives decreases satisfaction with organizational IS, fostering behavioral change. Interaction effects indicate that innovative employees reach higher satisfaction with high organizational IS performance, while non-inert employees become dissatisfied with organizational IS when they experience well-performing IS in private environments.	antecedents
12	Vandana; Purkayastha B.; Kumar A.	Issues and Challenges in Management related to Information Technology	Highlight IT management challenges, including cloud computing, virtualization, and social networks.	Overview of IT trends and challenges, discussing features, types, benefits, and solutions.	Identifies challenges like downtime, vulnerability, and limited control in cloud computing; backup and resource distribution in virtualization; and security and privacy threats in social networks. Proposes solutions to protect users and manage these technologies.	overview
13	Gozman D.; Willcocks L.	The emerging Cloud Dilemma: Balancing innovation with cross-border privacy and outsourcing regulations	To understand specific risks in relation to Cloud adoption and the regulations and penalties for non-compliance, and to theorize a framework for deciding when to engage with or avoid Cloud technologies.	The study focuses on global financial services, detailing emerging effective practices for managing Cloud-based innovation sustainably, and balancing the need to innovate with the need to manage compliance risk.	Cloud adoption challenges and risks are a concern among regulators. The proposed framework helps executives balance innovation with compliance risk management, detailing effective practices for sustainable Cloud-based innovation. While focusing on financial services, the analysis is applicable to all regulated industries where Cloud-based innovations impact business-critical services.	solution
14	Klotz S.; Kopper A.; Westner M.; Strahringer S.	Causing factors, outcomes, and governance of shadow IT and business-managed IT: A systematic literature review	To conduct a systematic literature review on Shadow IT and Business-managed IT, structuring research themes in a framework of causing factors, outcomes, and governance.	Systematic literature review analyzing research themes related to Shadow IT and Business-managed IT, categorizing them into causing factors, outcomes, and governance.	Identifies enablers, motivators, and missing barriers as causing factors. Outcomes include benefits and risks/shortcomings. Governance is categorized into general governance for Shadow IT and Business-managed IT, and instance governance for overt Business-managed IT. Governance themes have been the primary research focus since 2016, while older publications focused on causing factors.	antecedents
15	Sillie M.	Critical impact of organizational and individual inertia in explaining non-compliant security behavior in the Shadow IT context	Investigate the role of organizational and individual inertia in explaining non-compliant security behavior in the Shadow IT context.	Theoretical framework using the theory of organizational and individual inertia and status quo framework to explain factors forming an individual's cognitive-based inertia.	Organizational and individual inertia shape and drive cognitive-based inertia, influencing the behavioral intention to continue using Shadow IT. Provided insights for theory and practitioners on addressing Shadow IT phenomenon to enhance agility, productivity, and compliance with information security policies.	antecedents

	Author	Title of Paper	Objective of Study	Methodology/How Research was Conducted	Findings	discourse
16	Haag S.; Eckhardt A.; Schwarz A.	The Acceptance of Justifications among Shadow IT Users and Nonusers – An Empirical Analysis	Understand the acceptance of justifications for shadow IT usage among users and nonusers.	Empirical analysis of shadow IT usage and justification acceptance.	Significant differences exist between shadow IT users and nonusers in justification acceptance. Noncompliance influences users' acceptance, while nonusers accept justifications if they expect benefits. Provides implications for managers to reduce shadow IT usage.	antecedents
17	Junglas I.; Goel L.; Ives B.; Harris J.	Innovation at work: The relative advantage of using consumer IT in the workplace	Examine antecedents and consequences of IT consumerization behaviors.	Investigates satisfaction with enterprise IT, perceived relative advantage of consumer IT, organizational mandates, and IT empowerment.	IT consumerization influences innovative behaviors at work. Satisfaction with enterprise IT and relative advantage of consumer IT impact usage. Organizational mandates and IT empowerment also influence behaviors.	antecedents
18	Mallmann G.L.; Maçada A.C.G.; Oliveira M.	The influence of shadow IT usage on knowledge sharing: An exploratory study with IT users	To identify types and occurrences of shadow IT used by employees, investigate how knowledge sharing occurs via shadow IT, and how shadow IT influences knowledge sharing.	Exploratory study using qualitative approach. Interviews with IT users were conducted to identify types and occurrences of shadow IT, and to understand its impact on knowledge sharing.	Employees frequently use collaborative systems and mobile devices unauthorized by IT departments to share knowledge and communicate, mainly due to the lack of suitable tools provided by organizations. Shadow IT facilitates knowledge sharing, especially for geographically distributed teams. The study contributes to understanding the usage of shadow IT and balancing its risks and benefits.	impact
19	Huber M.; Zimmermann S.; Rentrop C.; Felden C.	Conceptualizing shadow IT integration drawbacks from a systemic viewpoint	Identify drawbacks of shadow IT integration from a systemic viewpoint using path dependency and switching costs.	Literature review, including a systematic search and analysis from a systemic viewpoint using path dependency and switching costs.	Developed a conceptual framework for shadow IT integration drawbacks, classifying drawbacks into three dimensions: switching costs (financial, procedural, emotional), organizational/technical/level-spanning criteria, and global/local/interaction levels. Provided criteria for practitioners to collect evidence for IT integration decisions.	solution
20	Zimmermann S.; Rentrop C.; Felden C.	A multiple case study on the nature and management of shadow information technology	Describes shadow IT based on case studies of three companies and investigates its management.	Case studies of three companies, examining 62% of cases where companies decided to reengineer detected instances or reallocate related subtasks to their IT department.	Shadow IT is often transformed into controlled business-managed IT activities, enhancing end-user computing management and providing a way to formalize the role of workarounds in business workgroups.	solution
21	Silic M.; Barlow J.B.; Back A.	A new perspective on neutralization and deterrence: Predicting shadow IT usage	To examine the role of neutralization and deterrence in discouraging employees from using Shadow IT.	Survey of employees from four organizations. Studied effects of neutralization on intentions (self-reported) and actual behavior, examining the role of shame as a mediator.	The "metaphor of the ledger" neutralization technique predicts Shadow IT intention and actual usage. Neutralization and deterrence effects influence shame. The study contributes to IT security literature by providing insights into the predictors of Shadow IT usage and the role of neutralization and deterrence in influencing employee behavior.	antecedents

	Author	Title of Paper	Objective of Study	Methodology/How Research was Conducted	Findings	discourse
22	Walterbusch M.; Fietz A.; Teuteberg F.	Missing cloud security awareness: investigating risk exposure in shadow IT	Explore cloud computing risks and unauthorized use (shadow IT).	Mixed-methods approach including literature review, cloud computing awareness study, vignette study, and expert interviews.	Identifies reasons for cloud computing services use, counteractions against unauthorized use, and associated risks. Proposes a belief-action-outcome model and recommendations for employers and employees to mitigate risks.	solution
23	Kalyani B.J.D.; Rao K.R.H.	A roadmap to develop multi cloud computing systems	Provide milestones in constructing Multi Cloud Computing Systems (MCCS) and address design issues for MCCS architecture.	Identified organizational need for MCCS, emphasizing design issues, requirements for development groups, and types of architectures (cloud-hosted proxy, proxy as a service, point-to-point proxy, on-premises proxy).	MCCS helps core IT organizations offer cloud infrastructure services while ensuring governance and cost control. Highlighted the shift from shadow IT to a strategic imperative for MCCS. Suggested making Cloud Broker a proxy to reduce complexity and cost of MCCS architecture and improve application performance.	solution
24	Walters R.	Bringing IT out of the shadows	Discusses how organizations can manage and audit web-based applications to combat shadow IT and maintain security and compliance.	Conceptual discussion on identity and access management, auditing web-based applications, and comparing these to traditional on-premise application management policies.	Emphasizes the importance of restoring identity and access management and auditing web-based applications to detect and prevent insider misuse, maintaining compliance and benefiting from cloud scalability and portability.	solution
25	Kure J.; Ito K.; Tateiwa M.; Suzuki S.	Integrating multi-cloud environment with FUJITSU cloud services management	To address the challenges of multi-cloud environments and shadow IT by offering a solution (FUJITSU Cloud Services Management) that integrates multi-cloud management, enhancing ICT governance and optimizing ICT operation and spending.	Describes the challenges of multi-cloud environments and presents FUJITSU Cloud Services Management as a solution to centrally manage enterprise-wide usage, contracts, and costs.	Highlights the challenges pertaining to multi-cloud environments and how FUJITSU Cloud Services Management provides a solution to enhance ICT governance and optimize ICT operation and spending.	solution
26	Klotz S.; Westner M.; Strahinger S.	Critical Success Factors of Business-managed IT: It Takes Two to Tango	To identify critical success factors of Business-managed IT based on case study results, focusing on governance options for Business-managed IT.	Case study results	Identified four groups of critical success factors: general approach to Business-managed IT/Business-managed IT strategy, Business-managed IT project prerequisites/Business-managed IT team, Business-managed IT project execution and outcome, and information technology management for Business-managed IT. Bilateral responsibility between the business unit and the IT organization is the most favorable governance option.	
27	Huber M.; Zimmermann S.; Rentrop C.; Felden C.	The relation of shadow systems and ERP systems—Insights from a multiple-case study	To explore the relationship between shadow systems and ERP systems, providing a dependency approach to enable their comparison and integration possibilities.	Multiple-case studies analyzing the capabilities of shadow systems compared to ERP systems and deriving categories for different stages of dependency.	Found that 64% of shadow systems are related to ERP systems, sharing parts or all of their data and/or functionality. Provides insights into integration possibilities and contributes to the discussion about shadow systems and enterprise integration.	solution

	Author	Title of Paper	Objective of Study	Methodology/How Research was Conducted	Findings	discourse
28	De Vargas Pinto A.; Beerepoot I.; Maçada A.C.G.	Encourage autonomy to increase individual work performance: the impact of job characteristics on workaround behavior and shadow IT usage	To ascertain the impact of job characteristics on workaround behavior and shadow IT usage and how these behaviors relate to individual performance.	Survey conducted among 415 IT users. Reliability Analysis and Exploratory Factor Analysis in SPSS software, followed by Confirmatory Factor Analysis and Structural Equation Modeling in SmartPLS software.	Autonomy is strongly related to workaround behavior and shadow IT usage, which in turn are positively related to individual performance. Skill variety and task identity do not significantly affect these behaviors. Organizations are encouraged to increase job autonomy to enhance individual performance through workarounds and shadow IT, which boost communication and collaboration.	antecedents
29	White M.S.	Workarounds and shadow IT – balancing innovation and risk	To explore the use of workarounds and shadow IT in enterprise and clinical settings, focusing on the balance between innovation and risk.	Review of existing research on workarounds and shadow IT in data-rich processes and digital workplaces.	Workarounds and shadow IT can introduce corporate risk or provide a basis for process innovation. Existing research focuses on data-rich processes, with less attention to workarounds in digital workplaces, where processes may be more complex.	solution
31	Scalabrin Bianchi I., Vaquina A., Pereira R., Dinis Sousa R., Dávila G.A.	A Benefit Dependency Network for Shadow Information Technology Adoption, Based on Practitioners' Viewpoints	Propose a benefit dependency network (BDN) for shadow IT and synthesize findings on SIT practices and benefits	Systematic literature review (SLR) and design science research methodology, including semi-structured interviews with 14 interactions	Proposed a BDN model with five dimensions for SIT, aiding decision-making for organizations aiming for innovation, increased revenue, or client retention	impact
32	Ali M.I., Kaur S.	BYOD secured solution framework	Focus on secured design architecture of BYOD solutions and highlight security risks associated with BYOD	Practical analysis and demonstration of a secured BYOD design model	Highlighted the security risks and proposed a secured BYOD model to maintain organizational security policies and address concerns of enterprise leaders	impact
33	Silic M., Back A.	Shadow IT - A view from behind the curtain	Investigate the phenomenon of Shadow IT and its implications on organizational security	In-depth analysis of organizational Shadow IT software database using a triangulation approach	Revealed that greynet, content apps, and utility tools are the most used shadow systems; provided insights for information management professionals and research directions for academia	overview
34	Huang H.-H., Lin J.-W.	Inconsistencies Between Information Security Policy Compliance and Shadow IT Usage	Investigate the effects of self-efficacy on information security policy compliance and shadow IT usage	Experiment with 83 valid subjects, data collected through behavior monitoring and posttest questionnaire	Found positive correlation between ITSE/ISSE and ISP compliance intention; no significant correlation between ISP compliance and shadow IT usage, indicating a discrepancy between intention and actual behavior	
35	Myers N., Starliper M.W., Summers	The impact of shadow IT systems on perceived information credibility	Examine how shadow IT in product costing impacts information credibility and managerial decision making	Two experiments	Participants view information from shadow IT systems as less credible and are less likely to rely on costing reports from shadow IT systems; despite concerns, managers do not	impact

	Author	Title of Paper	Objective of Study	Methodology/How Research was Conducted	Findings	discourse
	S.L., Wood D.A.	and managerial decision making			exercise sufficient care in evaluating reports from shadow IT systems	
36	Johnson S.	Bringing IT out of the shadows	Discuss the broader challenge of shadow IT and propose policy-based networking as a solution	Discussion and explanation by Steve Johnson of Extreme Networks	Highlights the complexity of shadow IT and suggests that policy-based networking can help manage and maintain policies centrally to address shadow IT challenges	
37	Haag S.; Eckhardt A.; Venkatesh V.	Deviant affordances: when tensions, deadlocks, and nonconformance generate performance	Conceptualize affordances as deviant when they deviate from organizational IT policies and identify mechanisms underlying deviant affordances that support both individual and organizational goals.	Multimethod research design integrating interview and experimental studies	Identified three key mechanisms underlying deviant affordances: tension, deadlock, and actualization mechanisms. Explained the importance of users' perceived deadlock in generating deviant outcomes that support organizational goals through improved task, contextual, and innovative job performance.	antecedents
38	Raković L.; Sakal M.; Matković P.; Marić M.	Shadow IT – A systematic literature review	Show the extent to which shadow IT has been researched and present the reasons for shadow IT occurrence and its management possibilities.	Systematic literature review of papers covering the topic of shadow IT from electronic databases (Web of Science, Scopus, AIS Electronic Library).	More than half of the analyzed papers are case studies. Presented the reasons for shadow IT occurrence and proposed a project called "illuminating" shadow IT, which comprises three phases. The review is limited to papers published in English.	
39	Khalil S.; Samhan B.	The impact of cloud adoption on talent management: an exploratory study from the "learning organization" perspective	Explore the impact of cloud adoption on large French organizations from a "learning organization" perspective.	Interviews with business and IT stakeholders from 35 multinational organizations in France	Cloud services have a high impact on large organizations, leading to a demand for cloud-related skills, a power shift from IT to business departments, and increased shadow IT activities. Effective utilization requires organizational learning and change management projects, transforming organizations into productive and innovative learning organizations. Contributes to cloud computing, organizational learning, and talent management literature.	antecedents
40	Richter S.; Waizenegger L.; Steinhueser M.; Richter A.	Knowledge management in the dark: The role of shadow IT in practices in manufacturing	Study the role of private smartphones (and related applications like WhatsApp) in knowledge-intensive practices in the manufacturing domain.	In-depth case study based on data gained from observations and interviews	Workers use private smartphones against company guidelines and find significant productivity gains using forbidden applications. Provides insights into the rise of shadow IT in manufacturing, taking place in a self-organized manner without management knowledge.	antecedents
41	Cox G.	Managing the risks of shadow IoT	Discuss the complexities and security risks inherent in BYOD schemes and shadow IT operations, exacerbated by the growth of the Internet of Things (IoT).	Discussion and explanation	Highlights the complexities and risks of shadow IoT, suggesting the need for comprehensive management strategies to address the increasing use of consumer devices in enterprise networks.	antecedents

	Author	Title of Paper	Objective of Study	Methodology/How Research was Conducted	Findings	discourse
42	Jarrahi M.H.; Reynolds R.; Eshraghi A.	Personal knowledge management and enactment of personal knowledge infrastructures as shadow IT	Examine key personal knowledge management (KM) and knowledge building (KB) practices among adult professionals, highlighting the role of shadow IT in these practices.	Interviews with 58 consultants from 17 managing consulting firms	Personal knowledge infrastructures emerge from personal KM and KB practices, supported by informal ties and various technologies. Highlights the role of informal social networks and social media in supporting personal KM and KB. Contributes a conceptual model of factors that help knowledge workers build a personal knowledge infrastructure and balances organizational KM strategies with personal knowledge goals of individual workers.	antecedents



Appendix B: Other existing publications (Conference Papers and lecture Notes) on Shadow IT

S/N	Authors	Title	Objective	Methodology	Findings
1	Györy et al., 2012	Exploring the shadows: IT Governance approaches to user-driven innovation	To explore IT governance approaches to user-driven innovation, particularly shadow IT, in the context of digital natives and ubiquitous computing.	Triangulation approach using three independent data sources within IS research, IS Security (ISsec), IT Governance (ITG), and Business IT Alignment (BITA).	Found that user-driven IT solutions emerge due to IT departments' inability to meet business needs. Identified three IT governance approaches to shadow IT based on business or IT strategy: IT-control, user-oriented, and user-driven. Highlighted the need for adaptive IT governance to accommodate user-driven innovation while managing associated risks.
2	Kretzer & Maedche, 2014	Generativity of business intelligence platforms: A research agenda guided by lessons from shadow IT	To provide a research agenda on generativity of business intelligence platforms, drawing lessons from shadow IT.	Literature review	Presented a literature review on positive and negative shadow IT impacts and suggested a research agenda on the generativity of BI platforms.
3	Haag & Eckhardt, 2014	Normalizing the shadows-The role of symbolic models for individuals' shadow IT usage	To address shadow IT usage at the individual level and develop a research model analyzing the effect of explicit IT usage restrictions.	Theoretical model development, future laboratory experiment	Defined shadow IT usage as voluntary usage violating IT norms to enhance work performance. Proposed a model based on organizational frustration, social learning, and norm salience theories to analyze inhibiting effects of IT usage restrictions on deviant behaviors.
4	Fürstenau & Rothe, 2014	Shadow IT systems: Discerning the good and the evil	To provide a nuanced understanding of shadow IT systems with respect to their architectural embeddedness	Method using centrality measures from network analysis, demonstrated with data from a recycling company	Identified critical and disregarded shadow IT systems, introduced measures for better governance of these systems
5	Zimmermann et al., 2014	Managing shadow IT instances - A method to control autonomous IT solutions in the business departments	To develop a method to manage shadow IT instances	Design science research and multiple-case study	Provided measures to identify, evaluate, and control shadow IT instances, contributing to IT Governance research regarding IT activities at the business and user level

S/N	Authors	Title	Objective	Methodology	Findings
6	Thatte et al., 2014	Understanding feral IT practices as deviance: The contribution of Merton's theory of anomie	The authors discuss feral IT practices, defined as work practices deviating from organizational norms, often beyond IT management's control. They explore how Merton's Theory of Anomie can shed light on such deviance and propose a conceptual framework based on structural strain.	Conceptual framework based on Merton's theory.	Feral IT practices can be innovative but risky; managing risks while harnessing innovation is crucial.
7	Zimmermann & Rentrop, 2014	On the emergence of shadow it - A transaction cost-based approach	Explores why Shadow IT emerges based on Transaction Cost Theory, using expert interviews and multiple-case study.	Triangulation approach with expert interviews and multiple-case study.	Prohibitive transaction costs and misalignment between business and IT departments are key factors in Shadow IT emergence, suggesting the application of Transaction Cost Theory for managing Shadow IT.
8	Chua et al., 2014	Central IT or Shadow IT? Factors shaping users' decision to go rogue with IT	Investigates factors influencing the decision to use Shadow IT instead of central IT, using paired interviews with CIOs and senior users.	Paired interviews with CIOs and senior users.	Factors influencing Shadow IT use include perceptions of legitimacy and user departments' ability to procure IT independently.
9	Haag et al., 2015	Are shadow system users the better IS users?-Insights of a lab experiment	To analyze individual-level system usage to improve performance by adapting and expanding the number and configuration of systems in use.	Lab experiment	Shadow system users are more intrinsically motivated, easier accept neutralization techniques, and perform better regarding task output and behavior. Deviant usage behavior improves both task achievement and the functionality of the mandatory system.
10	Singh, 2015	Emergence and consequences of drift in organizational information systems	To examine the emergence and consequences of locally-driven, centrally-unintended adaptations of an organization's IT assets (IS portfolio drift).	Practice theory perspective, ten case studies	Highlighted the dual nature of IS portfolio drift, with both costly consequences and potential benefits. Explained how portfolio drift is an ongoing macro-level outcome of micro-level actions and is influenced by power allocation within the organization.

S/N	Authors	Title	Objective	Methodology	Findings
11	Gozman & Willcocks, 2015	Crocodiles in the regulatory swamp: Navigating the dangers of outsourcing, SaaS and shadow IT	To detail the increasing body of regulations and inherent risks for businesses related to outsourcing, SaaS, and shadow IT, and to propose a model for managing these risks.	Research in financial services, examining regulatory frameworks and their implications.	Highlighted the risks associated with losing control over IT architecture, security, applications, and deployment due to outsourcing and shadow IT. Proposed a model for managing these risks through investigation, strategizing, and governance of outsourcing arrangements and related regulatory obligations. Emphasized the need for businesses to navigate regulatory challenges effectively to avoid compliance issues and potential damages.
12	Haag & Eckhardt, 2015	Justifying shadow it usage	Examines employees' justifications for Shadow IT usage at the individual level, using a research model based on neutralization theory and a proposed laboratory experiment.	Proposed research model and laboratory experiment.	Employees justify Shadow IT usage based on factors like necessity and perceived injustice, which are mitigated by explicit IT guidelines.
13	Mallmann et al., 2016	Can shadow IT facilitate knowledge sharing in organizations? An exploratory study	To analyze how knowledge sharing occurs via Shadow Information Technology.	Qualitative study	Identified that respondents use unauthorized collaborative systems like WhatsApp and Skype to share knowledge. Shadow IT facilitates knowledge sharing, especially in geographically distributed settings. Provided insights for IT managers on balancing risks and benefits of Shadow IT.
14	Furstenau et al., 2016	Shadow IT, risk, and shifting power relations in organizations	To understand the persistence of shadow IT within organizations using notions of power and social construction of risk.	Case study	Identified two feedback cycles concerning power relations between business units and central IT. The weakening of formal programs may not stop the shadow IT cycle if underlying causes are not addressed.
15	Kopper & Westner, 2016b	Towards a taxonomy for Shadow IT	To develop a taxonomy for Shadow IT concepts by identifying and classifying common characteristics.	Literature review, iterative methodology	Identified 21 different terms for Shadow IT related concepts, reduced them to six distinct concepts (Feral Practices, Workarounds, Shadow IT, Shadow Systems, Un-enacted Projects, and Shadow Sourcing), and provided a guide to their usage to unify existing knowledge.

S/N	Authors	Title	Objective	Methodology	Findings
16	Zimmermann et al., 2016b	Governing IT activities in business workgroups—design principles for a method to control identified shadow IT	To propose design principles for a method to control identified shadow IT in business workgroups.	Action design research in four organizational settings	Developed a procedure for allocating task responsibilities between business and IT units, following risk considerations and transaction cost economics. Contributed to governance research regarding business-located IT activities.
17	Kopper & Westner, 2016a	Deriving a framework for causes, consequences, and governance of shadow IT from literature	To derive a framework for the causes, consequences, and governance of shadow IT through a structured literature review.	Structured literature review	Identified motivators, enablers, and missing barriers as causes of shadow IT, both positive and negative consequences at organizational and technical levels, and governance approaches focusing on clearance or prevention of shadow IT. Revealed a dominance of constructivist, qualitative designs in existing research and highlighted the lack of dominant theories explaining shadow IT. Suggested future research to focus on the less explored governance aspect.
18	Silic et al., 2016	Shadow IT: Steroids for innovation	To understand if shadow IT can be an important source of innovation for firms and provide evidence of its positive effects.	Single case study with an international firm, interviews with 15 IT executives, and a focus group using Twitter to interact with 65 IT professionals	Revealed that shadow IT can be an important source of innovation for organizations. Provided new theoretical contributions for researchers and important insights for practitioners. Discussed limitations and future directions for research.
19	Zimmermann et al., 2016a.	Governing identified shadow IT by allocating IT task responsibilities	To propose design principles for controlling identified shadow IT through the allocation of IT task responsibilities between business workgroups and the IT unit.	Action design research in four organizational settings, following risk considerations and transaction cost economics.	Proposed a method for allocating IT task responsibilities between business workgroups and the IT unit to control shadow IT. Emphasized the importance of adaptive and efficient IT service governance to reduce risks and inefficiencies associated with shadow IT. Contributed to governance research by providing design principles for managing business-located IT activities.
20	Mallmann & Maçada, 2016	Behavioral drivers behind Shadow IT and its outcomes in terms of individual performance	To verify the behavioral drivers behind shadow IT usage and its outcomes in terms of individual performance.	Developed a conceptual model based on literature on Human-Computer Interaction and Shadow IT. Survey research with IT users of companies.	Preliminary results indicated various behavioral drivers behind shadow IT usage, influencing individual performance. Highlighted the changing nature of IT management due to unauthorized technology use by employees. Suggested further research to refine the conceptual model and fully understand the impact of shadow IT on individual performance.

S/N	Authors	Title	Objective	Methodology	Findings
21	Zimmermann et al., 2016a	Governing identified shadow IT by allocating IT task responsibilities	To propose design principles for a method to control identified shadow IT and allocate IT task responsibilities between business workgroups and the IT unit.	Action design research in four organizational settings	Proposed design principles for controlling identified shadow IT and allocating IT task responsibilities between business workgroups and the IT unit, contributing to governance research regarding adaptive and efficient arrangements with reduced risks for business-located IT activities.
22	Lüker et al., 2016	IT consumerization and compliant use: Do policies matter?	Investigates the effect of IT consumerization strategies on employees' policy-related attitudes and compliance with policies, using mixed methods interviews with employees at higher education institutions.	Mixed methods interviews with 36 employees.	Middle ground strategies accommodating IT consumerization are associated with higher understanding but lower satisfaction with policies, impacting compliant behavior.
23	Born & Krönung, 2016	Deviant cloud usage in public institutions - A matter of personal innovativeness?	Explores the influence of personal innovativeness on deviant cloud usage in public institutions, using preliminary findings among public officials.	Preliminary findings among public officials.	Users with high personal innovativeness are less likely to comply with IS security policies regarding cloud usage in public institutions.
24	Huber et al., 2017a	Integration of shadow IT systems with enterprise systems—a literature review	To define shadow IT systems (SITS) integration with enterprise systems (ES) and provide guidelines for integration decision and process.	Literature review	Defined SITS integration and derived guidelines for integration decision, phases preceding and following integration, and the integration process. Offers insights into SITS integration specifics and provides a basis for future SITS research.
25	Kopper, 2017	Perceptions of IT managers on shadow IT	To get an up-to-date perspective of IT managers on the phenomenon of shadow IT.	16 interviews with executive or senior IT managers, content analysis	Found that many practitioners currently deal with governance aspects of shadow IT and its controlled use in organizations. Some participants enable "Business-Managed IT" to harness the potential of shadow IT while managing associated risks. Participants prefer to improve the IT organization to better serve users and reduce the need for shadow IT. Highlighted a contrast between academic research and practitioner focus, with the latter emphasizing governance and controlled use.

S/N	Authors	Title	Objective	Methodology	Findings
26	Steinhueser et al., 2017	Knowledge management without management - Shadow IT in knowledge-intensive manufacturing practices	To examine Shadow IT in knowledge-intensive manufacturing practices	Case studies in knowledge-intensive manufacturing practices	Highlighted the prevalence of Shadow IT in manufacturing, emphasizing the need for better knowledge management practices
27	Huber et al., 2017b	The influence of shadow IT systems on enterprise architecture management concerns	To analyze the influence of Shadow IT systems on enterprise architecture management concerns	Case studies and interviews with enterprise architects	Demonstrated how Shadow IT impacts enterprise architecture management, leading to various concerns and challenges
28	Johnson, 2017	IT & shadow IT (embrace or squash)	To explore the dilemma of whether to embrace or eliminate Shadow IT	Literature review	Discussed the pros and cons of embracing versus eliminating Shadow IT, providing insights into potential strategies for managing Shadow IT within organizations
29	Hunter & Boersen, 2017	Out from the shadows: Encouraging girls in New Zealand into IT careers	Evaluates the effectiveness of an intervention (Shadow IT) in encouraging girls to consider IT careers in New Zealand, using surveys conducted before and after the intervention.	Surveys conducted before and after the intervention.	Shadow IT intervention positively influences girls' interest in IT careers initially, but long-term effects vary based on individual career intentions.
30	Shaikh, 2018	Shadow-IT system and insider threat: An assessment of an opportunity dimension for the identity theft	To understand the specific threats posed by insiders using shadow IT and assess the risk of identity theft (ID theft) to PII.	Survey design	Integrated the opportunity dimension from the fraud triangle and organizational context of insider threat to present a theoretical model explaining the relationship between shadow IT systems and the potential for fraudulent behavior.
31	Magunduni & Chigona, 2018	Revisiting shadow IT research: What we already know, what we still need to know, and how do we get there?	To review past literature on shadow IT to identify research gaps and propose future research directions.	PRISMA approach	Found that definitions and terminologies in shadow IT literature are inconsistent, making it difficult for new researchers. Most studies focus on individual rather than group perspectives. Consequences and punishments for shadow IT are not explored. This study informs theory on research gaps and future research opportunities in the field of shadow IT.

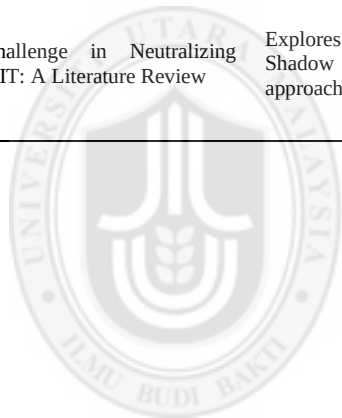
S/N	Authors	Title	Objective	Methodology	Findings
32	Mallmann, Maçada, et al., 2018	We are social: A social influence perspective to investigate shadow IT usage	To investigate the mechanisms underlying the dissemination process of shadow IT among users and uncover the reasons for its use from a social influence perspective.	Survey among employees of four companies	Found that social influence varies depending on the reference group (peers, superiors, mass influence). Employees are strongly influenced by peers and a mass of people, suggesting a broader range of social influence affecting shadow IT use. Highlighted the importance of communication and social interactions in shadow IT dissemination. Suggested organizations create initiatives and take actions to engage users in information security policies, addressing one of the primary concerns related to shadow IT.
33	Sauerwein et al., 2018	Shadow cyber threat intelligence and its use in information security and risk management processes	To investigate the use of shadow cyber threat intelligence in organizations	Structured, in-depth analysis	Revealed the unstructured and informal manner in which shadow cyber threat intelligence is obtained and shared internally, highlighting its impact on information security and risk management
34	Kopper et al., 2018	Business-managed iT: A conceptual framework and empirical illustration	Proposes "Business-managed IT" for overt systems managed by business entities, distinct from Shadow IT, with case vignettes.	Conceptual framework and case vignettes.	Provides a concept for business-managed IT, distinct from Shadow IT, aiding in task responsibility discussions.
35	Ostermann, 2018	How experience with private IS affects employees' satisfaction with organizational IS	Investigates the impact of private IS use on organizational IS satisfaction.	Theoretical framework based on cybernetic negative feedback loop.	Satisfaction with organizational IS is influenced by private IS use, indicating a need to consider both in IS adoption research.

S/N	Authors	Title	Objective	Methodology	Findings
36	Šedivcová Nesvedová & Potančok, 2019	Shadow IT Management Concept for Public Sector	To propose a shadow IT management concept for the public sector.	Case study, interviews with main stakeholders	Identified 7 problematic areas related to shadow IT in the public sector and recommended approaches and solutions for these areas. Created a Shadow IT Management Concept based on case study findings.
37	Wibisono et al., 2019	Understanding theory of workarounds in practice	To capture the use of Theory of Workarounds in research to explain workaround creation	Literature review and analysis of ten top-cited articles and ten recent articles from Google Scholar	Demonstrated the application of Theory of Workarounds to understand how researchers explain workaround creation, contributing to the Information Systems body of knowledge
38	Mallmann, De Vargas Pinto, et al., 2018	Shedding Light on Shadow IT: Definition, Related Concepts, and Consequences	To understand shadow IT based on existing literature, discussing its definition, types, related concepts, and consequences	Literature review	Enhanced understanding of shadow IT, provided contributions to the emerging body of knowledge, and suggested research gaps for future exploration
39	Klotz, 2019	Shadow IT and business-managed IT: Where is the theory?	Reviews existing research on Shadow IT and Business-managed IT to identify reference theories used and suggests category-spanning theories for future research.	Literature review and analysis of reference theories.	Calls for enhanced theorizing in Shadow IT and Business-managed IT research, highlighting the importance of using reference theories for theory testing and building.
40	Mallmann et al., 2019	The social side of shadow IT and its impacts: Investigating the relationship with social influence and social presence.	Examines the relationship between social factors (social influence, social presence) and Shadow IT usage, focusing on how Shadow IT impacts work performance and collaboration.	Survey among employees from different companies.	Shadow IT usage is positively related to social influence and social presence, leading to improved work performance and communication among employees.
41	Klotz et al., 2019	Transformed Knowledge Sharing through Business-managed IT and Shadow IT	Analyzes how Business-managed IT and Shadow IT transform knowledge sharing in enterprises, using two case studies and the knowledge-based view theoretical lens.	Case studies and theoretical analysis.	Business-managed IT and Shadow IT both transform knowledge sharing, with benefits and challenges related to cross-unit collaboration.

S/N	Authors	Title	Objective	Methodology	Findings
42	Klotz et al., 2020	From shadow IT to business-managed IT and back again: How responsibility for IT instances evolves over time	Conceptualizes IT responsibility progression and transitions using case vignettes.	Conceptual framework and case vignettes.	IT responsibility can transition from Shadow IT to Business-managed IT over time, highlighting the need for temporal governance.
43	Keskin et al., 2021	Domesticating a Treasury Shadow IT Application in a Turkish Bank	To control Shadow IT applications in organizations by presenting a case study of a Turkish bank.	Case study	Highlighted factors for the Shadow IT application occurrence, risks, conversion project from Shadow IT to business IT, challenges, and solution approach. Provided implications and insights for organizations in similar contexts.
44	Kapepo et al., 2021	Towards a theoretical understanding of workarounds emerging from use of a referral mobile application: A developing country context	To describe factors driving the enactment of workarounds to the Vula mobile referral application in public hospitals in South Africa and Namibia.	Multiple case study in three public hospitals, semi-structured interviews with 29 HCPs, thematic analysis approach	Identified substantial evidence of misfits between work and the use of referral applications. Developed a conceptual framework explaining workaround practices. Found workarounds in the form of Shadow IT, augmenting existing systems, and adapting the e-referral application. Highlighted design-reality gaps and security risks, compromising patient information privacy and confidentiality. Recommended developing effective measures, policies, and strategies to address unresolved constraints in the referral system.
45	Akello et al., 2021	Volitional non-malicious insider threats: At the intersection of COVID-19, WFH and cloud-facilitated shadow-apps	To examine the insider-related threat to organizational data due to the self-support model of computing facilitated by cloud-based applications, especially in the context of COVID-19 and the new Work From Home (WFH) model.	Theoretical framework using Theory of Planned Behavior (TPB) and General Strain Theory (GST), examining insider threats and data security in the context of WFH and COVID-19.	Identified new data security threats due to the increased use of unapproved cloud-based applications during WFH. Highlighted the benefits and risks of shadow IT in this context. Suggested that diminished formal workplace structures during WFH increase the risk of introducing vulnerabilities through shadow IT. Contributed to theoretical research by incorporating GST with TPB to explain volitional non-malicious insider threats better. Provided practical insights for managing data security in the evolving work environment.

S/N	Authors	Title	Objective	Methodology	Findings
46	Ozkan et al., 2021	Controlling Shadow IT: Case Study from a Turkish Bank	To present the development of an IT governance and management system to control shadow IT in Kuveyt Turk Participation Bank, including an accompanying control approach.	Case study from Kuveyt Turk Participation Bank, examining IT processes and governance models.	Developed an IT governance and management system to control shadow IT, focusing on risk management and control approaches. Highlighted the financial and reputational risks associated with unmanaged shadow IT. Contributed to the literature by addressing the under-emphasized control of shadow IT in the finance sector. Provided practical insights for other organizations to manage shadow IT effectively.
47	Nassar et al., 2021	Identifying NAT Devices to Detect Shadow IT: A Machine Learning Approach	To identify NAT devices to detect Shadow IT using a machine learning approach	Machine learning approach to identify NAT devices	Effective identification of NAT devices aiding in detection of Shadow IT
48	Käss et al., 2021	Towards a taxonomy of concepts describing IT outside the IT department	To create a taxonomy of concepts describing IT outside the IT department	Systematic literature review	Developed a taxonomy of concepts such as Lightweight IT, IT Consumerisation, BYOD, Shadow IT, and Business-Managed IT, aiding in better transfer of research results between streams
49	Godefroid et al., 2021	IT Outside of the IT Department: Reviewing Lightweight IT in Times of Shadow IT and IT Consumerization	Conducts a systematic literature review on lightweight IT, comparing it with Shadow IT and IT Consumerization to derive drivers, benefits, and risks of lightweight IT and suggest further research questions.	Systematic literature review.	Lightweight IT has similarities and differences with Shadow IT and IT Consumerization, highlighting the need for further research in this area.
50	Castellano et al., 2022	Shadow IT Behavior of Financial Executives in Germany and Italy as an Antecedent to Internal Data Security Breaches	To investigate Shadow IT behavior of financial executives in Germany and Italy as a precursor to internal data security breaches	Empirical study conducted in Germany and Italy, involving financial executives' behavior towards Shadow IT	Identified risky Shadow IT behaviors among financial executives, contributing to internal data security breaches

S/N	Authors	Title	Objective	Methodology	Findings
51	van Acken et al., 2023	Poster: The Unknown Unknown: Cybersecurity Threats of Shadow IT in Higher Education	To study shadow IT and related cyber threats in higher education.	Interviews with 11 IT and security experts	Provided a comprehensive overview of observed shadow IT types and related cyber threats in higher education. Found prevalent cloud and self-acquired software use, with cybersecurity risks from outdated software and visibility gaps. Suggested managing shadow IT with cybersecurity best practices, considering stakeholder needs, supporting educators and researchers, and offering usable IT solutions.
	Ure notesTialih, 2023	The Challenge in Neutralizing Shadow IT: A Literature Review	Explores challenges in neutralizing Shadow IT using a literature review approach.	Literature review.	Neutralizing Shadow IT poses challenges due to workarounds and system limitations.



UUM
Universiti Utara Malaysia

Appendix C: Construct Measurement

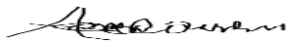
Variable	Original construct	Modified construct	Reference
Exclusion criteria question		To what extent do you use IT services at work?	
Shadow IT usage			
1	I use Internet-based software or cloud services that are unauthorised or unrecognised by the IT department	I use cloud-based services that are unauthorised by the IT department	Mallmann & Maçada, 2017
2	I use a solution developed by me or another employee on the company’s computers that is unauthorised or unrecognised by the IT department to perform my work tasks	I use cloud-based solutions that were unauthorised by the IT department to perform my work tasks	
3	I use software installed by me or another employee on the company’s computers that is unauthorised or unrecognised by the IT department to perform my work tasks	I install software that was unauthorised by the IT department to perform my work tasks	
4	I use my own devices at work without permission from the IT department, including applications on my mobile device on the company’s network	I use applications on my mobile devices at work without permission from the IT department	
5	I use my own devices at work without permission from the IT department, including applications on my mobile device on the company’s network	I use my own devices at work without permission from the IT department	
	Where do you store data for business done as mobile work with personal devices?		Hatashima & Sakamoto, 2017
6	Information systems in the company	I store organisation data in the company provided Information systems	
7	cloud company prepared	I store organisation data in a cloud system provided by the IT department	
8	personal devices	I store organisation data in personal devices, e.g., my mobile phone and laptops	
7	external storage devices	I store organisation data in external storage devices, e.g., USB pen drive	
10	Home	I store organisation data at home	
11	personal cloud device, e.g., Evernote	I store organisation data in personal cloud devices, e.g., personal e-mail	
12	personal cloud storage, e.g., Dropbox	I store organisation data in personal cloud storage, e.g., Dropbox	
13	file transfer service	I transfer organisation data using a file transfer service	
14	client company	I store organisation data in the client company	
Strain			

Variable	Original construct	Modified construct	Reference
1	“How do you usually feel at the end of a normal working day? Rested?	I feel rested when the need to carry out work duties that require IT arises.	Hadzibajramovic et al., 2015
2	relaxed	I feel relaxed at work due to the ease of access to IT systems provided by my organisation	
3	calm	I feel calm when handling work challenges that require IT interaction	
4	stressed	I feel stressed due to the need to complete tasks using IT	
5	pressured	I feel pressured at work by my colleagues ' IT interactions	
6	Tense	I feel tense about the tasks that need to be carried out using IT systems	
IT accessibility			
	My country has easily accessible wireless Internet connectivity	My organisation has easily accessible wireless connectivity	Barlett et al., 2018
	My country is technologically advanced in terms of communication devices (cellular phones, computers, tablets, etc.)	My organisation is technologically advanced in terms of the provision of IT communication systems	
	My country has laws and regulations regarding Internet use and connectivity	My organisation has laws and regulations regarding internet use and connectivity	
	My country has laws concerning cyberbullying and cyber-harassment	My organisation has laws concerning internet interactions and cyber-harassment	
	My country is considered to be technologically advanced by other countries in the world	My organisation is considered to be technologically advanced	
	My country is at the forefront of technological innovation, the Internet, and online communication	My organisation is at the forefront of technological innovation	
	My country is at the forefront of technological innovation, the Internet, and online communication	My organisation is at the forefront of the Internet and communication	
SETA			
1	My department provides learning/training opportunities to meet the changing needs of the workplace	My organisation provides learning opportunities to meet the changing IT needs of the workplace	Hanaysha, 2016
2	Training and development are encouraged and rewarded in my department.	IT Training and development are encouraged in my department.	
3	Overall, the on-the-job training I receive applies to my job.	The IT on-the-job training I receive applies to my job.	
4	Overall, the training I receive on the job meets my needs.	The IT training I receive on the job meets my needs.	
5	Overall, I am satisfied with how much training I receive on the job.	I am satisfied with how much IT training I receive on the job.	
6	In each work situation, I am aware of the information security issues that can be caused or allowed for through my actions as well as eventual negligence	My organisation creates awareness of the information security issues that my IT actions can cause	Bauer & Bernroider, 2017

Variable	Original construct	Modified construct	Reference
7	I understand concerns regarding information security and the risks that information security threats pose in general	My organisation provides information security education on the risks that information security threats pose in general	
8	I am aware of potential information security threats related to my work and the organisation's business activities, as well as the negative consequences they may cause.	My organisation provides information security education on the negative consequences that my IT usage at work may cause	
Work overload			
1	I am pressured to work long hours	I need IT to cope with the pressure of working long hours.	Cousins et al., 2004
2	I have unachievable deadlines	I need IT to meet unachievable work deadlines.	
3	I have to work very fast	I need IT to work faster.	
4	I have to work very intensively	I need IT to carry out intensive tasks.	
5	I have unrealistic time pressure	I need IT to ease unrealistic time pressure.	
Work Pressure			
1	My coworkers have been telling me about the usefulness of using shadow IT at work.	My coworkers have been telling me about the usefulness of using cloud-based services that are unauthorised by the IT department	Mallmann, Maçada, & Eckhardt, 2018
2	My co-workers often use shadow IT to perform work tasks.	My co-workers often use cloud-based services that are unauthorised by the IT department to perform work tasks.	
3	My co-workers often use shadow IT to communicate.	My co-workers often use cloud-based services that are unauthorised by the IT department to communicate	
4	The head of my team/department has supported the use of shadow IT to perform work tasks.	The head of my team/department supports the use of cloud-based services that are unauthorised by the IT department to communicate	
5	My boss has been telling me about the usefulness of using shadow IT.	My boss has been telling me about the usefulness of cloud-based services that are unauthorised by the IT department to communicate	
6	Many people in my company use shadow IT to perform work tasks.	Many people in my company use cloud-based services that are unauthorised by the IT department to perform work tasks.	

Appendix D: Validation

After pre-testing by experts, suggestions were made. Some of these were presented below:

Comments	Expert
Overall, I think the survey is good to go. Please, move the part III to the part II.	Yusuff Aremu Adejare Ph.D Management Information Systems Othman Yeop Abdullah Graduate School of Business Universiti Utara Malaysia 
The survey looks good The demography section should come first The Google form needs to be edited to make each question compulsory	Dr Okere Prince-Hector C. Director, Centre of Technological Advancement and International Collaboration Precious Cornerstone University Nigeria
I realize you didn't break your items based on your constructs. I hope you noted that in your chapter 3 (your methodology write-up). You need to be careful as it might influence your analysis. I will suggest breaking it into sections as it is easier for respondents to fill when questions are short and in sections rather than it being in a one long table.	Dr Adelaja, Ayotunde Lecturer, School of Business Baze University, Abuja

Some of the Experts comments on individual items.

	Items	Comments
1	My organization has easily accessible wireless connectivity	It is easy to access internet connectivity in my organization
	My organization mandate training on cloud computing for all employees/	mandating cloud training for all employees is a welcome idea.
	My organization provides learning/training opportunities to meet the changing Cloud IT needs of the workplace	
2	I need Cloud IT to cope with the pressure of working long hours.	Tasks at my organization is effectively implemented via cloud computing
3	Overall, the Cloud IT on-the-job training I receive is applicable to my job	Should be the last, since you use overall.
	My boss is concerned about my usage of cloud-based systems which were not provided by the IT department.	Be extra careful on negative question especially when analyzing your data. You need to transpose.
4	I enjoy working on cloud platforms	I might suggest this before the second negative item
	I feel upset at work when the need to carry out work duties that require cloud access arises.	Same as 5
5	Many people in my organization use cloud-based systems that were not provided by the IT department to accomplish their work tasks.	
	I am aware of potential negative consequences of my cloud shadow IT usage may cause.	Are you talking about Cloud shadow or general cloud computing? You need to be clear on this
6	I need Cloud IT to work faster. Working with cloud IT makes my work easier to accomplished	Need to rephrase
		I need cloud IT to carry out tasks faster.
7	I feel angry at work due to pressure at work that is beyond my control	Need to rephrase.
		I feel angry at work due to inaccessible cloud IT system **

8	I use cloud-based solutions that were not provided by my organization to perform my tasks at work	
9	Overall, the Cloud IT training I receive on the job meets my needs.	
10	My organization has laws concerning or regulate cloud interactions	concerning or regulate cloud interactions
Part III: Demography		This should come first



Appendix E: Modification to the Questionnaire following the result of the pilot study

1	The major research objective was stated specifically on the questionnaire cover page
2	The description of the key terms used in the questionnaire
3	The major term “Shadow IT” is more of an IS jargon. Hence, the researcher explained the term with its definition, “IT systems that were unauthorised by the organisation’s IT department”. The respondents understood it better when it was explained.
4	Six items were deleted from the 14 items prepared for the shadow IT construct. This is due to the reliability and validity of the constructs during the pilot study.
5	One item was deleted from the IT accessibility construct which was due to the reliability and validity of the construct.
6	The online survey should not be depended on when the focus of data collection is in Nigeria. It is better to go for the physical distribution of the questionnaire.
7	The physical appearance of the questionnaire. The questionnaire should be attractive, using soft colors, which may attract people rather than the common black and white colours.
8	The items used for the questionnaire is shown in the Table 4.5.

Appendix F: Validated Items Used for Questionnaire

Final items after pre-tests and pilot tests used for questionnaire.

	Modified construct	Reference
	Exclusion criteria question: "Do you use IT systems or devices to perform your job tasks?"	
Shadow IT usage		
1	I use cloud-based services that are unauthorised by the IT department.	Mallmann & Maçada, (2017)
2	I use cloud-based solutions that were unauthorised by the IT department to perform my work tasks.	
3	I install software that was unauthorised by the IT department to perform my work tasks.	
4	I use my devices at work without permission from the IT department, including applications on my mobile device, to complete my work tasks.	
5	I store organisation data on personal devices, e.g. my mobile phone and laptops.	Hatashima & Sakamoto, (2017)
6	I store organisation data in external storage devices, e.g., USB pen drives.	
7	I store organisation data at home.	
8	I store organisation data in the client company.	
Strain		
1	I feel rested when the need to carry out work duties that require IT arises.	Hadzibajramovic et al. (2015)
2	I feel relaxed at work due to the ease of access to IT systems provided by my organisation.	
3	I feel calm when handling work challenges that require IT interaction.	
4	I feel stressed due to the need to complete tasks using IT.	
5	I feel pressured at work by my colleagues ' IT interactions.	
6	I feel tense about the tasks that must be carried out using IT systems.	
IT Accessibility		
1	My organisation has easily accessible wireless connectivity.	

	Modified construct	Reference
2	My organisation is technologically advanced in terms of the provision of IT communication systems.	Barlett et al., (2018)
3	My organisation has laws and regulations regarding internet use and connectivity.	
4	My organisation has laws concerning internet interactions and cyber harassment.	
5	My organisation is considered to be technologically advanced.	
6	My organisation is at the forefront of technological innovation.	
7	My organisation is at the forefront of the Internet and communication.	
SETA		
1	My organisation provides learning opportunities to meet the changing IT needs of the workplace.	Bauer & Bernroider, 2017
2	IT Training and development are encouraged in my department.	
3	The IT on-the-job training I receive applies to my job.	
4	The IT training I receive on the job meets my needs.	
5	I am satisfied with how much IT training I receive on the job.	
6	My organisation creates awareness of the information security issues that my IT actions can cause.	
7	My organisation provides information security education on the risks that information security threats pose in general.	
8	My organisation provides information security education on the negative consequences that my IT usage at work may cause	
Work Overload		
1	I need IT to cope with the pressure of working long hours.	Cousins et al. (2004)
2	I need IT to meet unachievable work deadlines.	
3	I need IT to work faster.	
4	I need IT to carry out intensive tasks.	
Work Pressure		

	Modified construct	Reference
1	My coworkers have been telling me about the usefulness of using IT services that are unauthorised by the IT department.	Mallmann, et al. (2018).
2	My co-workers often use IT services that are unauthorised by the IT department to perform work tasks.	
3	My co-workers often use IT services that are unauthorised by the IT department to communicate.	
4	The head of my team/department supports the use of IT services that are unauthorised by the IT department to communicate.	
5	My boss has been telling me about the usefulness of IT services that are unauthorised by the IT department to communicate.	



Appendix G: Survey Questionnaire

Survey Questionnaire

THE RELATIONSHIP BETWEEN ORGANISATIONAL STRUCTURAL FACTORS AND STRAIN TOWARDS SHADOW IT USAGE AMONG NIGERIAN EMPLOYEES

Dear Sir/Ma

The study relates to the usage of cloud shadow IT among employees. Shadow IT usage refers to the interactions with various IT tools that were neither provided to be used officially nor sanctioned for usage by the organisation's IT department to carry out official duties. This includes personal internet connection at work, cloud applications, and personal storage devices.

The questionnaire is divided into three parts; part I is an exclusion criteria question. Part II consists of demographic questions, and part III consists of survey questions. Part III has four sections.

Respondents:

Employed individuals should answer this questionnaire. Respondents must be at least 18 years of age.

Thank you for your participation!

ogedengbe_fowokem@oyagsb@uum.edu.my

Tunku Puteri Intan Safinaz School of Accountancy

Universiti Utara Malaysia



Part I: Exclusion Criteria Question

"Do you use IT systems or devices to perform your job tasks?"

- ☐ Yes ☐ No

Part II: About yourself

1. Gender
 - ☐ Male
 - ☐ Female
2. Age
 - ☐ Under 25
 - ☐ 25 - 35
 - ☐ 36 – 45
 - ☐ 46–55
 - ☐ 55 and above
3. Highest academic qualification?
 - ☐ High School
 - ☐ Diploma
 - ☐ First Degree/HND
 - ☐ Masters
 - ☐ Doctoral
 - ☐ Others
4. Geo-political zone
 - ☐ South-South
 - ☐ South-East
 - ☐ South-West
 - ☐ North-Central
 - ☐ North-East
 - ☐ North-West
5. Nature of organisation?
 - ☐ Public Sector:
 - ☐ Academic
 - ☐ Health
 - ☐ Others
 - ☐ Private Sector
 - ☐ SME
 - ☐ Corporation
 - ☐ NGO
 - ☐ Social Workers
 - ☐ Other NGO
 - ☐ Others



Part III: Survey questions

Please answer the following questions using a 1 to 5 scale with 1-Strongly Disagree and 5-Strong Agree. Please circle your answer to each item.

1. IT accessibility: Provision of IT by organisations	
1. My organisation has easily accessible wireless connectivity.	1 2 3 4 5
2. My organisation is technologically advanced in terms of the provision of IT communication systems.	1 2 3 4 5
3. My organisation has laws and regulations regarding internet use and connectivity.	1 2 3 4 5
4. My organisation has laws concerning internet interactions and cyber harassment.	1 2 3 4 5
5. My organisation is considered to be technologically advanced.	1 2 3 4 5
6. My organisation is at the forefront of technological innovation.	1 2 3 4 5
7. My organisation is at the forefront of the Internet and communication.	1 2 3 4 5

2. SETA: Provision of security education, training, and awareness by your workplace	
1. My organisation provides learning opportunities to meet the changing IT needs of the workplace.	1 2 3 4 5
2. IT Training and development are encouraged in my department.	1 2 3 4 5
3. The IT on-the-job training I receive applies to my job.	1 2 3 4 5
4. The IT training I receive on the job meets my needs.	1 2 3 4 5
5. I am satisfied with how much IT training I receive on the job.	1 2 3 4 5
6. My organisation creates awareness of the information security issues that my IT actions can cause.	1 2 3 4 5
7. My organisation provides information security education on the risks that information security threats pose in general.	1 2 3 4 5
8. My organisation provides information security education on the negative consequences that my IT usage at work may cause	1 2 3 4 5

3. Work over-load: Your workload in relation to your IT needs	
1. I need IT to cope with the pressure of working long hours.	1 2 3 4 5
2. I need IT to meet unachievable work deadlines.	1 2 3 4 5
3. I need IT to work faster.	1 2 3 4 5
4. I need IT to carry out intensive tasks.	1 2 3 4 5

4. Work Pressure: how the perception of shadow IT by others influences your usage	
1. My coworkers have been telling me about the usefulness of using IT services that are unauthorised by the IT department.	1 2 3 4 5
2. My co-workers often use IT services that are unauthorised by the IT department to perform work tasks.	1 2 3 4 5
3. My co-workers often use IT services that are unauthorised by the IT department to communicate.	1 2 3 4 5
4. The head of my team/department supports the use of IT services that are unauthorised by the IT department to communicate.	1 2 3 4 5
5. My boss has been telling me about the usefulness of IT services that are unauthorised by the IT department to communicate.	1 2 3 4 5

6. Strain: strain due to the organisation's poor provision of needed IT.	
1. I feel rested when the need to carry out work duties that require IT arises.	1 2 3 4 5
2. I feel relaxed at work due to the ease of access to IT systems provided by my organisation.	1 2 3 4 5
3. I feel calm when handling work challenges that require IT interaction.	1 2 3 4 5
4. I feel stressed due to the need to complete tasks using IT.	1 2 3 4 5
5. I feel pressured at work by my colleagues' IT interactions.	1 2 3 4 5
6. I feel tense about the tasks that must be carried out using IT systems.	1 2 3 4 5

7. Shadow IT usage: using IT systems at work aside from the organisation's provided ones.	

1. I use cloud-based services that are unauthorised by the IT department.	1 2 3 4 5
2. I use cloud-based solutions that were unauthorised by the IT department to perform my work tasks.	1 2 3 4 5
3. I install software that was unauthorised by the IT department to perform my work tasks.	1 2 3 4 5
4. I use my devices at work without permission from the IT department, including applications on my mobile device, to complete my work tasks.	1 2 3 4 5
5. I store organisation data on personal devices, e.g. my mobile phone and laptops.	1 2 3 4 5
6. I store organisation data in external storage devices, e.g., USB pen drives.	1 2 3 4 5
7. I store organisation data at home.	1 2 3 4 5
8. I store organisation data in the client company.	1 2 3 4 5

Suggestion: What are your suggestions towards cloud shadow IT in Nigerian organisations? (optional)

.....

.....

.....

.....

.....

Thank you for participating in this survey.

Appendix H: Calculation of the sample frame

	Unemployment rate	Employment rate		384 sample	550 sample
SOUTH-SOUTH ZONE					
Akwa Ibom (37.7%), followed by Rivers State (36.4%), Bayelsa State (32.6%), Cross River State (30.6%), Delta State (25.4%), and Edo State (25.1%).	187.8/6=31.3	68.7 68.7/459.13 *100%	14.9	57	81.95
SOUTH-EAST ZONE					
Abia (31.6%) in the zone this was followed by Imo State (28.2%), Ebonyi State (21.1%), Enugu State (18.7%), and Anambra State (17.5%).	117.1/5=23.42	76.58 76.58/459.13 *100%	16.6	63.7	91.3
SOUTH-WEST ZONE					
Ekiti State reported the highest unemployment rate (20.2%), this was followed by Ogun State (16.4%), Lagos (14.6%), Ondo (14.2%), Oyo (10.3%), and Osun (10.1%) States.	85.8/6 =14.3	85.7 85.7/459.13 *100%	18.6	71.4	102.3
NORTH-CENTRAL ZONE					
Plateau State reported the highest unemployment rate (29.8%), followed by Nasarawa State (27.4%), FCT (24.4%), Kwara State (21.1%), Niger State	163.4/7= 23.34	76.65 76.65/459.13 *100%	16.69	64	91.79

	Unemployment rate	Employment rate		384 sample	550 sample
(20.9%), Benue State (20.1%), and Kogi State (19.7%);					
NORTH-EAST ZONE					
Borno State reported the highest unemployment rate (31.4%) in the North-East zone, Yobe State followed this with (29.0%), Gombe State with (27.0%), Bauchi State (23.5%), Adamawa State (20.8%) and Taraba State, with the lowest (19.0%).	150.7/6 =25,1	74.8 74.8/459.13 *100%	16.29	62.55	89.59
NORTH-WEST ZONE					
In the third quarter of 2018, Kano State reported the highest unemployment rate in the zone with (31.3%), this was followed by Kaduna State at (26.8%), Jigawa State at 26.5%, Sokoto State (at 26.0%), Kebbi State (20.1%), Zamfara State (18.0%), and Katsina State (14.3%).	163/7=23.2	76.7 76.7/459.13 *100%	16.7%	64.12	91.85
		459.13			550

Source: based on the NBS 2020 report

Appendix I: missing number

For this study, the missing number was assessed SPSS. The procedure involved navigating to Analyze, Descriptive, and Frequencies. All the items were moved to the “Variable(s)”. A box showing “Display frequency tables” was clicked and OK. Missing Numbers.

Univariate Statistics					
	N	Mean	Std. Deviation	Missing	
				Count	Percent
ITextent	345	3.83	0.949	0	0.0
gender	345	1.74	1.014	0	0.0
age	345	2.62	1.178	0	0.0
academics	345	2.65	1.097	0	0.0
tribe	345	1.54	0.835	0	0.0
nature	345	2.14	0.706	0	0.0
IT1	345	1.95	0.814	0	0.0
IT2	345	2.49	1.154	0	0.0
IT3	345	2.31	1.146	0	0.0
IT4	345	2.49	1.215	0	0.0
IT5	345	2.61	1.260	0	0.0
IT6	345	2.34	1.150	0	0.0
SETA1	345	2.30	1.046	0	0.0
SETA2	345	1.72	0.891	0	0.0
SETA3	345	1.84	0.834	0	0.0
SETA4	345	1.80	0.820	0	0.0
SETA5	345	1.74	0.858	0	0.0
SETA6	345	1.75	0.929	0	0.0
SETA7	345	1.77	0.883	0	0.0
SETA8	345	1.74	0.847	0	0.0
WL1	345	4.26	0.836	0	0.0
WL2	345	4.31	0.792	0	0.0

WL3	345	4.26	0.789	0	0.0
WL4	345	4.32	0.824	0	0.0
WP1	345	4.23	0.862	0	0.0
WP2	345	4.25	0.858	0	0.0
WP3	345	4.30	0.810	0	0.0
WP4	345	4.21	0.879	0	0.0
WP5	345	4.30	0.868	0	0.0
CS1	345	4.12	0.785	0	0.0
CS2	345	4.35	0.893	0	0.0
CS3	345	4.28	0.888	0	0.0
CS4	345	4.12	0.958	0	0.0
CS5	345	4.23	0.881	0	0.0
CS6	345	4.28	0.921	0	0.0
SIT1	345	4.37	0.896	0	0.0
SIT2	345	4.28	0.841	0	0.0
SIT3	345	4.34	0.773	0	0.0
SIT4	345	4.30	0.819	0	0.0
SIT5	345	4.29	0.769	0	0.0
SIT6	345	4.22	0.849	0	0.0
SIT7	345	4.32	0.847	0	0.0
SIT8	345	4.28	0.788	0	0.0

Appendix J: *Multivariate Outlier*

To check for the multivariate outliers for this analysis, random numbers were generated using a Microsoft Excel datasheet for the 345 cases (total useable questionnaires) using the "random ()" function. This random number column was included in the dataset as Random variable. Subsequently, Mahalanobis distances were computed for each case using IBM SPSS Statistics 26.

The procedure involved navigating to Analyze, Regression, and Linear. Upon clicking "continue" in the Linear Regression dialog box, the "save" option was selected, Mahalanobis was ticked, and the analysis was continued. The Random variable was designated as the dependent variable, and the six variables under assessment were assigned to the independent box. Clicking "OK" automatically added a new variable, MAH_1, to the dataset.

To convert Mahalanobis distances into probabilities, the Transform menu and Compute Variable were accessed, and a new variable, PMAH_1, was created using the Cumulative Distribution Function (CDF) and noncentral CDF. This indicates the cumulative distribution function for variance distribution. Specifically, the formula applied was $1 - \text{Cdf.Chisq}(\text{MAH\_1}, 6)$. The 6 represents the number of variables being assessed in this study. The PMAH_1 variable was then adjusted to four decimal places.

To identify the smallest Mahalanobis values in the data, the PMAH_1 variable was sorted in ascending order. A case with a low p-value ($p < 0.001$) may suggest that the case deviates from the rest of the population, potentially classifying it as an outlier

(Tabachnick & Fidell, 2007b). Values less than 0.001 in PMAH_1 revealed 7 cases with $p < 0.001$.

Regression without outliers

(Constant)	Beta	T-value	P-value
Strain	0.388	7.777	0.000
ITA	-0.072	-3.092	0.002
SETA	-0.070	-1.257	0.210
WL	0.123	3.141	0.000
WP	0.143	2.403	0.017

Regression With Outliers

(Constant)	Beta	T-value	P-value
Strai	0.444	7.846	0.000
ITA	-0.115	-3.122	0.002
SETA	-0.086	-1.270	0.205
WL	0.146	3.173	0.002
WP	0.167	2.422	0.016

Appendix K: Outlier casesOutlier cases $p < 0.005$

Cases	MAH_1	PMAH_1
137	0.19855	0.0002
285	0.21825	0.0002
71	0.31777	0.0006
295	0.31777	0.0006
75	0.36266	0.0009
236	0.36266	0.0009
275	0.46127	0.0017
206	0.46905	0.0018
93	0.48447	0.002
269	0.48953	0.002
262	0.52988	0.0025
67	0.53191	0.0026
58	0.55042	0.0028
165	0.54499	0.0028
177	0.54494	0.0028
78	0.55459	0.0029
121	0.55206	0.0029
246	0.57295	0.0032
219	0.57967	0.0033
229	0.59096	0.0035
243	0.59096	0.0035
189	0.61889	0.0039
115	0.63357	0.0042
205	0.63569	0.0042

Appendix L: Collinearity

The VIF outer model

Item	VIF
SIT1	1.934
SIT2	1.867
SIT4	1.672
SIT5	1.506
SIT7	2.248
SIT8	1.792
CS2	1.554
CS3	1.794
CS4	1.25
CS5	1.537
CS6	1.819
IT1	1.069
IT3	2.56
IT4	1.928
IT5	2.211
IT6	2.604
SETA2	1.597
SETA5	1.625
SETA6	2.196
SETA7	2.056
SETA8	1.873
WL2	1.524
WL3	1.599
WL4	1.316
WP1	1.722
WP2	1.659
WP3	1.603
WP4	1.605
WP5	1.791

