

AN ENHANCEMENT OF TOE MODEL BY INVESTIGATING THE INFLUENTIAL FACTORS OF CLOUD ADOPTION SECURITY OBJECTIVES

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“My dearest mum, my everlasting father’s soul, my elder brother, and friend”

This is for all of you

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ABSTRACT

Cloud computing (CC) is a future technological trend for technological infrastructure development. And it is growing strongly as the backbone of industrial future technological infrastructure. As CC service has a lot to offer, it also has some major downside that clients cannot ignore. For CC service adoption, the potential candidates are SMEs but due to lack of resources, experience, expertise and low financial structure scenario CC can be most helpful. CC faces a major issue in term of cloud security, an organization doesn't understand the cloud security factors in the organization and data owner doubts about their data. In the research paper, an investigation on the cloud security objectives to find out the influential factors for cloud adoption in SMEs by proposing an enhancement of Technology-Organization-Environment (TOE) model with some positive influential factor like cloud security, relative advantages, cost saving, availability, SLA, capability, top management, organizational readiness, IS knowledge, malicious insiders, government regulatory support, competitive pressure, size and type. Some negative influencing factors like technological readiness, cloud trust and lack of standards in cloud security. Data were collected by questionnaires from a selected IT company based on SaaS and public cloud. Case study method has been used for validating the enhance TOE model. The IBM Statistics SPSS v22 tool was used for data analysis. The results of data analysis support the enhancement as well as all the proposed hypotheses. In summary, the results of the analysis show that all the enhancement factors were found to have a significant cloud security influence on adoption of cloud computing for SMEs.

ABSTRAK

Perkomputeran awan merupakan tren teknologi masa hadapan, dan kini menjadi nadi kepada pembangunan infrastruktur teknologi. Perkomputeran awan diperkenalkan dengan membawa pelbagai ciri dan servis, namun beberapa isu penting perlu dititik beratkan oleh pengguna. Perusahaan kecil dan sederhana (PKS) merupakan platform terbaik bagi mengimplementasi servis perkomputeran awan bagi mengatasi beberapa isu dalam PKS seperti kekurangan sumber, pengalaman, tenaga mahir, dan kelemahan struktur kewangan. Perkomputeran awan tidak terlepas daripada kecacatan keselamatan awan, dek tidak memahami sepenuhnya faktor keselamatan awan bagi sesebuah organisasi, ditambah pula dengan keraguan data oleh pemilik data sendiri. Justeru, kajian terhadap objektif keselamatan awan terhadap penggunaan servis perkomputeran awan bagi IKS telah dijalankan, dengan mencadangkan penambah baikkan terhadap model Teknologi-Organisasi-Persekitaran (TOP) dengan mengambil kira beberapa faktor, termasuk keselamatan awan, kelebihan saksama, penjimatan kos, ketersediaan, kemampuan, pengurusan atasan, kesediaan organisasi, kefahaman keselamatan maklumat, orang dalam yang berniat jahat, sokongan kawal selia kerajaan, tekanan, saiz, dan jenis persaingan. Beberapa faktor berpengaruh negatif seperti kesediaan teknologi, kepercayaan awan, dan kekurangan standard dalam keselamatan awan. Data dikumpulkan melalui soal selidik dari syarikat IT yang dipilih berdasarkan SaaS dan awan awam. Kaedah kajian telah kes telah digunakan untuk mengesahkan peningkatan model TOP. Penggunaan SPSS v22 bagi kajian ini adalah untuk menganalisis data, Secara ringkas, hasil penyelidikan ini menunjukkan bahawa semua faktor penambah baikkan mempengaruhi keselamatan awan yang ketara, terhadap penerimaan pengkomputeran awan untuk PKS.

TABLE OF CONTENT

CHAPTER	TITLE	PAGE
	DECLARATION	ii
	DEDICATION	iii
	ACKNOWLEDGMENT	iv
	ABSTRACT	v
	ABSTRAK	vi
	TABLE OF CONTENTS	vii
	LIST OF TABLES	xi
	LIST OF FIGURES	xiv
	LIST OF ABBREVIATIONS	xvi
	LIST OF APPENDICES	xvii
1	INTRODUCTION	
	1.1 Introduction	1
	1.2 Problem Background	3
	1.3 Problem Statement	5
	1.4 Research Questions	6
	1.5 Research Goal	6
	1.6 Research Objectives	6
	1.7 Research Scopes	7
	1.8 Research Significance	7
	1.9 Research Organization	8
2	LITERATURE REVIEW	
	2.1 Introduction	11

2.2	Cloud Computing Definition	12
2.2.1	Cloud Computing Deployment models	14
2.2.2	Cloud Computing Service Delivery model	16
2.2.3	Characteristics of Cloud Computing	17
2.2.4	Consumer, Provider and Partner Relation	18
2.3	Advantages and Disadvantages of Cloud Adoption	19
2.4	Cloud and Small and Medium Enterprises (SMEs)	20
2.5	Security in Cloud Computing	22
2.5.1	Security Benefits of Cloud Computing	23
2.5.2	Security Function in Cloud Computing	24
2.5.3	Security Control in Cloud Computing	25
2.5.4	Security Objectives in Cloud Computing	25
2.6	Issues and Challenges	27
2.6.1	Cloud Computing Issues	28
2.6.2	Cloud Computing Adoption Issue	28
2.6.3	Cloud Computing Security Issue	29
2.7	Existing Work on Cloud Computing Security	33
2.8	Existing Research Approach	36
2.8.1	Technology Acceptance Model (TAM)	37
2.8.2	Diffusion of Innovations (DOI)	37
2.8.3	Technology Organization Environment (TOE)	38
2.9	Justification of Selecting TOE Model to Enhance	39
2.10	Justification of Selection Approaches	40
2.11	Existing Evaluation Method	41
2.12	Justification of Selection Evaluation Method	44
2.13	Summary	44

3 RESEARCH METHODOLOGY

3.1	Introduction	45
3.2	Research Methodology	46
3.3	Research Design	46
3.4	Research Framework	47
3.4.1	Phase 1	50
3.4.2	Phase 2	53
3.4.3	Phase 3	54
3.5	Summary	56

4	DESIGN AND IMPLEMENTATION	
4.1	Introduction	57
4.2	Prepare Initial development	58
4.3	Extract Concept	59
4.4	Finalize the Concept Model	62
4.4.1	Propose Conceptual Model	62
4.4.1.1	Technological	65
4.4.1.2	Organizational	73
4.4.1.3	Environmental	75
4.4.1.4	Control Variable	76
4.5	Case Study	79
4.6	Questionnaires Development	80
4.7	Data Collection and Analysis	81
4.8	Validation of the Measures	81
4.9	Reliability of the Measures	82
4.10	Summary	82
5	DATA ANALYSIS	
5.1	Introduction	84
5.2	Questionnaire Analysis	85
5.2.1	The pilot study	85
5.3	Questionnaire (Final)	87
5.3.1	Questionnaire Section A: Demographic	87
5.3.2	Descriptive Statistics of the Variables	94
5.3.2.1	Technological Variables	94
5.3.2.2	Organizational Variables	100
5.3.2.3	Environmental Variables	103
5.3.2.4	Control Variables	105
5.3.2.5	Cloud Adoption	107
5.4	Reliability Test Table	108
5.5	Correlation	108
5.6	Regression	120
5.7	Hypotheses Testing	122
5.8	Research Model	126
5.9	Chapter Summary	128
6	DISCUSSION AND CONCLUSION	

6.1	Introduction	129
6.2	Summary of Findings	129
6.2.1	Hypothesis 1	130
6.2.2	Hypothesis 2	130
6.2.3	Hypothesis 3	131
6.2.4	Hypothesis 4	131
6.2.5	Hypothesis 5	131
6.2.6	Hypothesis 6	132
6.2.7	Hypothesis 7	132
6.2.8	Hypothesis 8	133
6.2.9	Hypothesis 9	133
6.2.10	Hypothesis 10	134
6.2.11	Hypothesis 11	134
6.2.12	Hypothesis 12	135
6.2.13	Hypothesis 13	135
6.2.14	Hypothesis 14	135
6.2.15	Hypothesis 15	136
6.2.16	Hypothesis 16	136
6.2.17	Hypothesis 17	137
6.3	Limitation of the Research	137
6.4	Future Recommendation	138
6.5	Contribution of this Research	139
6.6	Conclusion	139

REFERENCE	139
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Appendix	A – E	158 – 181
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LIST OF TABLES

TABLE NO.	TITLE	PAGE
2.1	SME categories based on employees, turnover and balance sheet	20
3.1	Description of Research Framework Phase	49
4.1	Substantial previous study of the selected context for enhancement of TOE model.	60
4.2	Likert Scale	80
4.3	The Scale of Cronbach With Its Description	82
5.1	Results of the pilot study summary statistics of the Cronbach's Alpha	86
5.2	Results of the reliability statistics of the Cronbach's Alpha	86
5.3	A Summary of The Reliability Analysis for Each Item	87
5.4	Presents the demographic items used and the related references: Demographic Questions	88
5.5	Gender Demographic	88
5.6	Age Demographic	89
5.7	Type of Job Demographic	89
5.8	A Summary of The Experience People	90
5.9	Number of Employee	90
5.10	Service Layer Statistics	91
5.11	Cloud Deployment Model Statistics	91
5.12	Choice of Cloud Provider	91
5.13	Reason Behind Cloud Adoption for Companies Statics	92
5.14	Company views about Cloud Adoption Benefits	93
5.15	Company Decision Makers Statics	93
5.16	Company Cloud Budget Statics	93
5.17	Descriptive Statistics for Technological Statics	95

5.18	Frequency Analysis for Cloud Security Questions (TCS)	95
5.19	Frequency Analysis for Relative Advantages Questions (TRA)	96
5.20	Frequency Analysis for Cost Saving Questions (TCOS)	97
5.21	Frequency Analysis for Availability Questions (TAV)	97
5.22	Frequency Analysis for Service Level Agreement Questions (TSLA)	98
5.23	Frequency Analysis for Technological Readiness Questions (TTR)	98
5.24	Frequency Analysis for Cloud Trust Questions (TCT)	99
5.25	Frequency Analysis for Capability Questions (TCAP)	99
5.26	Frequency Analysis for Lack of Standards Questions (TLS)	100
5.27	Descriptive Statistics for Organizational Statics	101
5.28	Frequency Analysis for Top Management Questions (OTM)	101
5.29	Frequency Analysis for Organizational Readiness Questions (OOR)	102
5.30	Frequency Analysis for IS Knowledge Questions (OIS)	102
5.31	Frequency Analysis for Malicious Insiders Questions (OMIS)	103
5.32	Descriptive Statistics for Environmental Statics	103
5.33	Frequency Analysis for Government Regulatory Support Questions (EGRS)	104
5.34	Frequency Analysis for Competitive Pressure Questions (ECP)	105
5.35	Descriptive Statistics for Control Variable Statics	105
5.36	Frequency Analysis for Industry Size Questions (VINS)	106
5.37	Frequency Analysis for Industry Type Questions (VITS)	106
5.38	Descriptive Statistics for Cloud Adoption Statics	107
5.39	Frequency Analysis for Cloud Adoption Questions (CAD)	107
5.40	Reliability Statistics Item	108
5.41	Guilford rule of thumb for size and strength of the relationship	109
5.42	Correlation Summary with Technological Variable	111
5.43	Correlation Summary of Organizational Variables	113
5.44	Correlation Summary of Environmental Variables	115
5.45	Correlation Summary of Environmental Variables	116

5.46	Correlation Summary of Cloud Adoption Variables	117
5.47	Hypothesis Correlation Status according to p-value and R-value	118
5.48	Regression Model Summary	120
5.49	ANOVAa Result	121
5.50	Coefficients ^a	122

LIST OF FIGURES

FIGURE NO.	TITLE	PAGE
1.1	Research Organization	9
2.1	Organization of Literature Review	12
2.2	Characteristics, Service and Deployment Model	14
2.3	Two Type of Privet Cloud	15
2.4	Cloud Deployments model adopting rate analysis	16
2.5	SaaS Most Highly Deployed Global Cloud Service	17
2.6	Consumer, Provider, Partner and their basic roles	18
2.7	Disadvantages of Cloud Computing	19
2.8	Cloud Security Controls	25
2.9	Cloud Computing Security Challenges	28
2.10	Technological Adoption Models	36
2.11	Previous TOE model	39
3.1	Research Framework	48
4.1	Chapter 4 Organization flow chart	58
4.2	Conceptual Enhance of TOE Model	64
4.3	Conceptual Enhance of TOE Model Hypothesis	78
4.4	Case Study Design	79
5.1	Idea of Pilot Study	86
5.2	Gender Statistics Graph	88
5.3	Age Statistics Graph	89
5.4	Job Type Statistics Graph	89
5.5	Experience Statistics Graph	90
5.6	Company Type (Number of Employee)	90
5.7	Service Layer Statistics (SaaS) Service	91
5.8	SaaS Cloud User Statistics Graph	91
5.9	Choice of Cloud Provider Statistics Graph	91

5.10	Reason Behind Cloud Adoption for Companies Statics in Percentages	92
5.11	Company views about Cloud Adoption Benefits Statistics (in Percentage)	93
5.12	Company Decision Makers View Statics (in Percentage)	93
5.13	SMEs Budget for cloud Yearly Statistics Graph	93
5.14	Analysis for Cloud Security Response in percentages	95
5.15	Analysis for Relative Advantages Response in percentages (TRA)	96
5.16	Analysis for Cost Saving Response in percentages (TCOS)	97
5.17	Analysis for Availability Response in percentages (TAV)	97
5.18	Analysis for Service Level Agreement Response in Percentages (TSLA)	98
5.19	Analysis for Technological Readiness Response in Percentages (TTR)	98
5.20	Analysis for Cloud Trust Response in Percentages (TCT)	99
5.21	Analysis for Capability Response in Percentages (TCAP)	99
5.22	Analysis for Lack of Standards Response in Percentages (TLS)	100
5.23	Analysis for Top Management Questions Response in Percentages (OTM)	100
5.24	Analysis for Organizational Readiness Response in Percentages (OOR)	102
5.25	Analysis for IS Knowledge Response in Percentages (OIS)	102
5.26	Analysis for Malicious Insiders Response in Percentages (OMIS)	103
5.27	Analysis Government Regulatory Support Response in Percentages (EGRS)	104
5.28	Analysis Competitive Pressure Response in Percentages (ECP)	105
5.29	Analysis Industry Size Response in Percentages (VINS)	106
5.30	Analysis Industry Size Response in Percentages (VINT)	106
5.31	Analysis Cloud Adoption Response in Percentages (CAD)	107
5.32	The Correlation Between Dependent Variable (ISA) VS. Independent Variables	119
5.33	Revised Research Model (after analysis)	127

LIST OF ABBREVIATIONS

AWS	Amazon Web Service
CAGR	Compound Annual Growth Rate
DOI	Diffusion of Innovations
IS	Information Security
ISO	International Organization for Standardization.
IT	Information Technology
NIST	National Institute of Standards and Technology
SLA	Service Level of Agreement
SLO	Service Level Objective
SME	Small and Medium Enterprises
TAM	Technology Acceptance Model
TOE	Technology-Organization-Environment Model

LIST OF APPENDIX

NO	TITLE	PAGE
A	Summary of the previous (38) research using TOE model.	158
B	Prior study table in cloud security influential factors, TOE model (enhancement context) relationship matrix	164
C	Case Study Questionery	168

CHAPTER 1

INTRODUCTION

1.1 Introduction

As we come to know from NIST (National Institute of Standards and Technology) cloud computing (CC) is a worldwide, suitable, anytime available network, which can share the data and configuration of the computing properties (like desktop, server, software, apps, ERP, data storage, and services) anywhere in the world with remote connection with the slight administration effort or with our any necessity of communicating with service providers (Mell, 2009).

Thus, the on-demand availability and easy use feature increase the CC flexibility in comparison to traditional forms of computing (Tehrani, 2014). In terms of lot of money saving CC consents companies and most importantly for SMEs so that they can be more industrious, similarly improve their work productivities and success. As a result, companies can more focus in their main businesses and profit and they don't have to bother about regular technological upgrading or schedule maintaining the system (Ross and Blumenstein, 2015; Zhao et al., 2014).

As the limitless scalability, resource sharing elasticity and high level of computerization making CC as the future Internet technology. In the cloud environment growing swiftly day by day it is also worried about, it is security, privacy and trust for data and applications on the hosted situation. There are many providers also available for providing CC for consumers and this is also a great situation for the customer to make trust on any provider that it will provide the best service as customer require. This is the most important decision-making time when the customer cannot fix the right provider to move and cannot explore the best of cloud service because of lack of knowledge and provider reliability issues CC adoption is really appealing to the organization as they want this inexpensive and swifter IT resources under their system (Pawar, 2015).

CC is now highly acknowledged technology, that is why cloud providers also introducing many cloud services in the market. Though there are many advantages of CC with it is quick evolution, it faces many issues in terms of privacy, trust and mostly security issues (Pearson, 2013). Those are also important factors that cloud customer should keep in a mind while they negotiate in terms of service with the provider. CC reduces the cost of purchasing and maintaining IT infrastructure for the businesses that use cloud computing. It also provides better flexibility regarding how computing resources can be bought and utilized.

Organizations are still concerned about the security, losing control and other disagreeable results over their data which is affecting the decision making on the migration of the service, software, server or data to the cloud (Phaphoom, 2015). Besides, organizations are typically focused on moving some of their systems into the cloud because of the difficulty in adoption related applications, security concern, less understanding the process as well as the lack of information about agreements (Andrikopoulos, 2013).

The purpose of this study is to understand the determinants of cloud adoption in small and medium enterprises (SMEs). It seeks to investigate whether the determinants of cloud adoption influential factor in cloud security. For this purpose, we develop an enhanced research model of the technological, organizational and environmental (TOE) (Tornatzky and Fleischer, 1990).

1.2 Problem Background

In the small and medium enterprises (SMEs), They are the most illegible customer for the CC because of it is various service advantages like organization do not need to build the physical system by their self instead of that they will pay the bill as much as a service they will use in the CC platform (Buyya, 2009). Cloud offers so many appalling officers still most of the SMEs are worried about move in to cloud environment. Be that as it may, some SMEs are yet to be worried about moving a present framework to the cloud. Just a couple of observational examinations inspect the powerful factors in appropriation choice of CC at an association level (Pawar, 2015; Pearson, 2013).

From a recent research that was published in Forbes 2017, saying about cloud adoption in information technology (IT) that 80% of all IT budgets will be considered for cloud solutions and applications within a year (Columbus, 2017). The most demanding technology in CC is security that always needs to take account when ever think about cloud adoption. Security is the most important factor for delaying CC adoption for cloud customers.

As cloud storage is hosted by a third party which is stored in a virtual pool of storage online network model. Cloud provider provide many different kind of storage service. As clines wants to keep their data in the cloud they need to buy or lease the storage with the capacity. As per customer requirement vendor provide the storage and

functionality also take care the background systems. And physical in cloud environment they keep copy in different geo location as per resource utilization by multiple servers. They use API (Application Programming Interface) or web based interfaces as gateway of customers services (Beulah et al., 2016). As with time security issues are growing with time and technology virtualization also need to improve to give security for storages, can't be security with the traditional system for this new age. Cloud network security is must for network traffic analysis and safe data in while transmission like firewall, security to make proper security.

CC security will get vulnerability factors if the cloud adoption terminology gets unbalanced. Few paper advices that CC environment is still not adequately for trust factors. If customer do not trust in the provider and their security factors, cloud adoption result will be affected vastly (Chen et al., 2010; Habib at al., 2010).

For any CC concept, trust is one of the most vital elements for selecting cloud that safeguard the financial profitability and reduce the risk service is. If there is any issue with the security, privacy and confidentiality, it always decreases the efficiency of cloud adoption business success factors. In the CC, most of the users think about location issue, where is the data stored physically and what kind of security, they are using, no one knows but the cloud providers. The increasing factor of cloud adoption growing the security and privacy issues concern also growing This issue generally handles by the security service agreements which guaranty the service (Martin Gilje Jaatun et al., 2012).

Some research paper shows, working with the TOE model for technological cloud adoption is more influential than other, because TOE model theory has been applied individually and successfully to several studies for the adoption of innovation in cloud and technology. There have been numbers of literature, exploring the use of innovative technologies in the past that combine the Technology Organization Environment (TOE) model better for the organizational perspective (Hsu et al., 2006).

On the Low (2013) paper is focused on the management and technology but lacking in the security, support and cost factors. The Chong (2009) paper worked on relevant advantages, compatibility and top management, but it doesn't have data about a technological scenario like security, technical readiness, cost problem. There is some other research which combine the TOE and DOI model, like On the Bose (2011) research shows the process to make adoption decision based on organization type, size and regulatory management these papers don't have strong technical functionality.

Such approach has never been exploited in CC security factors. Most of the previous research have a leaking on privacy, security, technological readiness, availability, malicious insiders, issues. In TOE model focus on the security context of technology adoption and better to explain intra firm technology adoption (Tehrani, 2013). The main advantages of TOE model are doing the support and theoretical aspects of this research.

1.3 Problem Statement

Many researchers prove that beside the beneficially factors of CC technology not everyone is interested to adopt CC solution (Abdollahzadehgan and Trigueros-Preciado, 2013). An efficient enhancement in cloud security in the TOE model is the best approach to assess the cloud adoption security factor. Previous research show that their papers are lacking in specific cloud security features, trust, SLA, malicious insiders, so it is hard for cloud customer to trust in the cloud adoption process. Ma and Xin (2015) study paper gave details in qualitative review of six case studies on a small and medium accounting firm concern with security, but this study lacking core security, privacy, malicious insider, SLA issue. In prior research, it is shown that there are not many papers are focusing on this data protection, data ownership, monitoring) and showed some limitations in their research on technological and organizational aspects. Our study fulfilled the research gap, by assessing influential factor for CC adoption in terms of security.

1.4 Research Questions

To achieve the research goal, the main research questions is –“What are the main influential factor of CC adoption?”

The main research questions supported by two sub-questions as follows,

1. Which technological adopt model can be used to improve CC security factors?
2. What validation approach will be most helpful to finalize the conceptual model for IT cloud adoption?

1.5 Research Goal

Through enhancement of TOE model, this paper provided understanding of the influential factors for IT cloud adoption in terms of security objectives by case study approach.

1.6 Research Objectives

In the research, there are objectives that are necessary to be achieved. There are as follows:

1. To investigate the Technology-Organization-Environment (TOE) Model
2. To propose enhance TOE model for cloud adoption in security perspective
3. To validate the enhancement of TOE model for identifying cloud adoption influential security factor by following case study.

1.7 Research Scopes

Scopes for many researches is very important as it can limit the area of research to a specific field. Although there are some limitations in this study that represent opportunities and recommendations for the further research on cloud adoption. The scopes of the research are as follows,

1. IT related SME companies.
2. Focused on most popular technology adoption TOE model for theoretical perspectives to develop the research model.
3. Worked on the influential cloud security factors
4. Focused on SMEs software as a service (SaaS) and public cloud aspects.
5. Most of the information and data are used for the research contributed from previously TOE model and cloud security research that was done on cloud domains.
6. The method of evaluation and validation used case study qualitative with quantitative validation approach.

1.8 Research Significance

The study has a significant value to researchers toward observing, analyzing and interpreting the importance of a proposed enhance model of cloud adoption. Furthermore, the study will provide the researchers with a lot of information, knowledge about influential factor for security concern in cloud computing. CC is now trendy not only for corporate aspect, but also it has increased the business flexibility and more focus on organization objective rather than technical concern. As most of the big organizations already in the cloud, as SMEs is falling behind because of lack of understanding and knowledge about security aspects so the research showed a

complete view of cloud security perspective. And by this paper clients understand the relation and responsibility as well as important security factors which they need to recognize on CC adoption or migrate to cloud platform. In IT cloud helps with the organization to use the minimum amount of resources and investment to achieve the maximum amount of business growth using cloud services. Using the advantages of technology adoption model (TOE model) this paper will provide a recommendation guideline for SMEs. By this cloud customer can understand why they need to trust on the cloud in terms of cloud security features. This is also a great opportunity for the SMEs to increase their business with more felicity and using the CC attractive service facility to reduce financial expanses. The research will reduce the cloud customer dilemma for adopting CC and provides a clear understanding for security and SMEs influence factors.

1.9 Research Organization

This thesis is divided into five chapters. A building of the overall thesis is depicted in Figure 1.1 and described in the following sections.

Chapter 1 will bewitho the knowledge regarding research background, research problems,research goall, objectives, in addition tothe scopee and significance of the research.

Chapter 2 presents a detailed literature review of CC covering a brief general background, definitions of CC, functionality, services and deployment models of cloud, special features of CC and advantages. It also describes the SMEs, cloud adoption, cloud security and specifically influential cloud security objectives. Based on the existing literature on technology adoption, focusing on CC security factors.

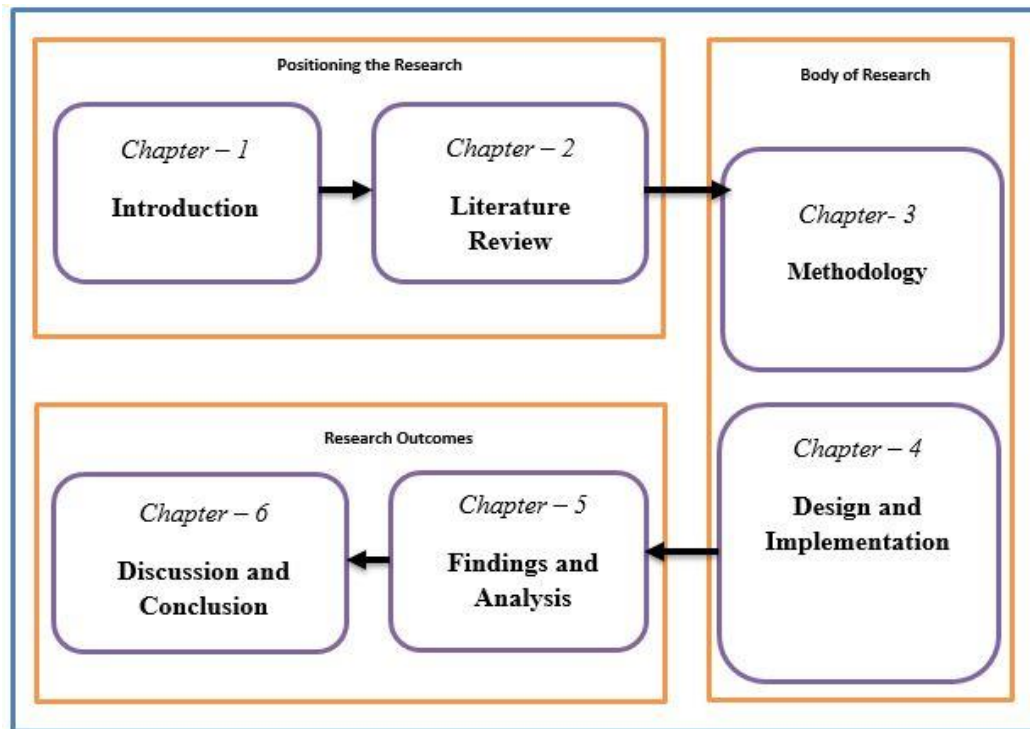


Figure 1.1: Structure of the Research

Chapter 3 discusses the research method using three phase that fulfills the research objectives of this paper. Using A theoretical technology adoption model to develop a TOE model to enhance the security context, is described in chapter 4.

Chapter 4 describes the preliminary study design and implementation, presents the process and outcome of a qualitative study. The qualitative study is conducted through a structured quantitative survey questions and case study IT company SMEs across the ICT sector. Research hypotheses are generated and as a result, a first theoretical enhance model for CC adoption is developed.

Chapter 5, The pilot study, presents the process of questionnaire deployment and how the researcher specifies the constructs as a reflective or formative. Then, the analysis of a pilot study using IBM Statistics SPSS v. 22 software is discussed precisely. Analysis on real responders from the SMEs, explains the findings from the questionnaires. Descriptive analysis using IBM Statistics SPSS v.22 software as

discussed. Then, the chapter provides confirmation or rejection of the research hypotheses based on the results of the analysis. Following this, the findings from the survey are explained in depth.

Chapter 6, Discussion and conclusion, presents the summary of the research and provides contribution of the research findings, based on theoretical, and chapter 5 results perspectives. This chapter acknowledges the limitations of the current research and hence proposes the recommendations for future research outlining the possible directions.

REFERENCES

- Abdollahzadehgan, A., Che Hussin, A. R., Gohary, M. M., & Amini, M. (2013). The Organizational Critical Success Factors For Adopting Cloud Computing In Smes. *Journal Of Information Systems Research And Innovation*, 4(1), 67–74. Retrieved From [Http://Seminar.UtmSPACE.Edu.My/Jisri/](http://Seminar.UtmSPACE.Edu.My/Jisri/)
- Ahmed, M., & Mahbub. (2013). Trust Enhanced Security In Saas Cloud Computing By Access To Thesis - A. Retrieved From [Http://Dro.Deakin.Edu.Au/View/Du:30063020](http://Dro.Deakin.Edu.Au/View/Du:30063020)
- Al, S. (2016). Cloud computing adoption determinants : an analysis of Australian SMEs Cloud computing adoption determinants : an analysis of Australian SMEs, 1–17. Retrieved from <http://ro.uow.edu.au/cgi/viewcontent.cgi?article=6855&context=eispapers>
- Aldossary, S., & Allen, W. (2016). Data Security, Privacy, Availability and Integrity in Cloud Computing: Issues and Current Solutions. *International Journal of Advanced Computer Science and Applications*, 7(4), 485–498.
- Aleem, A., & Ryan Sprott, C. (2012). Let Me In The Cloud: Analysis Of The Benefit And Risk Assessment Of Cloud Platform. *Journal Of Financial Crime*, 20(1), 6–24. <https://doi.org/10.1108/13590791311287337>
- Alemeye, F., & Getahun, F. (2015). Cloud readiness assessment framework and recommendation system. *IEEE AFRICON Conference*, 2015–Novem. <https://doi.org/10.1109/AFRCON.2015.7331995>
- Alharbi, F., Atkins, A., & Stanier, C. (2016). Understanding The Determinants Of Cloud Computing Adoption In Saudi Healthcare Organisations. *Complex & Intelligent Systems*, 2(3), 155–171. <https://doi.org/10.1007/S40747-016-0021-9>
- Ali, O., Soar, J., McClymont, H., Yong, J., & Biswas, J. (2015). Anticipated Benefits of Cloud Computing Adoption in Australian Regional Municipal

- Governments: An Exploratory Study. Proceedings of the 19th Pacific-Asian Conference on Information Systems (PACIS 2015), (January 2016), 1–17.
<https://doi.org/10.1109/CSCWD.2015.7231017>
- Alismaili, S., Li, M., Shen, J., & He, Q. (2015). A Multi Perspective Approach for Understanding the Determinants of Cloud Computing Adoption among Australian SMEs. Australasian Conference on Information Systems. Retrieved from <https://arxiv.org/ftp/arxiv/papers/1606/1606.00745.pdf>
- Aljournah, E., Al-Mousawi, F., Ahmad, I., Al-Shammri, M., & Al-Jady, Z. (2015). SLA in Cloud Computing Architectures: A Comprehensive Study. International Journal of Grid and Distributed Computing, 8(5), 7–32.
<https://doi.org/10.14257/ijgdc.2015.8.5.02>
- Alkhalil, A., Sahandi, R., & John, D. (2017). An exploration of the determinants for decision to migrate existing resources to cloud computing using an integrated TOE-DOI model. Journal of Cloud Computing, 6(1), 2.
<https://doi.org/10.1186/s13677-016-0072-x>
- Alkhalil, A., Sahandi, R., & John, D. (2017). An exploration of the determinants for decision to migrate existing resources to cloud computing using an integrated TOE-DOI model. Journal of Cloud Computing, 6(1), 2.
<https://doi.org/10.1186/s13677-016-0072-x>
- Alkhatir, N., Chang, V., Wills, G., & Walters, R. (2015). Towards an Integrated Conceptual Model for Cloud Adoption in Saudi Arabia. Proceedings of the 2nd International Workshop on Emerging Software as a Service and Analytics, 80–85. <https://doi.org/10.5220/0005528400800085>
- Alshamaila, Y, Papagiannidis, S & Stamati, T 2013, 'Cloud Computing Adoption In Greece', In Proceedings Of Uk Academy For Information Systems Conference, Pp. 1-17.
- Andrikopoulos V, Binz T, Leymann F, Strauch S (2013) How to adapt applications for the Cloud environment. Computing 95(6):493–535
 April 2010, <URL: <http://csrc.nist.gov/publications/nistpubs/800-122/sp800-122.pdf>>.
- Asiaei, A., Zairah, N., & Rahim, A. (2016). CONCEPTUALIZING A MODEL FOR CLOUD COMPUTING ADOPTION BY SMEs. Retrieved from <http://ais.utm.my/paris2016/files/2016/11/21-Conceptualizing-a-Model-for-Cloud-Computing-Adoption-by-SMEs.pdf>

- Atiq Dar, M. (2017). What Is A Cloud Service - Datamation. [Online] Available At: <https://www.datamation.com/cloud-computing/what-is-cloud-service.html> [Accessed 20 Sep. 2017].
- Australian SMEs, 1–17. Retrieved from <http://ro.uow.edu.au/cgi/viewcontent.cgi?article=6855&context=eispapers>
- Avram, M.-G. (2014). Advantages and challenges of adopting cloud computing from an enterprise perspective. *Procedia Technology*, 12, 529-534.
- Awa, H. O., Ojiabo, O. U., & Emecheta, B. C. (2015). Integrating TAM, TPB and TOE frameworks and expanding their characteristic constructs for e-commerce adoption by SMEs. *Journal of Science and Technology Policy Management*, 6(1), 76–94. <https://doi.org/10.1108/JSTPM-04-2014-0012>
- Baars, M. J. H., Henneman, L., & ten Kate, L. P. (2005). Deficiency of knowledge of genetics and genetic tests among general practitioners, gynecologists, and pediatricians: a global problem. *Genetics in Medicine*, 7(9), 605–610.
- Baker, J. (2012). *The Technology–Organization–Environment Framework* (Vol. 1, pp. 231–245). Springer, New York, NY. https://doi.org/10.1007/978-1-4419-6108-2_12
- Balaid, A., Rozan, M. Z. A., & Abdullah, S. N. (2014). Conceptual model for examining knowledge maps adoption in software development organizations. *Asian Social Science*, 10(15), 118–132. <https://doi.org/10.5539/ass.v10n15p118>
- Benlian, (2011) T. Hess, Opportunities and risks of software-as-a-service: findings from a survey of IT executives, *Decis. Support Syst.* 52, 2011, pp. 232–246.
- Bernsmed K , Jaatun Mg , Meland Ph , Undheim A . Security Slas For Federated Cloud Services. In: *Proceedings Of The 6th International Conference On Availability, Reliability And Security*, Ares'11; 2011. P. 202–9 .
- Beulah, S., & Ramesh Dhanaseelan, F. (2016). Survey on Security Issues and Existing Solutions in Cloud Storage. *Indian Journal of Science and Technology*, 9(13). <https://doi.org/10.17485/ijst/2016/v9i13/90588>
- Bharadwaj, Ss & Lal, P 2012, 'Exploring The Impact Of Cloud Computing Adoption On Organizational Flexibility: A Client Perspective', In *Cloud Computing*

- Technologies, Applications And Management (Iccctam), 2012 International Conference, Pp. 121-31.
- Borgman, H. P., Bahli, B., Heier, H., & Schewski, F. (2013). Cloudrise: Exploring Cloud Computing Adoption And Governance With The Toe Framework. In Proceedings Of The Annual Hawaii International Conference On System Sciences (Pp. 4425–4435). <https://doi.org/10.1109/Hicss.2013.132>
- Bouchenak, S. (2010). Automated control for SLA-aware elastic clouds. Paper presented at the proceedings of the Fifth International Workshop on Feedback Control Implementation and Design in Computing Systems and Networks, ACM, New York.
- Braunstein, M.L. (2013). Health informatics in the cloud. New York: Springer (ebook).
- C. L. Tsai, U. C. Lin, A. Y. Chang, And C. J. Chen, “Information Security Issue Of Enterprises Adopting The Application Of Cloud Computing,” 2010 Sixth International Conference On Networked Computing And Advanced Information Management (Ncm), Pp. 645-649, 2010.
- C. Low, Y. Chen, and M. Wu(2011), "Understanding the determinants of cloud computing adoption", Industrial Management and Data Systems, vol. 11,2011, pp.1006-1023.
- C. S. Yeo Deassuncao Md, Y. J. Sulistio, A. Venugopal, S. Placek And M. Buyya, “Utility Computing On Global Grids”, [Http://Www.Buyya.Com/Papers/Handbookcn_Utility_Grids.Pdf](http://www.Buyya.Com/Papers/Handbookcn_Utility_Grids.Pdf), (2006).
- Carvalho, C. A. B. de, Andrade, R. M. de C., Castro, M. F. de, Coutinho, E. F., & Agoulmine, N. (2016). State of the art and challenges of security SLA for cloud computing. Computers and Electrical Engineering, 0, 1–12. <https://doi.org/10.1016/j.compeleceng.2016.12.030>
- Catteddu, D., And Hogben, G. (2009). Cloud Computing: Benefits, Risks And Recommendations For Information Security (Pp. 1-25): European Network And Information Security Agency (Enisa)
- Cervone, H. F. 2010. An overview of virtual and cloud computing. OCLC Systems & Services: International digital library perspectives, 26, 162-165.
- Chang, V., & Ramachandran, M. (2016). Towards Achieving Data Security with the Cloud Computing Adoption Framework. IEEE Transactions on Services Computing, 9(1), 138–151. <https://doi.org/10.1109/TSC.2015.2491281>

- Chawngsangpuui, R., & Das, R. K. (2014). A Challenge For Security And Service Level Agreement In Cloud Computing, 2319–2322.
- Chen, Y., Paxson, V., & Katz, R. H. (2010). What's New About Cloud Computing Security? University of California, Berkeley Report No. UCB/EECS-2010-5 January, 20(2010), 1–8. <https://doi.org/10.1007/978-1-4419-6524-0>
- Chiarini, A., & Chiarini, A. (2012). Risk Management And Cost Reduction Of Cancer Drugs Using Lean Six Sigma Tools. *Leadership In Health Services*, 25(4), 318–330. <https://doi.org/10.1108/17511871211268982>
- Chiu, C.-Y., Chen, S. ., & Chen, C.-L. (2017). (2017) : An integrated perspective of TOE framework and innovation diffusion in broadband mobile applications adoption by enterprises. *International Journal of Management Economics and Social Sciences*, 6(1), 2304–1366. Retrieved from <http://hdl.handle.net/10419/157921>
- Chong, A.Y.-L., Ooi, K.-B., Lin, B., Tang, S.Y., 2009. Influence of interorganizational re- lationships on SMEs' e-business adoption. *Internet Res.* 19 (3), 313–331.
- Choo, K-K.R. (2010). Cloud Computing: Challenges And Future Directions. *Academic Journal Of Trends And Issues In Crime And Criminal Justice*, No. 400, Canberra: Australian Institute Of Criminology, Australia. Issn 1836-2206, Pp. 1-6, Creswell.
- Christina N. Hoefer and Georgios Karagiannis, Taxonomy of cloud computing services, *Proceedings of the 4th IEEE Workshop on Enabling the Future Service-Oriented Internet (EFSOI'10)*, pages 1345–1350, 2010.
- Cloud Security Allianc(2010), “Security Guidance For Critical Areas Of Focus In Cloud Computing V2.1.” [Http://Www.Cloudsecurityalliance.Org/Csaguide.Pdf](http://www.cloudsecurityalliance.org/csaguide.pdf), December 2009. Accessed On March 22nd, 2010.
- Cloud Standards Customer Council. (2015). Practical Guide To Cloud Service Level Agreements Version 2.0, (April), 1–42.
- Columbus, L. (2015). Forbes Welcome. [online] Forbes.com. Available at: <https://www.forbes.com/sites/louiscolumbus/2015/01/24/roundup-of-cloud-computing-forecasts-and-market-estimates-2015/#1cb9a334db7a> .
- Da Silva, C. A., & De Geus, P. L. (2014). An approach to security-SLA in cloud computing environment. 2014 IEEE Latin-America Conference on

- Communications, IEEE LATINCOM 2014.
<https://doi.org/10.1109/LATINCOM.2014.7041843>
- Davis, F.D. (1989), “Perceived usefulness, perceived ease of use, and user acceptance of information technology”, *MIS Quarterly*, Vol. 13 No. 3, pp. 319-340
- De Chaves, S. A., Westphall, C. B., and Lamin, F. R. (2010). SLA Perspective in Security Management for Cloud Computing. In *Proceeding of the 2010 Sixth International Conference on Networking and Services*, pages 212–217. IEEE.
- Desai, A. M., & Mock, K. (2013). Security In Cloud Computing, (June), 208–221.
<https://doi.org/10.4018/978-1-4666-2187-9.Ch011>
- Dillon, S., & Vossen, G. (2009). SaaS Cloud Computing in Small and Medium Enterprises : A Comparison between Germany and New Zealand, (Mather), 1–16. <https://doi.org/10.1504/IJITCC.2015.070998>
- Doherty, N.F. & Fulford, H. (2006) Aligning the Information Security Policy with the Strategic Information Systems Plan, *Computers & Security*, 25(2), 55-63
- Ahmed, M., & Mahbub. (2013). Trust Enhanced Security in SaaS Cloud Computing by ACCESS TO THESIS - A. Retrieved from <http://dro.deakin.edu.au/view/DU:30063020>
- Doom, C., Milis, K., Poelmans, S., & Bloemen, E. (2010). Critical success factors for ERP implementations in Belgian SMEs. *Journal of Enterprise Information Management*, 23(3), 378-406.
- Duan, Y., Zhang, M., Yin, H., Tang, Y., 2015. Privacy-preserving offloading of mobile app to the public cloud. In: *Proceedings of the 7th USENIX Workshop on Hot Topics in Cloud Computing (HotCloud15)*.
- Edtech. (2013). Lowering IT costs is just one of many benefits driving organizations to IaaS. Available at:
http://www.edtechmagazine.com/higher/sites/edtechmagazine.com/higher/files/108289-wp-inf_service_df.pdf, Last accessed 1st Apr 2013.
- Enisa. (2009). An SME perspective on Cloud Computing. Main, 16. Retrieved from <http://www.enisa.europa.eu>

- Erika McCallister, Tim Grance, Karen Scarfone, Guide to Protecting the Confidentiality of Personally Identifiable Information (PII), SP 800-122, National Institute of Standards and Technology,
- Fernandes, D. A. B., Soares, L. F. B., Gomes, J. V., Freire, M. M., & Inácio, P. R. M. (2014). Security issues in cloud environments: a survey. *International Journal of Information Security*, 13(2), 113–170. <https://doi.org/10.1007/s10207-013-0208-7>
- Fernando J. Corbató and V. A. Vyssotsky. Introduction and overview of the multics system. *IEEE Ann. Hist. Comput.*, 14(2):12–13, 1992
- Ferrer, A.J., Hernández, F., Tordsson, J., Elmroth, E., Ali-Eldin, A., Zsigri, C., Sirvent, R., Guitart, J., Badia, R.M., Djemame, K., Ziegler, W., Dimitrakos, T., Nair, S.K., Kousiouris, G., Konstanteli, K., Varvarigou, T., Hudzia, B., Kipp, A., Wesner, S., Corrales, M., Forgó, N., Sharif, T., Sheridan, C., 2012. OPTIMIS: A holistic approach to cloud service provisioning. *Future Gener. Comput. Syst.* 28, 66–77. doi:10.1016/j.future.2011.05.022
- Forbes.com. (2017). Forbes Welcome. [online] Available at: <https://www.forbes.com/sites/louiscolumbus/2017/02/18/rightscale-2017-state-of-the-cloud-report-azure-gaining-in-enterprises/#32a1546b8481> [Accessed 18 Feb. 2017].
- Friedman, Aa & West, Dm (2010), Privacy And Security In Cloud Computing, Center For Technology Innovation, Brookings
- Fu, H.-P., & Chang, T.-S. (2016). An analysis of the factors affecting the adoption of cloud consumer relationship management in the machinery industry in Taiwan. *Information Development*, 32(5), 1741–1756. <https://doi.org/10.1177/0266666915623318>
- Fu, H.-P., & Chang, T.-S. (2016). An analysis of the factors affecting the adoption of cloud consumer relationship management in the machinery industry in Taiwan. *Information Development*, 32(5), 1741–1756. <https://doi.org/10.1177/0266666915623318>
- G. Rui (2007), "Information Systems Innovation Adoption among Organizations a Match-Based Framework and Empirical Studies", National University of Singapore, Singapore, 2007

- Gangwar, H., Date, H., & Ramaswamy, R. (2015). Understanding Determinants Of Cloud Computing Adoption Using An Integrated Tam-Toe Model. *Journal Of Enterprise Information Management*, 28(1), 107–130.
<https://doi.org/10.1108/Jeim-08-2013-0065>
- Gartner (2008). Gartner Says Cloud Computing Will Be As Influential As E-Business. Gartner Press Release, 26 June 2008.
<http://www.gartner.com/it/page.jsp?id=707508>. Retrieved 3rd May 2010
- Gholami, A., & Laure, E. (2015). Security and Privacy of Sensitive Data in Cloud Computing : A Survey of Recent Developments. In *Computer Science & Information Technology (CS & IT)* (pp. 131–150).
<https://doi.org/10.5121/csit.2015.51611>
- Gide, E., & Sandu, R. (2015). A Study to Explore the Key Factors Impacting on Cloud Based Service Adoption in Indian SMEs. *Proceedings - 12th IEEE International Conference on E-Business Engineering, ICEBE 2015*, 387–392.
<https://doi.org/10.1109/ICEBE.2015.72>
- Grover, V. (1993). An empirically derived model for the adoption of customer-based interorganizational systems. *Decision Sciences*, 24(3), 603-640.
<http://dx.doi.org/10.1111/j.1540-5915.1993.tb01295.x>
- Grubin, D., & Beech, A. (2010). CLOUD COMPUTING ADOPTION: AN EXPLORATORY STUDY. *BMJ UK:BMJ Group*, 340, 433–434. Retrieved from www.webist.org/
- H. N. Van et al. (2009), “SLA-aware virtual resource management for cloud infrastructures,” in *Proceedings of Ninth IEEE International Conference on Computer and Information Technology*, Xiamen, China, 2009.
- H. P. Borgman, H. Heier, and B. Bahli, "Cloudrise: opportunities and challenges for IT governance at the dawn of cloud computing," in *45th Hawaii International Conference on System Sciences*, Big Island, 2012, pp. 1-11.
- Habib, S.M., Ries, S., Muhlhauser, M., 2010. Cloud Computing Landscape and Research Challenges Regarding Trust and Reputation. *IEEE*, pp. 410–415.
[doi:10.1109/UIC-ATC.2010.48](https://doi.org/10.1109/UIC-ATC.2010.48)
- Haddad P, Gregory M, Wickramasinghe N (2014) Business value of IT in Healthcare Peter. In: Wickramasinghe N, Al-Hakim L, Gonzalez C, Tan J (eds) *Lean thinking for healthcare*. Springer, New York, pp 55–81

- Hair JF, Anderson RE, Tatham RL, Black WC (1992) *Multivariate Data Analysis*, 3rd edn. Macmillan, New York
- Harjula, H 2008, Scoping study on the inclusion of releases and transfers from small and medium-sized enterprises (SMEs) in PRTRs, Environment Directorate, Organisation for Economic Co-operation and Development, Paris, France.
- Hashizume, K., Rosado, D. G., Fernández-Medina, E., & Fernandez, E. B. (2013). An analysis of security issues for cloud computing. *Journal of Internet Services and Applications*, 4(1), 1–13. <https://doi.org/10.1186/1869-0238-4-5>
- Hong, W. And Zhu, K. (2006), “Migrating To Internet-Based E-Commerce: Factors Affecting E-Commerce Adoption And Migration At The Firm Level”, *Information & Management*, Vol. 43 No. 2, Pp. 204-221
- Husband, S & Mandal, P 1999, ‘A conceptual model for quality integrated management in small and medium size enterprises’, *International Journal of Quality and Reliability Management*, vol. 16, no. 7, pp. 699–713
- Hussein, N. H., & Khalid, A. (2016). A survey of cloud computing security challenges and solutions. *International Journal of Computer Science and Information Security*, 14(1), 52–56. Retrieved from https://www.cse.wustl.edu/~jain/cse570-15/ftp/cld_sec.pdf
- Ian Foster and Yong Zhao and Ioan Raicu and Shiyong Lu, *Cloud Computing and Grid Computing 360-Degree Compared*, Grid Computing Environments Workshop (GCE '08), pages 1-10, 2008.
- Ifinedo, P. (2011). Internet/e-business technologies acceptance in canada's smes: An exploratory investigation. *Internet Research*, 21 (3), 255-281.
- Ilin, V., Ivetić, J., & Simić, D. (2017). Understanding the determinants of e-business adoption in ERP-enabled firms and non-ERP-enabled firms: A case study of the Western Balkan Peninsula. *Technological Forecasting and Social Change*, (July). <https://doi.org/10.1016/j.techfore.2017.07.025>
- Joseph, & Dieter. (2013). Knowledge mapping: encouragements and impediments to adoption. *Journal of Knowledge Management*, 17(1), 16-28. <http://dx.doi.org/10.1108/13673271311300714>
- K. Rangan, A. Cooke, And M. Dhruv, “The Cloud Wars: \$100+ Billion At Stake,” Tech. Rep., Merrill Lynch, 2008.
- Kalaiprasath, R., Elankavi, R., & Udayakumar, R. (2017). A Cloud Security and Compliance-A Semantic Approach in End to End Security. *International*

- Journal Of Mechanical Engineering And Technology (Ijmet), 8(5), 482–494.
Retrieved from
https://www.exeley.com/exeley/journals/in_jour_smart_sensing_and_intelligent_systems/10/4/pdf/10.21307_ijssis-2017-265.pdf
- Karim, F., & Rampersad, G. (2017). Factors Affecting the Adoption of Cloud Computing in Saudi Arabian Universities. *Computer and Information Science*, 10(2), 109–123. <https://doi.org/10.5539/cis.v10n2p109>
- Karunagaran, S., Mathew, S. K., & Lehner, F. (2017, August 13). Differential Cloud Adoption: A Comparative Case Study Of Large Enterprises And Smes In Germany. *Information Systems Frontiers*, Pp. 1–15.
<https://doi.org/10.1007/S10796-017-9781-Z>
- Khajeh-Hosseini, A., Greenwood, D., Sommerville, I., (2010a). Cloud Migration: A Case Study Of Migrating An Enterprise It System To Iaas. Submitted To Ieee Cloud 2010
- Khasawneh, A.M. (2008), “Concepts and measurements of innovativeness: the case of information and communication technologies”, *International Journal of Arab Culture, Management and Sustainable Development*, Vol. 1 No. 1, pp. 23-33
- Kim, W., Kim, S. D., Lee, E. & Lee, S. (2009). Adoption issues for cloud computing. Paper presented at proceedings of MoMM2009, ACM, Kuala Lumpur, Malaysia.
- Krutz, Ronald L., And Russell Dean Vines. "Cloud Computing Security Architecture." *Cloud Security: A Comprehensive Guide To Secure Cloud Computing*. Indianapolis, In: Wiley, 2010. 179-80. Print.
- Kuan, K. K. Y., & Chau, P. Y. K. (2001). A Perception-Based Model For Edutainment Adoption In Small Businesses Using A Technology-Organization-Environment Framework. *Journal Of Information And Management*, 38(8), 507–521
- Kuo, A.M. (2011). Opportunities and challenges of cloud computing to improve healthcare service. *Journal of medical internet research*. 13 (3), pp. 2-22.
- L. Tomatzky, and M. Fleischer(1990), *The Process of Technology Innovation*, Lexington, MA, 1990

- Lee, Y.-H., Hsu, P., Chang, Y.-W., Cheng, Y.-S., Hsu, P. ;, & Cheng, M.-S. (2016). Integrating Tra And Toe Frameworks For Cloud Erp Switching Intention By Taiwanese Company. Retrieved from <http://aisel.aisnet.org/pacis2016>
- Lewandowski, J., Salako, A. O., & Garcia-Perez, A. (2013). SaaS Enterprise Resource Planning Systems: Challenges of Their Adoption in SMEs. 2013 IEEE 10th International Conference on E-Business Engineering, (September), 56–61. <https://doi.org/10.1109/ICEBE.2013.9>
- Lin, H. F. (2014). Understanding the determinants of electronic supply chain management system adoption: Using the technology–organization–environment,
- Linlin Wu and Rajkumar Buyya,(2010) "Service Level Agreement(SLA) in Utility Computing Systems", Technical Report CLOUDS-TR-2010-5, Cloud Computing and Distributed Systems Laboratory, The University of Melbourne, Australia, September 3, 2010.
- Low, C., Chen, Y. and Wu, M. (2011), “Understanding the determinants of cloud computing adoption”, *Industrial Management & Data Systems*, Vol. 111 No. 7, pp. 1006-1023. Lyr.
- Lucas, H.C. And Olson, M. (1994), “The Impact Of Information Technology On Organizational Flexibility”, *Journal Of Organizational Computing*, Vol. 4 No. 2, Pp. 155-176.
- M. Alhamad, T. Dillon And E. Chang, “Conceptual Sla Framework For Cloud Computing”, Australia,
[Http://ieeexplore.Ieee.Org/Xpl/Login.Jsp?Tp=&Arnumber=5610586&Url=Http%3a%2f%2fieeexplore.Ieee.Org%2fxpls%2fabs_All.Jsp%3farnumber%3d5610586](http://ieeexplore.ieee.org/Xpl/Login.Jsp?Tp=&Arnumber=5610586&Url=Http%3a%2f%2fieeexplore.Ieee.Org%2fxpls%2fabs_All.Jsp%3farnumber%3d5610586).
- M. Bishop,(2003) *Computer Security: Art and science*, Addison-Wesley, Boston, 2003.
- Ma, X. (2015). The adoption of cloud computing for small and medium accounting firms. Retrieved from <https://ir.canterbury.ac.nz/handle/10092/11349>
- Mangula, I. S., Van De Weerd, I., & Brinkkemper, S. (2014). The Adoption Of Software-As- Service: An Indonesian Case Study. Association For Information Systems Ais Electronic Library (Aisel). Retrieved From <Http://Aisel.Aisnet.Org/Pacis2014>

- Marks, E. And Lozano, B. (2010), *Executives Guide To Cloud Computing*, Wiley, Hoboken, Nj.
- Marston, S., Li, Z., Bandyopadhyay, S., Zhang, J. & Ghalsasi, A. (2011). "Cloud Computing - The Business Perspective". *Decision Support Systems*, 51, 176-189
- Martin Gilje Jaatun and Karin Bernsmed and Astrid Undheim,(2012), "Security SLAs - An Idea Whose Time Has Come?" pages 123-130, *Lecture Notes in Computer Science*, Springer Berlin/Heidelberg.
- Martins, R., Oliveira, T., & Thomas, M. A. (2013). Comparing Information Systems Outsourcing between Human Resource and Finance. *Proceedings of the 2013 8th Iberian Conference on Information Systems and Technologies (Cisti 2013)*, 265–271.
- Mell, P., and Grance, T., 2009a, *Effectively and Securely Using the Cloud Computing Paradigm*, Ver.26, [Http://csrc.nist.gov/groups/SNS/cloud-computing/cloud-computing-v26.ppt](http://csrc.nist.gov/groups/SNS/cloud-computing/cloud-computing-v26.ppt), last visited on 15, May 2012
- Melville, N., and Ramirez, R. (2008). Information technology innovation diffusion: An information requirements paradigm. *Information Systems Journal*, 18 (3), 247-273
- Michael Armbrust et al.(2009), *Above the Clouds: A Berkeley View of Cloud Computing*. Technical report EECS-2009-28, UC Berkeley, <http://www.eecs.berkeley.edu/Pubs/TechRpts/2009/EECS-2009-28.html>, Feb 2009.
- Mikkonen, I., Khan, I., & Mikkonen, Ilkka; Khan, I. (2016). Cloud computing – SME company point of view. *International Research Conference Management Challenges*, 35–49. <https://doi.org/10.1016/j.joep.2012.09.001>
- Mirobi, G. J., & Nadu, T. (2015). *Service Level Agreement In Cloud Computing . An Overview*, 1–6.
- Mladenow, A., Fuchs, E., Dohmen, P. and Strauss, C., 2012, *Value Creation using Clouds, Analysis of Value Drivers for Start-Ups and Small and Medium Sized Enterprises in the Textile Industry*, 26th International Conference on Advanced Information Networking and Applications Workshops.
- Mollah, M. B., Azad, M. A. K., & Vasilakos, A. (2017). Security And Privacy Challenges In Mobile Cloud Computing: Survey And Way Ahead. *Journal Of*

- Network And Computer Applications, 84(January), 38–54.
<https://doi.org/10.1016/J.Jnca.2017.02.001>
- Motta, G., Sfondrini, N. and Sacco, D. (2012), “Cloud Computing: A Business and Economical Perspective,” 2012 International Joint Conference on Service Sciences, IEEE, Shanghai, pp. 18– 22.
- Nkhoma, M. Z., & Dang, D. P. T. (2013). Contributing Factors of Cloud Computing Adoption : a Technology - Organisation - Environment Framework Approach. International Journal of Information Systems and Engineering, 1(1), 38–49. Retrieved from <http://researchbank.rmit.edu.au/view/rmit:22196>
- Oliveira, T., Thomas, M., & Espadanal, M. (2014). Assessing the determinants of cloud computing adoption: An analysis of the manufacturing and services sectors. Information and Management, 51(5), 497–510.
<https://doi.org/10.1016/j.im.2014.03.006>
- P. Mell And T. Grance,(2010) “The Nist Definition Of Cloud Computing Version 15.” [Http://Csrc.Nist.Gov/Groups/Sns/Cloud-Computing](http://csrc.nist.gov/groups/sns/cloud-computing), July 2009.
 Accessed On April 19th, 2010.
- P.F. Hsu, K.L. Kraemer, D. Dunkle, Determinants of e-business use in US firms, Int. J. Electr. Commer. 10, 2006, pp. 9–45.
- Pankesh Patel, Ajith Ranabahu and Amit Sheth,(2009) "Service Level Agreement in Cloud Computing", Report, Core Wright university Libraries, Kno.e.sis Publications
- Pawar, P. S. (2015). Cloud Broker Based Trust Assessment of Cloud Service Providers. Retrieved from <http://openaccess.city.ac.uk/13687/>
- Pearson, S., 2013. Privacy, security and trust in cloud computing, in: Privacy and Security for Cloud Computing. Springer, pp. 3–42.
- Phaphoom N, Wang X, Samuel S, Helmer S, Abrahamsson P (2015) A survey study on major technical barriers affecting the decision to adopt cloud services. J Syst Softw 103:167–181
- Porter, M.E.; van der Linde, C. (1995),Green and competitive: ending the stalemate. Harv. Bus. Rev. 1995, 73, 120–134.
- R. Bose, X. Luo, Integrative framework for assessing firms’ potential to undertake Green IT initiatives via virtualization – a theoretical perspective, J. Strat. Inf. Syst. 20, 2011, pp. 38–54.

- R. Buyya, et al.,(2009) "Cloud computing and emerging IT platforms: Vision, hype, and reality for delivering computing as the 5th utility," *Future Generation Computer Systems*, vol. 25, pp. 599-616.
- R. Schneiderman,(2011) For cloud computing, the sky is the limit, *Signal Process. Mag. IEEE* 28, 2011, pp. 15–18.
- Rapela, J., Westerfield, M., Townsend, J., & Makeig, S. (2016). A new foreperiod effect on single-trial phase coherence. Part I: existence and relevance. *Diss Draft*, (August), 1–45. <https://doi.org/10.1515/9781400821334.toc>
- Rodney, H 2010, ‘Successful exit processes of SMEs in Australia’, Doctor of Business Administration Thesis, Victoria University
- Rodney, H 2010, ‘Successful exit processes of SMEs in Australia’, Doctor of Business Administration Thesis, Victoria University.
- Rogers, E.M.,(1983), *Diffusion of Innovations*, 3rd ed.; Simon and Schuster: New York, NY, USA.
- Ronald L. Krutz and Russell Dean Vines, *Cloud Security: A Comprehensive Guide to Secure Cloud Computing*, pages 384, John Wiley & Sons, Inc., 2010.
- Ross, PK & Blumenstein, M 2015, 'Cloud computing as a facilitator of SME entrepreneurship', *Technology Analysis & Strategic Management*, vol. 27, no. 1, pp. 87- 101.
- Ruwan, & Ruwansenarathna, R. (2016). *Cloud Computing Adoption By Smes In Australia*, (February). Retrieved From <Http://Dro.Deakin.Edu.Au/View/Du:30088887>
- Ryan Houlihan, Xiaojiang Du, Chiu C. Tan, Jie Wu And Mohsen Guizani, (2014),"Auditing Cloud Service Level Agreement On Vmcpu Speed", In *Proceedings Of Ieee International Conference On Communications (Icc)*,2014, Inspec Accession Number:14545672, Doi:Io.Ii09/Icc.2014.6883417, Pp. 799-803.
- Saedi, A., & Iahad, N. A. (2013). An Integrated Theoretical Framework for Cloud Computing Adoption by Small and Medium-Sized Enterprises. In *PACIS 2013 Proceedings* (pp. 1–12). Retrieved from <http://aisel.aisnet.org/pacis2013>

- Safari, F., Safari, N., & Hasanzadeh, A. (2015). The Adoption Of Saas: Ranking The Determinants. *Journal Of Enterprise Information Management*, 28(3), 400–422. <https://doi.org/10.1108/Jeim-02-2014-0017>
- Salvatore Venticinque, Rocco Aversa, Beniamino di Martino Massimiliano Rak and Dana Petcu, "A cloud Agency for SLA Negotiation and Management", *Euro-Par 2010 Parallel Processing Workshops Lecture Notes in Computer Science* Volume 6586, 2011 , Online ISBN : 978-3-642-21878-1, Print ISBN : 978-3-642-21877-4, pp. 587-594
- Salwani, M.I., Marthandan, G., Norzaidi, M.D. and Chong, S.C. (2009), "E-commerce usage and business performance in the Malaysian tourism sector: empirical analysis", *Information Management & Computer Security*, Vol. 17 No. 2, pp. 166-185.
- Savu, L. (2011). Cloud Computing: Deployment Models, Delivery Models, Risks And Research Challenges. *Proceedings Of 2011 International Conference On Computer And Management (Caman)*, May 2011, Wuhan, China. Pp. 1-4.
- Saya, S., Pee, L. and Kankanhalli, A. (2010), "The impact of institutional influences on perceived technological characteristics and real options in cloud computing adoption", Paper No. 24, *ICIS 2010 Proceedings*, 12-15 December.
- Schnjakin, M., Alnemr, R., & Meinel, C. (2010, October). Contract-based cloud architecture. Paper presented at the *CloudDB'10 Proceedings of the Second International Workshop on Cloud Data Management*, Toronto, Ontario, Canada, 33-40.
- Security European Union Agency for Network and Information. (2014). Cloud standards and security, (August), 1–23. Retrieved from <https://resilience.enisa.europa.eu/cloud-security-and-resilience/Cloudstandards.pdf>
- Sengupta, S., Kaulgud, V. and Sharma, V.S. (2011), "Cloud Computing Security--Trends and Research Directions," *2011 IEEE World Congress on Services*, IEEE, Washington, DC, pp. 524–531.
- Senyo, P. K., Effah, J., & Addae, E. (2016). Preliminary Insight Into Cloud Computing Adoption In A Developing Country. *Journal Of Enterprise Information Management*, 29(4), 505–524. <https://doi.org/10.1108/Jeim-09-2014-0094>

- Sfondrini, N., Motta, G., & You, L. (2015). Service Level Agreement (SLA) In Public Cloud Environments: A Survey On The Current Enterprises Adoption. In 2015 5th International Conference On Information Science And Technology, Icist 2015 (Pp. 181–185). Ieee. <https://doi.org/10.1109/Icist.2015.7288964>
- Shashikala P. Subashini and Veeraruna R. Kavitha, A survey on security issues in service delivery models of cloud computing, Journal of Network and Computer Applications, pages 1-11, 2011.
- Sliman, E., Stingley, P., Syputa, R., Tidwell, D., Walker, K., Williams, K., ... Zappert, F. (2010). Review and Summary of Cloud Service Level Agreements, 1–8.
- Standardizing Cloud Security SLAs. (2016), (1), 2014.
- Stieninger, M., Nedbal, D., Wetzlinger, W., Wagner, G., & Erskine, M. A. (2014). Impacts on the Organizational Adoption of Cloud Computing: A Reconceptualization of Influencing Factors. *Procedia Technology*, 16(16), 85–93.
- Sullivan, T. (2009). The ways cloud computing will disrupt it Retrieved 23 June, 2012, from <http://www.cio.com.au/>
- Sultan, N 2010, 'Cloud Computing For Education: A New Dawn?', *International Journal Of Information Management*, Vol. 30, No. 2, Pp. 109-16.
- Sultan, NA 2011, 'Reaching for the “cloud”': How SMEs can manage', *International Journal of Information Management*, vol. 31, no. 3, pp. 272-8
- Tan, M., Tc, T., & Margaret, L. (2012). Exploring Organisational Adoption of Cloud Computing in Singapore. In *Proceedings of the 19th ITS Biennial Conference 2012 Bangkok , Thailand* (pp. 1–21). Retrieved from <http://hdl.handle.net/10419/72509>
- Tang, C & Liu, J 2015, 'Selecting a trusted Cloud service provider for your SaaS program', *Computers & Security*, vol. 50, Issue C, pp. 60-73.
- Tariq, M. I., Haq, I. U., & Iqbal, J. (2013). SLA Based Information Security Metric for Cloud Computing from COBIT 4.1 Framework. *International Journal of Computer Networks and Communications Security*, 1(3), 95–101. Retrieved from www.ijcnscs.org
- Tarmidi, Oliveira, T., Thomas, M., & Espadanal, M. (2014). Assessing The Determinants Of Cloud Computing Adoption: An Analysis Of The

- Manufacturing And Services Sectors. *Information And Management*, 51(5), 497–510. <https://doi.org/10.1016/J.Im.2014.03.006>
- Tashkandi, A., & Al-Jabri, I. (2015). Cloud Computing Adoption by Higher Education Institutions in Saudi Arabia: Analysis Based on TOE. In 2015 International Conference on Cloud Computing (ICCC) (pp. 1–8). <https://doi.org/10.1109/CLOUDCOMP.2015.7149634>
- Tehrani, S. R. (2013). Factors Influencing the Adoption of Cloud Computing by Small and Medium-Sized Enterprises (SMEs). *Theses and Dissertations*, Paper 1179. Retrieved from <http://digitalcommons.ryerson.ca/dissertations/1179/%5Cnhttp://www.ijcat.com/archives/volume2/issue5/ijcatr02051003>
- Tehrani, S. R. and Shirazi, F. 2014. Factors influencing the adoption of cloud computing by small and medium size enterprises (smes). Human interface and the management of information. Information and knowledge in applications and services. Springer
- Tianfield, H. (2012). Security issues in cloud computing. 2012 IEEE International Conference on Systems, Man, and Cybernetics (SMC), 1082–1089. <https://doi.org/10.1109/ICSMC.2012.6377874>
- Tornatzky, L.G. and Fleischer, M. (1990), *The Processes of Technological Innovation*, Lexington Books, Lexington, MA.
- Trivedi, K. D., & Patel, N. J. (2013). Cloud based Conceptual Framework of Service Level Agreement for University, 65(5), 16–21. Retrieved from <http://citeseerx.ist.psu.edu/viewdoc/summary?doi=10.1.1.303.2645>
- Vadapalli, A. & Ramamurthy, K. (1997). Business Use of the Internet: An Analytical Framework and Exploratory Case Study. *International Journal of Electronic Commerce*, 2(2), pp. 71-94.
- Vatanasakdakul, S., Aoun, C., & Chen, Y. (Nicole). (2017). Chasing Success: An Empirical Model for IT Governance Frameworks Adoption in Australia. *Science, Technology and Society*, 22(2), 182–211. <https://doi.org/10.1177/0971721817702278>
- Velte, A. T., Velte, T. J., & Elsenpeter, R. (2009). *Cloud Computng: A Practical Approach*. New York,.

- Wang (2011), Z. Security and privacy issues within the Cloud Computing. Computational and Information Sciences (ICCIS), 2011 International Conference on, 2011. IEEE, 175-178
- Wang, Y.M., Wang, Y.S. and Yang, Y.F. (2010) Understanding the determinants of RFID adoption in the manufacturing industry, "Technological Forecasting and Social Change", Vol. 77, pp. 803-815.
- Web Security Journal, (2009), "Swamp Computing A.K.A. Cloud Computing". -12-28. Retrieved 2010-01-25.
- Wikipedia, Wikimedia Foundation, (2017) ,“Cloud Computing Security.”, En.Wikipedia.Org/Wiki/Cloud_Computing_Security#Cite_Note-3.
- Wikipedia, https://en.wikipedia.org/wiki/Cloud_Computing
- Wu(a), M., Low, C., & Chen, Y. (2011). Understanding the determinants of cloud computing adoption. *Industrial Management & Data System* , 1006-1023.
- Wu, L. (2014). Sla-Based Resource Provisioning For Management Of Cloud-Based Software-As-A-Service Applications. Retrieved From <https://minerva-access.unimelb.edu.au/handle/11343/41013>
- Wu, L., Garg, S. K., & Buyya, R. (2016). Service Level Agreement(SLA) based SaaS cloud management system. *Proceedings of the International Conference on Parallel and Distributed Systems - ICPADS, 2016–Janua*, 440–447. <https://doi.org/10.1109/ICPADS.2015.62>
- Yazn, A., Savvas, P., & Feng, L. (2013). Cloud Computing Adoption By Smes In The North East Of England: A Multi-Perspective Framework. *Journal Of Enterprise Information Management*, 26(3), 250–275. Retrieved From <https://doi.org/10.1108/17410391311325225>
- Yin, R. K. (1994). *Case study research: Design and methods* (2th ed.). Beverly Hills, California: Sage Publications.
- Yin, R. K. (2009). *Case Study Research: Design and Methods*, Beverly Hills, California, Sage Publications.
- Yun Chi, Hyun Jin Moon, Hakan Hacigumus And Junichi Tatemura,(2011), "Sla - Tree : A Framework For Efficiently Supporting Sla-Based Decisions In Cloud Computing", *Proceedings Of The 14th International Conference On*

Extending Database Technology, 2011 , Isbn: 978-1- 4503-0528-0, Pages 129-140.

Z. Shen, Q. Tong,(2010) The security of cloud computing system enabled by trusted computing technology, 2nd International Conference on Signal Processing Systems (ICSPS), IEEE, 2010.

Zhao, F, Scheruhn, H-J & von Rosing, M (2014), 'The impact of culture differences on Cloud computing adoption', in Human-computer interaction: Applications and services, Springer, pp. 776-85.

Zhu, K., Kraemer, K.L., Xu, S. and Dedrick, J. (2004), “Information technology payoff in e-business environments.

Ziegler, W., & Wolfgang. (2017). A Framework For Managing Quality Of Service In Cloud Computing Through Service Level Agreements. Retrieved From <https://Ediss.Uni-Goettingen.De/Handle/11858/00-1735-0000-002b-7d14-F>

ZikmundWG (2000) Business Research Methods, 6th edn. the Dryden Press, Chicago, IL