

ESTABLISHING INFORMATION PRIVACY FRAMEWORK FOR
CLOUD BASED E-LEARNING USERS

Maher Abdulla Almahdi Alghali

Thesis submitted in partial fulfillment for the degree of

DOCTOR OF PHILOSOPHY
SCIENCE AND TECHNOLOGY

UNIVERSITI SAINS ISLAM MALAYSIA

AUTHOR DECLARATION

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

I hereby declare that the work in this thesis is my own expect for quotations and summaries which have been duly acknowledged.

Date: 29 December 2017

Signature:

Name:

Metric No:

Address:



Mubet

4126161

إقرار

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

أنني اقر واعترف ، أن هذا البحث من عملي وجهدي الشخصي ، أما المقطعات والاقتباسات ، فقد أشرت إلى مصادرها في هامش البحث

التاريخ 29 ديسمبر 2017

التوقيع : 
الاسم : 
الرقم الجامعي : 4126161
العنوان :

BIODATA OF THE AUTHOR

Maher Abdulla Almahdi Alghali (4120161) was born on the 13th November 1979. He is currently residing at C-12-8Midfields condo- Sungai Besi – KL 57100. He is Libyan, Passport No NHZ162C9. He previously was a student of Sebha University and obtained Bachelor of Computer Science from Faculty of Science. He obtained Master of IT from Universiti Utara MalaysiaUUM. He is at present a PhD student ofUniversiti Sains Islam MalaysiaUSIM in Faculty of Science and Technology.

Maher Alghali, N.H.M Alwi& I. Roesnita (2013). “Privacy in Cloud Based E-Learning”. *Proceeding of theSecond International Conference on Informatics Engineering & Information Science (ICIEIS2013)*, The Society of Digital Information and Wireless Communication. p. 355-362.

Maher Alghali, N.H.M Alwi& I. Roesnita (2013). “Towards an efficient privacy in cloud based e-learning. *Proceeding of theInternational Conference on Intelligent Systems, Data Mining and Information Technology (ICIDIT'2014)*, Bangkok, Thailand. p.40-45.

Maher Alghali, N.H.M Alwi& I. Roesnita(2014).“Challenges and benefits of implementing cloud based e-learning in developing countries”. *Proceeding of the Social Sciences Research ICSSR* (2014).Kota Kinabalu,Sabah, Malaysia.

Maher Alghali, N.H.M Alwi& I. Roesnita (2014). “Massive Online Open Course (MOOC): New Learning Style” 1st Postgraduate Colloquium at USIM, Malaysia

Maher Alghali, Rabia Ihmouda&N.H.MAlwi (2015). “Assessing the Vulnerability” of E-learning Portals” *PostgraduateColloquium Faculty of Science & Technology (FST) at USIM, Malaysia*.

Maher Alghali, N.H.M. Alwi& I. Roesnita (2016).“A Framework to Assess Privacy in Cloud Based System”. *ARPN Journal of Engineering and Applied Sciences*.Vol. 11. No. 3. p. 1388- 1394

ACKNOWLEDGMENTS

Praise to Allah the Almighty, Creator and Sustainer of the Universe, and prayers and blessings are sent on His Prophet.

First, I thank Lord God Almighty as He has extended to me an incredible amount of grace in allowing me this opportunity.

My sincere thankfulness and appreciation to my supervisor, Dr. Najwa Hayaati Mohd Alwi, and Dr. Roesnita Ismail, for their continuous support, guidance with encouraging attitude and motivation throughout this work. I was lucky to have supervisors who taught me to explore by myself, at same time offered the guidance to improve when necessary.

To my father soul, to my dear mother who emphasized the importance of education and helped me throughout my life without their love, prayers, and understanding, nothing I've ever done would have been possible. I'm proud to be their son and would not have it any other way! I can't say enough how much I appreciate them.

To my wife Hanaa Naji, for her love, understanding, encouragement, sacrifice and help. I know words can never be enough to explain how much her support has meant to me. Also, one of the best experiences that we lived through during this period was the birth of our daughter, Aya, and our son, Abdulla, who provided an additional and joyful dimension to our life mission.

Finally, and most importantly, I thank my dear brothers and sisters as well as all my friends who were a constant source of strength and support.

I dedicate this work to all of you and prayed God Almighty to be beneficial.

ABSTRAK

Institusi pendidikan menggunakan teknologi perkomputeran awan untuk membolehkan sistem dan perkhidmatan pembelajaran dapat diakses bila-bila masa dan di mana sahaja dengan kos yang rendah. Namun begitu, pengkomputeran awan telah menimbulkan banyak kebimbangan privasi maklumat seperti kawalan data, kesedaran pengguna, akses data, keperluan pematuhan, lokasi data, tempoh penyimpanan, pemusnahan data, dan pengurusan pemberitahuan apabila pelanggaran privasi maklumat berlaku. Penyelidikan ini bertujuan untuk menangani jurang dalam kesusasteraan dan memahami isu-isu maklumat privasi dan kesan-kesannya (CBEL). Kajian ini menggunakan pendekatan penyelidikan deduktif bersama kaedah penyelidikan kuantitatif. Rangka kerja konseptual telah dibangunkan berdasarkan kajian kesusasteraan. Rangka kerja tersebut kemudiannya diuji melalui kaji selidik kepada 216 staf akademik dan staf dari pusat e-pembelajaran di Universiti Pendidikan Sultan Idris dengan kadar respons 96.86%. Data-data tersebut dianalisa melalui analisis faktor penerokaan dan diukur lagi oleh analisis faktor pengesahan. Pemodelan persamaan berstruktur telah digunakan untuk menganalisis maklumbalas kajian. Dapatan kajian menunjukkan bahawa kawalan faktor ($p < 0.001$), penyimpanan ($p < 0.001$), akses ($p = 0.003$), kesedaran ($p = 0.005$), Pelanggaran privasi ($p = 0.005$), kemusnahan ($p = 0.007$), pematuhan ($p = 0.007$), pengekalan ($p = 0.008$), dan audit dan pemantauan ($p = 0.014$) mempunyai kesan positif ke atas kebimbangan privasi CBEL. Selain itu, kebimbangan privasi mempunyai kesan yang positif ($p < 0.001$). pada kepercayaan risiko dan kesan negatif ke atas kepercayaan amarah ($p < 0.001$). Kajian ini juga mendapati bahawa kebimbangan privasi mempunyai hubungan antara faktor-faktor kepercayaan dan risiko kepercayaan. Kajian ini telah menyumbang kepada ilmu pengetahuan melalui suatu rangka kerja privasi maklumat dan alat pengesahan untuk mengukur kebimbangan pengguna terhadap privasi maklumat di CBEL. Akhir sekali, kajian ini memberi panduan bagi institusi pendidikan, pembekal perkhidmatan awan, dan pembuat dasar dalam usaha untuk meningkatkan amalan privasi mereka dan meningkatkan kepercayaan pengguna terhadap CBEL.

ABSTRACT

Educational institutions adopt cloud computing technology to allow their learning systems and services to be accessed anytime and anywhere with low cost. Moving to the cloud computing has raised many information privacy concerns such as data control, users awareness, data access, compliance requirements, data location, retention period, data destruction, and the notification management when an information privacy breach occurs. This study addresses the gap in the literature and gain a better understanding of information privacy issues and their consequences of cloud based e-learning. Deductive research approaches along with quantitative research method were adopted. A conceptual framework has been refined and developed based on reviewed literature. This framework was tested by means of a survey of 216 e-learning center and academic staff in Universiti Pendidikan Sultan Idris with response rate 96.86%. The items were clarified by exploratory factor analysis and measured again by confirmatory factor analysis. Structural equation modeling was used to analyze the survey responses. The finding indicates that the factors control ($p < 0.001$), storage ($p < 0.001$), access ($p = 0.003$), awareness ($p = 0.005$), privacy breaches ($p = 0.005$), destruction ($p = 0.007$), compliance ($p = 0.007$), retention ($p = 0.008$), and audit and monitoring ($p = 0.014$) have a positive effect on privacy concerns of cloud based e-learning. Besides, privacy concern has a positive effect ($p < 0.001$) on risk beliefs and negative effect on trust beliefs ($p < 0.001$). Additionally, the study found that an information privacy concern had a mediating the relationship between these factors and trust and risk beliefs. The results present a new contribution to the body of knowledge by validated and reliable 'cloud based e-learning users' information privacy framework and instrument to measure the users' information privacy concerns of cloud based e-learning. Finally, this study provides insights for education institutions, cloud service providers, and policy-makers to improve their privacy practices and increase the level of trust with their users.

TABLE OF CONTENTS

Contents	Page
AUTHOR DECLARATION	I
BIODATA OF AUTHOR	II
ACKNOWLEDGEMENTS	III
ABSTRAK	IV
ABSTRACT	V
TABLE OF CONTENTS	VI
LIST OF TABLES	XI
LIST OF FIGURES	XIV
LIST OF APPENDICES	XVI
CHAPTER 1 : INTRODUCTION	
1.0. Introduction	1
1.1. Background of The Research	2
1.2. Research Problem	4
1.3. The Motivation	7
1.4. Research Questions	7
1.5. Research Aim and Objectives	8
1.6. Research Scope and Limitation	8
1.7. Research Methodology	9
1.8. The Contribution of This Research	12
1.9. Organization of The Thesis	14
1.10. Chapter Summary	16

CHAPTER 2 : LITERATURE REVIEW

2.0. Introduction	18
2.1. Privacy	18
2.1.1. Information Privacy	19
2.2. E- Learning	20
2.2.1. E-Learning in Malaysia Higher Institution	22
2.2.2. Information Privacy In E-Learning	24
2.3. Cloud Computing	26
2.3.1. Service Deployment Models	27
2.3.2. Cloud Service Models	28
2.3.3. Characteristics of Cloud Computing	30
2.3.4. Cloud based Massive Online Open Courses	31
2.3.5. Information Privacy of Cloud Computing	32
2.3.6. Information Privacy Issues in Cloud Computing	34
2.4. The Existing Information Privacy Frameworks of Cloud Computing	39
2.5. Theoretical Background of Information Privacy Concerns	44
2.5.1. Social Contract Theory	48
2.5.2. Relationships Between Users Information Privacy of Cloud Based E-Learning and, Trusting Beliefs, Risk Beliefs	49
2.6. The Proposed Conceptual Framework	49
2.7. Research Hypotheses	51
2.7.1. The Research Hypothesizes for Direct Effect.	52
2.7.2. The Mediating Test	53
2.8. Chapter Summary	56

CHAPTER 3 : RESEARCH METHODOLOGY

3.0. Introduction	57
3.1. Research Strategy	57
3.1.1. Qualitative Research	58
3.1.2. Quantitative Research	58
3.1.3. Use of Multi-Method Research	59
3.2. Research Approach And Process	60
3.3. Data Analysis Strategy	66
3.3.1. Exploratory Factor Analysis (EFA)	67
3.3.2. Confirmatory Factor Analysis (CFA)	67
3.3.3. The Structural Equation Modelling (SEM)	67
3.4. Data Resources	71
3.4.1. Secondary Data Resource	71
3.4.2. Primary Data Resource	72
3.5. Ethical Consideration	72
3.6. Chapter Summary	73

CHAPTER 4 : DATA COLLECTION AND ANALYSIS

4.0. Introduction	74
4.1. Population and Sample	74
4.2. Research Instruments	75
4.3. Data Collection procedure	82
4.4. Main Data Analysis	83
4.4.1. Demographic Information	83

4.4.2. Descriptive Statistics	84
4.4.3. Data Preparation and Screening	84
4.4.4. Reliability	85
4.4.5. Exploratory Factor Analysis	86
4.4.6. The Measurement Model and Confirmatory Factor Analysis	89
4.4.7. Confirmatory Factor Analysis	89
4.4.8. Result of Fit Indices	92
4.4.9. Items Dropped	93
4.4.10. Structural Equation Modeling	93
4.4.11. Confirming the Results Through Bootstrapping	118
4.4.12. The Model Fits	122
4.5. Chapter Summary	124
 CHAPTER 5 : FINDING AND DISCUSSION	
5.0. Introduction	126
5.1. The Factors That Influence on Information Privacy of Cloud Based E-Learning Users	126
5.1.1. Direct Effect	127
5.1.2. Test of Mediation Effect	138
5.2. Information Privacy Framework for Cloud Based E-Learning Users	143
5.3. The Guide of Using Information Privacy Framework for Cloud Based E-Learning Users	145
5.4. The Validation of Framework	148
5.4.1. The Validation Process	149
5.4.2. The Panel of Experts	149

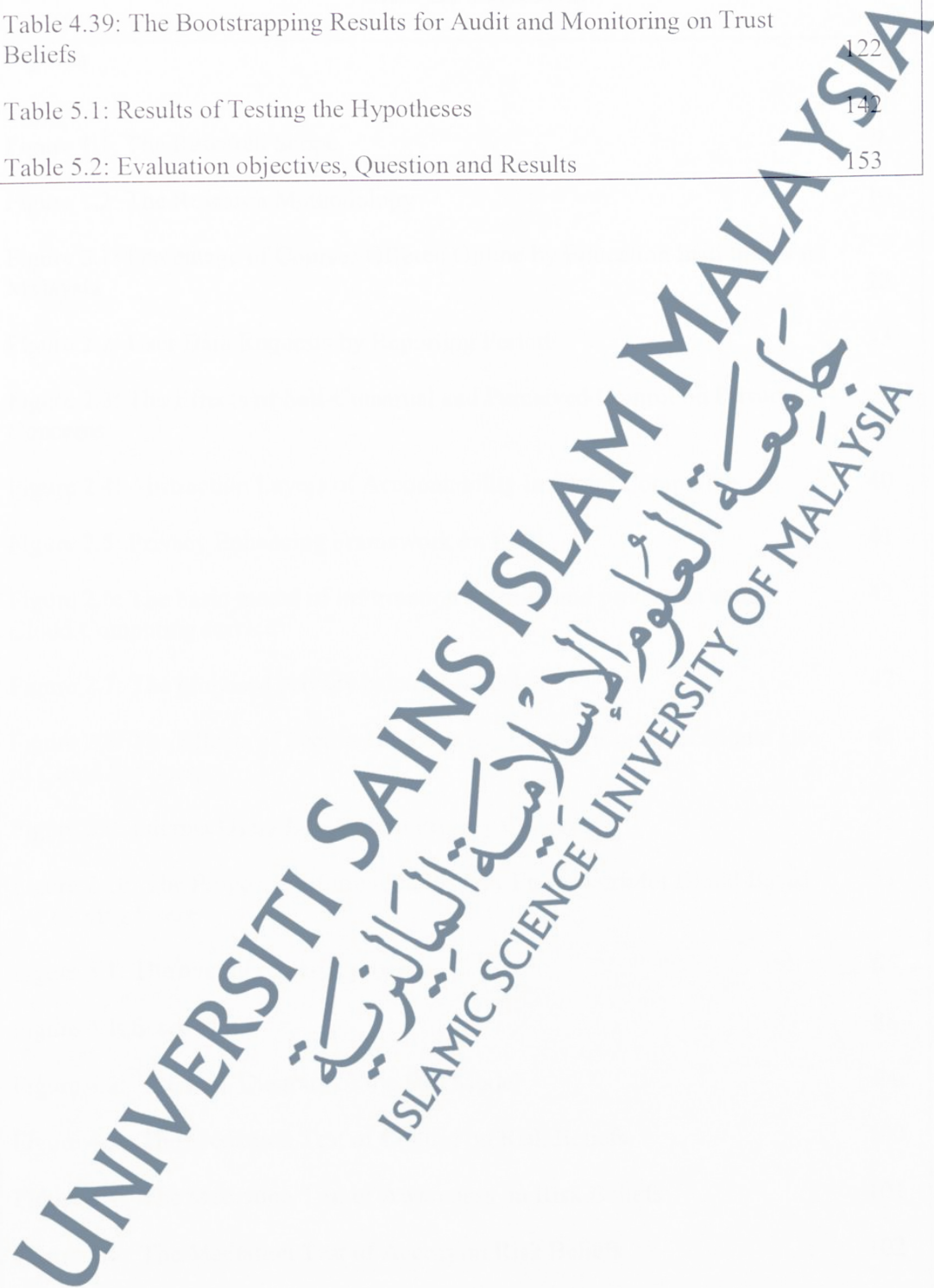
5.4.3. Validation Results	150
5.5. Chapter Summary	154
CHAPTER 6 : CONCLUSION	
6.0 Introduction	155
6.1 Overview of Study	155
6.2 Research Contributions	158
6.2.1 Theoretical Contribution	158
6.2.1 Industry Contribution	159
6.2.1 Policy Contribution	160
6.3 Limitations and Future Works	160
6.4 Conclusion	161

LIST OF TABLES

Tables	Page
Table 2.1: Type of information need to be protected	26
Table 2.2: Information Privacy Issues of Cloud Computing	38
Table 3.1: The Questions, Objectives, Method and Finding of the Research	60
Table 3.2: Research Methodology and Research Process	64
Table 3.3 Details of Fit Measures	68
Table 3.4: Literature Supports for the Respective Fitness Index	69
Table 4.1: Cronbach's Alpha for Each Component of the Instrument	78
Table 4.2: Factor Loading for Each Item of the Instrument	80
Table 4.3: Discriminant Validity	81
Table 4.4: Demographic Details	83
Table 4.5: KMO and Bartlett's Test	89
Table 4.6: All Dropped Items	93
Table 4.7: Path Analysis Results for Direct Effect	96
Table 4.8: Summary of Direct Effect on Risk Beliefs	98
Table 4.9: Summary of Direct Effect on Trust Beliefs	99
Table 4.10: The Result of Mediation Test of Control on Risk Beliefs	100
Table 4.11: The Result of Mediation Test of Awareness on Risk Beliefs	101
Table 4.12: The Result of Mediation Test of Access on Risk Beliefs	102
Table 4.13: The Result of Mediation Test of Storage on Risk Beliefs	103
Table 4.14: The Result of Mediation Test of Retention on Risk Beliefs	104
Table 4.15: The Result of Mediation Test of Destruction on Risk Beliefs	105
Table 4.16: The Result of Mediation Test of Compliance on Risk Beliefs	106

Table 4.17: The Result of Mediation Test of Audit and Monitoring on Risk Beliefs	107
Table 4.18: The Result of Mediation Test of Information Privacy Breaches on Risk Beliefs	108
Table 4.19: The Result of Mediation Test of Control on Trust Beliefs	109
Table 4.20: The Result of Mediation Test of Awareness on Trust Beliefs	110
Table 4.21: The Result of Mediation Test of Access on Trust Beliefs	111
Table 4.22: The Result of Mediation Test of Storage on Trust Beliefs	112
Table 4.23: The Result of Mediation Test of Retention on Trust Beliefs	113
Table 4.24: The Result of Mediation Test of Destruction on Trust Beliefs	114
Table 4.25: The Result of Mediation Test of Compliance on Trust Beliefs	115
Table 4.26: The Result of Mediation Test of Audit on Trust Beliefs	116
Table 4.27: The Result of Mediation Test of Information Privacy Breaches on Trust Beliefs	117
Table 4.28: The Bootstrapping Results for Control on Risk Beliefs	118
Table 4.29: The Bootstrapping Results for Awareness on Risk Beliefs	118
Table 4.30: The Bootstrapping Results for Storage on Risk Beliefs	119
Table 4.31: The bootstrapping results for Retention on Risk Beliefs	119
Table 4.32: The Bootstrapping Results for Compliance on Risk Beliefs	119
Table 4.33: The Bootstrapping Results for Audit and Monitoring on Risk Beliefs	120
Table 4.34: The Bootstrapping Results for Control on Trust Beliefs	120
Table 4.35: The Bootstrapping Results for Awareness on Trust Beliefs	120
Table 4.36: The Bootstrapping Results for Access on Trust Beliefs	121
Table 4.37: The Bootstrapping Results for Storage on Trust Beliefs	121
Table 4.38: The Bootstrapping Results for Retention on Trust Beliefs	121

Table 4.39: The Bootstrapping Results for Audit and Monitoring on Trust Beliefs	122
Table 5.1: Results of Testing the Hypotheses	142
Table 5.2: Evaluation objectives, Question and Results	153



LIST OF FIGURES

Figures	Page
Figure 1.1: The Research Scope	9
Figure 1.2: The Research Methodology	10
Figure 2.1: Percentage of Courses Offered Online by Education Institutions in Malaysia	23
Figure 2.2: User Data Requests by Reporting Period	33
Figure 2.3: The Effects of Self-Constraint and Perceived Control on Privacy Concerns	40
Figure 2.4: Abstraction Layers of Accountability in Cloud Computing	40
Figure 2.5: Privacy Enhancing Framework on PaaS	41
Figure 2.6: The basic model of information security and privacy in using Cloud Computing service	42
Figure 2.7: The proposed privacy calculus model	42
Figure 2.8: The Effects of Security and Privacy Concerns on Educational Use of Cloud Services	43
Figure 2.9: Internet Users Information Privacy Concerns	45
Figure 2.10: The Proposed Information Privacy Framework for Cloud Based E-Learning Users	51
Figure 3.1: The overall research process	65
Figure 4.1: Scree Plot	88
Figure 4.2: The Path Diagram of the Full Model	94
Figure 4.3: The Mediation Test of Control on Risk Beliefs	100
Figure 4.4: The Mediation Test of Awareness on Risk Beliefs	101
Figure 4.5: The Mediation Test of Access on Risk Beliefs	102
Figure 4.6: The Mediation Test of Storage on Risk Beliefs	103

Figure 4.7: The Mediation Test of Retention on Risk Beliefs	104
Figure 4.8: The Mediation Test of Destruction on Risk Beliefs	105
Figure 4.9: The Mediation Test of Compliance on Risk Beliefs	106
Figure 4.10: The Mediation Test of Audit and Monitoring on Risk Beliefs	107
Figure 4.11: The Mediation Test of Information Privacy Breaches on Risk Beliefs	108
Figure 4.12: The Mediation Test of Control on Trust Beliefs	109
Figure 4.13: The Mediation Test of Awareness on Trust Beliefs	110
Figure 4.14: The Mediation Test of Access on Trust Beliefs	111
Figure 4.15: The Mediation Test of Storage on Trust Beliefs	112
Figure 4.16: The Mediation Test of Retention on Trust Beliefs	113
Figure 4.17: The Mediation Test of Destruction on Trust Beliefs	114
Figure 4.18: The Mediation Test of Compliance on Trust Beliefs	115
Figure 4.19: The Mediation Test of Audit and Monitoring on Trust Beliefs	116
Figure 4.20: The Mediation Test of Information Privacy Breaches on Trust Beliefs	117
Figure 4.21: The Hypotheses Result of Information Privacy Framework for Cloud Based E-Learning Users	123
Figure 5.1: The Proposed Information Privacy Framework for Cloud Based E-Learning Users	144

LIST OF APPENDICES

Appendices	Page
APPENDIX A:Questionnaire	177
APPENDIXB:Results of Analysis	181
APPENDIX C:Expert Review Questionnaire	196
APPENDIX D:Experts' Responses	206

UNIVERSITI SAINS ISLAM MALAYSIA
جامعة العلوم الإسلامية
ISLAMIC SCIENCE UNIVERSITY OF MALAYSIA