Evaluating and Improving the Usability of E-government Websites in Sub-Saharan Africa for Enhancing Citizen Adoption and Usage

Submitted in fulfilment of the requirements for the degree

PHILOSOPHIAE DOCTOR

(Computer Information Systems)

In the Faculty of Natural and Agricultural Sciences

Department of Computer Science and Informatics

University of the Free State

Bloemfontein, South Africa

By

Verkijika *Silas Formunyuy*
2006097865

Promoter**: Dr Lizette De Wet**

Department of Computer Science and Informatics

2017

DECLARATION

I, Verkijika Silas Formunyuy declare that the thesis titled “Evaluating and Improving the Usability of E-Government Websites in Sub-Saharan Africa for Enhancing Citizen Adoption and Usage” is my own autonomous research. I also affirm that all the sources I have used or quoted in this study have been acknowledged by means of complete references. I further declare that the work is submitted for the first time at this university/faculty towards the Philosophiae Doctor degree in Computer Information Systems and that it has never been submitted to any other university/faculty for the purpose of obtaining a degree.

Signature: ______________________________

Date: ____________________________________

ACKNOWLEDGEMENTS

I would like to express my utmost thanks and heartfelt gratitude to the following:

- The Almighty God for all the wisdom, knowledge, strength and good health he provided to me throughout my entire study.
- Dr Lizette de Wet, my promoter for all of her valuable guidance, dedication, immense knowledge, constructive criticism and unwavering support, without which this achievement would not have been possible. I am very lucky to have her as my promoter for this PhD journey, and I will forever remain indebted to her.
- Dr Neneh Brownhilder, my wife for her unconditional love, support, patience and encouragement at every point of this journey.
- My family and friends for their support and encouragement at every point in my life.

SUMMARY

E-government has been widely known to be an important factor for fostering a nation's economic and social development. It holds enormous potential for improving the administrative efficiency of public institutions, encouraging democratic governance, deracinating public sector corruption, and building trust between citizens/private sector and governments. However, most e-government initiatives to date have failed to attain their full potential, because they are increasingly plagued by usability issues.

The case is worse for e-government initiatives in Sub-Saharan Africa (SSA) as many researchers have posited that this region is the least developed with regards to e-government diffusion. Moreover, its e-government systems are mostly characterised by poor usability. Consequently, advancing e-government in SSA necessitates advancing the usability of current e-government systems in the region, as usability has been shown to be a vital precondition for e-government progress. As such, this study had as primary objective to develop a model for improving the usability of e-government websites in SSA. The study focused on e-government websites as these sites are generally acknowledged to be the primary platform for government interaction with citizens and other stakeholders.

In order to achieve this goal, the design science research (DSR) approach was used as the overall research method for this thesis. The DSR was selected due to its core focus on developing useful artefacts that can effectively address DSR problems. This research approach was further supported by mixed methods encompassing usability evaluation (heuristic evaluation and automated testing) and cross-sectional analysis of national indicators.

Using a six-dimensional framework as the core theoretical framework for assessing the usability of e-government websites in SSA, the study concluded that SSA e-government websites were currently characterised by poor usability. After evaluating 279 e-government websites from 31 SSA countries, it was observed that the average usability score for the websites was 36.2%, with the most usable website having a score of 64.8%, while the least usable website scored 10.8%. The poor level of usability was consistent for all the six dimensions. Out of a weighted score of 16.7 for each dimension, the following mean scores were obtained: 7.6 for online services, 6.3

for user-help and feedback, 6.2 for navigation, 5.7 for legitimacy, 5.4 for information architecture, and 3.3 for accessibility accommodation. The study further identified 8 national indicators (corruption, cybersecurity, gender inequality, global competitiveness, human development, innovation, national income, and population age distribution) with significant associations to both e-government development and the usability of e-government websites in SSA.

Based on these findings, a policy-ingrained model was proposed for advancing the usability of e-government websites in SSA. The model comprised of four mental models (government, designer, evaluator, and user), with each having both general and specific strategies for improving e-government website usability in SSA. Additionally, the model presented the practical and policy implications regarding the role that the identified national indicators could play in advancing e-government website usability in the region. Moreover, the model was accompanied by a quick assessment checklist that could be used by IT staff of government agencies to evaluate their websites in order to determine which strategies from the model could be applied. The outcomes of this study could contribute to the development of practical and policy-based solutions for improving the usability of e-government websites in SSA, as well as advance the theoretical knowledge base on the use of information systems in government.

Keywords: E-government development, e-government websites, usability, Sub-Saharan Africa, policy-ingrained e-government usability model, mental models, national indicators

OPSOMMING

E-regering word allerweë beskou as ’n belangrike voorvereiste vir ’n nasie se ekonomiese en sosiale ontwikkeling. Dit hou ontsaglike moontlikhede in vir die verbetering van die administratiewe doeltreffendheid van openbare instellings, die aanmoediging van demokratiese regering, die uitroeiing van korrupsie in die openbare sektor en die bou van vertroue tussen burgers/die private sektor en regerings. Die meeste inisiatiewe van e-regering het egter tot op hede nie daarin kon slaag om hulle volle potensiaal te bereik nie omdat hulle toenemend deur bruikbaarheidsvraagstukke geteister word.

Die saak is nog slegter ten opsigte van e-regeringsinisiatiewe in sub-Sahara Afrika (SSA), aangesien hierdie streek die minste ontwikkel is wat betref die verspreiding van e-regering. Wat meer is, sy e-regeringstelsels word meestal gekenmerk deur swak bruikbaarheid. Die gevolg is dat dit noodsaaklik is dat die bruikbaarheid van hedendaagse e-regeringstelsels in SSA verbeter moet word vir die bevordering van e-regering, aangesien dit blyk dat bruikbaarheid ’n lewensnoodsaaklike voorvereiste vir die vooruitgang van e-regering is. As sodanig was hierdie studie se vernaamste doelstelling om ’n model te ontwikkel vir die verbetering van die bruikbaarheid van webwerwe vir e-regering in SSA. Die studie het op die webwerwe van e-regering gefokus aangesien hierdie werwe oor die algemeen erken word as die vernaamste verhoë vir die wisselwerking tussen die regering en burgers en ander belanghebbendes.

Ten einde hierdie doelwit te bereik, is die benadering van die ontwerpwetenskapnavorsing (design science research (DSR)) gebruik as die oorkoepelende navorsingsmetode vir hierdie tesis. Hierdie benadering is gekies vanweë sy kern fokus op die ontwikkeling van nuttige artefakte wat probleme ten opsigte van ontwerpwetenskapnavoring doeltreffend kan aanpak. Hierdie navorsingsbenadering is verder ondersteun deur gemengde metodes, insluitend bruikbaarheidsevaluering (heuristiese evaluering en outomatiese toetsing) en deursnee ontleding van nasionale aanwysers.

Deur gebruik te maak van die ses-dimensionele raamwerk as die kern teoretiese raamwerk vir die vasstelling van die bruikbaarheid van die webwerwe van e-regering in SSA, het die studie tot die gevolgtrekking gekom dat die e-regeringswebwerwe in SSA tans gekenmerk word deur baie swak bruikbaarheid. Nadat 279 e-regeringswebwerwe van 31 lande in SSA ge-evalueer is, is opgemerk dat die gemiddelde bruikbaarheid van die webwerwe 36.2% was, met ’n telling van 64.8% vir die bruikbaarste webwerf, terwyl die webwerf wat die minste bruikbaar was, 10.8% behaal het. Die swak vlak van bruikbaarheid was konsekwent vir al ses die dimensies. Uit ’n aangepaste telling van 16.7 vir elke dimensie is die volgende gemiddelde tellings behaal: 7.6 vir aanlyndienste, 6.3 vir gebruikershulp en terugvoer, 6.2 vir navigasie, 5.7 vir wettigheid, 5.4 vir inligtingsargitektuur en 3.3 vir toeganklikheidsbystand. Die studie het verder agt nasionale aanwysers geïdentifiseer (korrupsie, kuberveiligheid, geslagsongelykheid, globale mededingendheid, menslike ontwikkeling, innovering, nasionale inkomste en die verspreiding van die bevolking se ouderdom) met betekenisvolle verbintenisse met beide die ontwikkeling van e-regering en die bruikbaarheid van e-regeringswebwerwe in SSA.

Gegrond op hierdie bevindings, is ’n model, wat in beleid gewortel is, voorgestel vir die bevordering van die bruikbaarheid van e-regeringswebwerwe in SSA. Die model bestaan uit vier denkwyse-modelle (regering, ontwerper, evalueerder en gebruiker), waarvan elkeen beskik oor sowel algemene as besondere strategieë vir die verbetering van die bruikbaarheid van e-regeringswebwerwe in SSA. Hierbenewens toon die model die praktiese en beleidsgevolge aan ten opsigte waarvan die aangewese nasionale aanwysers ’n rol kan speel in die bevordering van die bruikbaarheid van e-regeringswebwerwe in die streek. Die model het verder ook ’n vinnige kontrolelys vir evaluering wat deur IT-personeel of regeringsagentskappe gebruik kan word om hulle webwerwe te beoordeel ten einde vas te stel watter strategieë van die model toegepas kan word. Die uitkoms van hierdie studie sou kon bydra tot die ontwikkeling van praktiese en beleidsgerigte oplossings vir die verbetering van die bruikbaarheid van e-regeringswebwerwe in SSA, sowel as die bevordering van die teoretiese kennisbasis van die gebruik van die inligtingstelsel van die regering.

Sleutelwoorde: E-regeringsontwikkeling, e-regeringswebwerwe, bruikbaarheid, sub-Sahara Afrika, e-regering se bruikbaarheidsmodel gewortel in beleid, denkwyse-modelle, nasionale aanwysers.

RESEARCH OUTPUT

An extract from this study was published in peer-reviewed conference proceedings (IST-Africa 2016) and another paper is under consideration for publication in the International Journal of Electronic Government Research. The full articles are presented in Appendix G.

- Verkijika, S.F. & De Wet, L. (2016, May 11-13). E-Government Development in Sub-Saharan Africa (SSA): Relationship with Macro Level Indices and Possible Implications. In P. Cunningham and M. Cunningham (Eds). IST-Africa 2016 Conference Proceedings. Durban, South Africa. DOI:10.1109/ISTAFRICA.2016.7530580

- Verkijika, S.F. & De Wet, L. (2017). Determining the Accessibility of E-Government Websites in Sub-Saharan Africa against WCAG 2.0 Standard. *International Journal of Electronic Government Research (IJEGR)*, 13(1), 52-68. Doi:10.4018/IJEGR.2017010104

PAPER UNDER REVIEW

- Verkijika, S.F. & De Wet, L. (2017). Quality Assessment of E-Government Websites in Sub-Saharan Africa: A Public Values Perspective. *Journal of Information Systems in Developing Countries.*

TABLE OF CONTENTS

DECLARATION i

ACKNOWLEDGEMENTS ii

SUMMARY iii

OPSOMMING v

RESEARCH OUTPUT vii

LIST OF TABLES xx

LIST OF FIGURES xxiv

LIST OF ACRONYMS xxvii

CHAPTER ONE 1

INTRODUCTION 1

1.1. Introduction 2

1.2. Background of the Study 7

1.2.1. Overview of e-government 7

1.2.2. E-government usability 8

1.3. Problem Statement 10

1.4. Research Questions 14

1.5. Research Objectives 15

1.6. Research Design and Methodology 16

1.6.1. Research design 16

1.6.2. Methodology 17

1.6.3. Methods and evaluation techniques 19

1.7. Ethical Approval 20

1.8. Limitations of the Study 21

1.9. Contributions of the Study 21

1.10. Chapter Outline 22

CHAPTER TWO 25

E-GOVERNMENT DEVELOPMENT AND ADOPTION IN SSA 25

2.1. Introduction 26

2.2. Sub-Saharan Africa (SSA) 26

2.3. Overview of E-government 28

2.4. E-Government in SSA 30

2.4.1. E-government development in SSA vs. the rest of the world 31

2.4.2. Regional differences in e-government development in SSA 32

2.4.3. Growth in e-government development in SSA 33

2.4.4. Factors affecting e-government development in SSA 37

2.5. E-Government Adoption Models 40

2.5.1. Theory of reasoned action (TRA) 41

2.5.2. Theory of planned behaviour (TPB) 42

2.5.3. Technology acceptance model (TAM) 43

2.5.4. Diffusion of innovation theory (DOI) 45

2.5.5. Perceived characteristics of innovation (PCI) 46

2.5.6. Unified theory of acceptance and use of technology (UTAUT) 47

2.5.7. E-government adoption model (GAM) 49

2.5.8. E-government adoption and utilisation model (EGAUM) 51

2.6. Lessons Learnt from E-Government Adoption Models and the Case for SSA 52

2.6.1. E-government adoption studies in SSA ... 53

2.6.2. Significant outcomes and future directions ... 56

2.7. E-Government Maturity Models ... 58

2.8. Public Values Perspective of E-Government ... 61

2.9. Summary ... 64

CHAPTER THREE ... 66

USABILITY OF E-GOVERNMENT WEBSITES ... 66

3.1. Introduction ... 67

3.2. Overview of Usability ... 67

3.3. Importance of Usability in E-Government ... 70

3.4. E-Government Usability Dimensions ... 72

3.4.1. Navigation ... 76

3.4.2. User-help and feedback ... 78

3.4.3. Online services ... 79

3.4.4. Accessibility accommodation ... 81

3.4.5. Information architecture ... 85

3.4.6. Legitimacy ... 88

3.5. User Characteristics and Usability ... 89

3.5.1. Culture ... 90

3.5.2. Gender ... 91

3.5.3. Age ... 91

3.6. E-Government Usability and Public Values Perspective of E-Government ... 92

3.7. National Indicators, E-Government Development and Usability of E-Government Websites……94
3.7.1. National income 95
3.7.2. Corruption 96
3.7.3. Global competitiveness 97
3.7.4. Innovation 98
3.7.5. Cybersecurity 99
3.7.6. Population age distribution 101
3.7.7. Gender inequality 102
3.7.8. Human development 103
3.7.9. Cultural diversity 104
3.8. State of E-Government Usability in SSA 105
3.9. Summary 108
CHAPTER FOUR 109
RESEARCH DESIGN AND METHODOLOGY 109
4.1. Introduction 110
4.2. The Research Pyramid 110
4.2.1. Research paradigm 111
4.2.2. Research methodology 114
4.2.3. Research methods 114
4.2.4. Research techniques 115
4.3. The DSR Paradigm 115
4.3.1. DSR artefacts 116

4.3.2. DSR guidelines and their application ... 118

4.3.3. DSR cycles ... 120

4.3.3.1. The relevance cycle ... 121

4.3.3.2. The rigour cycle ... 122

4.3.3.3. The design cycle ... 123

4.4. The DSR Methodology ... 124

4.4.1. Identify problem and motivate ... 124

4.4.2. Define solution objectives ... 125

4.4.3. Design and development ... 126

4.4.4. Demonstration ... 126

4.4.5. Evaluation ... 126

4.4.6. Communication of research ... 128

4.5. The Research Methods ... 128

4.5.1. Usability evaluation methods ... 128

4.5.1.1. Expert-based methods ... 129

4.5.1.1.1. Selection of expert-based usability evaluation method ... 129

4.5.1.1.2. Selection of heuristic evaluators ... 131

4.5.1.2. Automated testing methods ... 135

4.5.1.3. User-based methods ... 137

4.5.2. Mixed methods ... 137

4.6. The Research Techniques ... 140

4.6.1. Heuristic evaluation tools ... 141

4.6.1.1. Six-dimensional framework ... 141

4.6.1.2. UsabAIPO heuristics ... 142

4.6.2. Automated evaluation tools ... 143

4.6.2.1. Functional accessibility evaluator (FAE) 2.0 ... 143

4.6.2.2. Responsinator 145

4.6.2.3. Sucuri sitecheck 146

4.6.2.4. TAW 147

4.6.2.5. Xenu's link sleuth 148

4.6.3. Data sources for national indicators and the EGDI 150

4.6.4. Aggregation processes 151

4.6.4.1. Aggregation of data from different heuristic evaluators 152

4.6.4.2. Aggregation of heuristic evaluation data with automated testing data 154

4.6.4.3. Aggregation of evaluation scores from the two usability measures 155

4.7. Sample of E-Government Websites for Evaluation 155

4.8. Summary 157

CHAPTER FIVE 159

PROPOSED MODEL 159

5.1. Introduction 160

5.2. E-Government and Usability 160

5.3. The Role of National Indicators 161

5.4. Advancing Usability 162

5.4.1. The government's mental model 164

5.4.2. The designer's mental model 165

5.4.3. The evaluator's mental model 166

5.4.4. The user's mental model 167

5.5. Combining the Model Components 169

5.6. Summary 171

CHAPTER SIX 173

RESULTS AND ANALYSIS 173

6.1. Introduction 174

6.2. Heuristic Evaluation 174

6.2.1. Evaluation based on the six-dimensional framework 174

6.2.1.1. Online services dimension 174

6.2.1.1.1. Dichotomous variables for online services 175

6.2.1.1.2. Scale variables for online services 176

6.2.1.1.3. Overall online services dimension score 182

6.2.1.2. User-help and feedback dimension 186

6.2.1.2.1. Dichotomous variables of user-help and feedback 186

6.2.1.2.2. Scale variables of user-help and feedback 188

6.2.1.3. Overall user-help and feedback dimension scores 190

6.2.1.3. Navigation dimension 193

6.2.1.3.1. Dichotomous variables of navigation 193

6.2.1.3.2. Scale variables of navigation 195

6.2.1.3.3. Overall navigation dimension scores 198

6.2.1.4. Legitimacy dimension 200

6.2.1.4.1. Dichotomous variables of legitimacy 201

6.2.1.4.2. Scale variables of legitimacy 202

6.2.1.4.3. Overall legitimacy dimension scores 207

6.2.1.5. Information Architecture Dimension 209

6.2.1.5.1. Dichotomous variables of information architecture 209

6.2.1.5.2. Scale variables of information architecture 210

6.2.1.5.3. Overall information architecture dimension scores 213

6.2.1.6. Accessibility Accommodation Dimension 215

6.2.1.6.1. Scale variables of accessibility accommodation 215

6.2.1.6.2. Overall accessibility accommodation dimension scores 220

6.2.1.7. Overall Usability based on six-dimensional framework 222

6.2.1.8. Summary of the evaluation for six-dimensional usability heuristics 224

6.2.2. Evaluation based on UsabAIPO heuristics 225

6.3. Comparisons: National and Local E-Government Websites 232

6.3.1. Comparison based on the six-dimensional framework.. 232

6.3.2. Comparison based on UsabAIPO.. 235

6.4. Aggregating the Two Usability Measures 236

6.5. Cross-sectional Relationships 239

6.5.1. Relationship between EGDI and e-government usability.. 239

6.5.2. Relationship between national indicators and e-government development 241

6.5.3. Relationship between national indicators and the usability of SSA e-government websites 245

6.5.3.1. National income and e-government website usability 245

6.5.3.2. Corruption and e-government websites usability 248

6.5.3.3. Global competitiveness 249

6.5.3.4. Innovation and e-government website usability 251

6.5.3.5. Cybersecurity and e-government website usability 253

6.5.3.6. Cultural diversity and usability 254

6.5.3.7. Gender inequality and e-government website usability...255

6.5.3.8. Population age distribution and e-government website usability 257

6.5.3.9. Human Development and E-government Website Usability...259

6.6. Summary 261

CHAPTER SEVEN 263

MODEL FOR ADVANCING E-GOVERNMENT USABILITY IN SSA 263

7.1. Introduction.. 264

7.2. State of Usability.. 266

7.2.1. General strategies for enhancing usability in SSA.. 267

7.2.1.1. Government's mental model 267

7.2.1.1.1. Usability committee..*267*

7.2.1.1.2. Usability policies...*268*

7.2.1.1.3. Funding e-government usability research...*269*

7.2.1.1.4. Usability training *270*

7.2.1.2. Designer's mental model...270

7.2.1.2.1. Skills development...*271*

7.2.1.2.2. Compliance with usability standards as policies *271*

7.2.1.3. Evaluator's mental model..272

7.2.1.3.1. Government employed or contracted usability professionals *272*

7.2.1.3.2. E-government usability researchers...*272*

7.2.1.4. User's mental model...273

7.2.2. Specific strategies for enhancing e-government website usability in SSA 274

7.2.2.1. Specific strategies for the government's mental model..274

7.2.2.2. Specific strategies for the designer's mental model 279

7.2.2.3. Specific strategies for the evaluator's mental model 283

7.2.2.4. Specific strategies for the user's mental model 286

7.2.3. E-government website evaluation checklist for SSA... 288

7.3. Role of National Indicators... 289

7.3.1. Role of national income... 289

7.3.2. Role of corruption.. 290

7.3.3. Role of global competitiveness 291

7.3.4. Role of innovation.. 292

7.3.5. Role of cybersecurity 293

7.3.6. Role of gender inequality... 294

7.3.7. Role of population age distribution.. 294

7.3.8. Human development *295*

7.4. Summary 295

CHAPTER EIGHT 297

MODEL EVALUATION 297

8.1. Introduction 298

8.2. Evaluation Process 298

8.3. Problem Identification 302

8.4. First Evaluation Activity (Eval1 Activity) 303

8.5. Designing the Artefact 306

8.6. Second Evaluation Activity (Eval2 Activity) 307

8.6.1. Completeness *307*

8.6.2. Levels of detail *308*

8.7. Artefact Construction 309

8.8. Third Evaluation Activity (Eval3 Activity) 311

8.8.1. Fidelity with real world phenomena *311*

8.8.1.1. Including relevant parts of the knowledge base 311

8.8.1.2. Consistency in use of constructs 312

8.8.2. Robustness *312*

8.9. Artefact Use 314

8.10. Fourth Evaluation Activity (Eval4 Activity) 314

8.10.1. Internal consistency *314*

8.10.1.1. Form and function 315

8.10.1.1.1. Selection of Israel as the case study *315*

8.10.1.1.2. Form and function of the artefact as a policy carrier *320*

8.10.1.2. Principles of implementation 322

8.10.2. Applicability.... 322

8.10.3. Accessibility 323

8.10.4. Fitness-utility 324

8.10.4.1. Decomposable....324

8.10.4.2. Malleable....325

8.10.4.3. Open....326

8.10.4.4. Embedded in a design system 326

8.10.4.5. Novelty....326

8.10.4.5.1. Creating new knowledge 327

8.10.4.5.2. Promoting diversity....329

8.10.4.5.3. Applicable to more than one local context....329

8.10.4.6. Interesting 330

8.10.4.7. Elegance....331

8.11. Summary 331

CHAPTER NINE.... 333

CONCLUSIONS.... 333

9.1. Introduction.... 334

9.2. Summary of the Thesis 334

9.3. Attainment of the Research Objectives.... 336

9.3.1. Attainment of the primary objective 336

9.3.2. Attainment of the secondary objectives 337

9.4. Contributions of the Study 341

9.4.1. DSR contribution 341

9.4.2. Other contributions.... 344

9.5. Limitations of the Study 339

9.6. Recommendations for Future Studies 347

9.7. Final Note 348

REFERENCES 349

APPENDICES 403

Appendix A: Quick Evaluation Checklist for SSA E-Government Websites 403

Appendix B: Ethical Clearance 408

Appendix C: Consent Form 409

Appendix D: Usability Heuristics of the Six-dimensional Framework 411

Appendix E: UsabAIPO Heuristics 417

Appendix F: List of Evaluated E-Government Websites 419

Appendix G: Publications 426

LIST OF TABLES

Table 1.1: Factors influencing e-government development 6

Table 2.1: E-government Development in SSA 33

Table 2.2: Comparison between 2014 and 2016 EGDI for SSA 34

Table 2.3: Performance of SSA countries in 2014 and 2016 EGDIs... 35

Table 2.4: DOI factors 46

Table 2.5: PCI factors 47

Table 2.6: UTAUT factors... 48

Table 2.7: Summary of e-government adoption models used in SSA... 54

Table 2.8: Significant factors influencing e-government adoption in SSA 57

Table 2.9: E-government maturity models 59

Table 3.1: E-government website usability studies that used heuristics associated with the sis-dimensional framework 75

Table 3.2: Navigation variables 77

Table 3.3: User-help & feedback variables... 78

Table 3.4: Online Services variables 80

Table 3.5: WCAG 2.0 guidelines (Compiled from W3C website).. 83

Table 3.6: Overlap between usability heuristics and WCAG 2.0 success criteria........................ 84

Table 3.7: Information architecture variables.. 87

Table 3.8: Legitimacy factors 89

Table 4.1: Research paradigms.. 111

Table 4.2: Differences between the most commonly used research paradigms in IS research .. 113
Table 4.3: DSR artefacts 116
Table 4.4: DSR knowledge contribution types 117
Table 4.5: DSR methodology guidelines 118
Table 4.6: DSR evaluation methods 127
Table 4.7: Expert-based usability evaluation methods 129
Table 4.8: Classification of usability professionals 134
Table 4.9: Purposes of mixed methods research 138
Table 4.10: Mixed methods research 139
Table 4.11: FAE accessibility outcome classification 143
Table 4.12: Data sources of EGDI and national indicators 150
Table 4.13: Guttmann scale for downloadable forms 153
Table 4.14: Sample Guttmann scales for automated testing 154

Table 6.1: Online Services across the different SSA Countries 182
Table 6.2: Overall user-help & feedback scores 191
Table 6.3: Broken links among SSA e-government website 197
Table 6.4: Navigation dimension across different SSA countries 199
Table 6.5: Specific security issues among SSA e-government websites 205
Table 6.6: Overall Legitimacy Dimension across SSA Countries 208
Table 6.7: Overall scores for information architecture across SSA countries 213
Table 6.8: List of commonly violated WCAG 2.0 guidelines 218
Table 6.9: MobileOk test statistics 219
Table 6.10: Overall accessibility evaluation scores 220

Table 6.11: Overall usability scores for SSA e-government websites....................................... 223

Table 6.12: UsabAIPO evaluation scores 225

Table 6.13: Overall UsabAIPO scores for SSA e-government websites.................................... 229

Table 6.14: UsabAIPO evaluation scores for each SSA country.. 230

Table 6.15: Usability comparison between state and local e-government websites.................. 232

Table 6.16: Differences in overall usability across SSA countries.. 233

Table 6.17: Differences in UsabAIPO dimension 235

Table 6.18: Reliability statistics for overall usability dimensions... 237

Table 6.19: Combined usability scores across the different SSA countries 237

Table 6.20: Regression analysis for national indicators and EGDI... 242

Table 6.21: National income and usability 245

Table 6.22: National income and usability dimensions... 246

Table 6.23: Corruption and usability 248

Table 6.24: Corruption and usability dimensions.. 249

Table 6.25: Global competitiveness and usability 250

Table 6.26: Global competitiveness and usability dimensions.. 250

Table 6.27: Innovation and usability 251

Table 6.28: Innovation and usability dimensions 252

Table 6.29: Cybersecurity and usability 253

Table 6.30: Cybersecurity and usability dimensions 254

Table 6.31: Cultural diversity and usability... 255

Table 6.32: Gender inequality and usability.. 256

Table 6.33: Gender inequality and usability dimensions... 256

Table 6.34: Population age distribution and usability 257

Table 6.35: Population age distribution and usability dimensions 258

Table 6.36: Human development and usability 259

Table 6.37: Human development and usability dimensions 260

Table 7.1: Key usability areas of concern in SSA 266
Table 7.2: Government's roles in addressing identified usability issues 274
Table 7.3: Designer's roles in addressing identified usability issues 279
Table 7.4: Evaluator's role in addressing identified usability issues 283
Table 7.5: User's role in addressing identified usability issues 286
Table 7.6: Summary of significant results for national indicators 289

Table 8.1: National indicators for Israel, Mauritius and South Africa 316
Table 8.2: Usability comparison for Israel, Mauritius and South Africa 318
Table 8.3: Post-hoc test for differences in usability between Israel, Mauritius and SA 319

LIST OF FIGURES

Figure 1.1: High-level view of DSR methodology (Source: Kuechler & Vaishnavi, 2008:489) . 18

Figure 2.1: African Map Depicting SSA (Source: Segbefia, 2016) 27

Figure 2.2: E-Government Development Index from 2010-2016 31

Figure 2.3: Relationship between corruption and EGDI (Source: UNDESA, 2016) 38

Figure 2.4: Relationship between competitiveness and EGDI (Source: UNDESA, 2016) 39

Figure 2.5: TRA Model (Source: Fishbein & Ajzen, 1975, p. 16) 41

Figure 2.6: TPB model (Source: Ajzen, 1991, p.182) 42

Figure 2.7: TAM (Source: Davis *et al.,* 1989, p.453) 44

Figure 2.8: UTAUT (Source: Venkatesh *et al.*, 2003, p. 447) 48

Figure 2.9: GAM (Source: Shareef *et al.*, 2011, p. 30) 50

Figure 2.10: EGAUM (Source: Alghamdi & Beloff, 2014) 51

Figure 3.1: ISO Usability Dimension 68

Figure 3.2: Five Quality Components of Usability (Source: Cai, 2010, p. 25) 68

Figure 3.3: The usability Pyramid (Source: Nordby, 2003) 69

Figure 3.4: Six-dimensional usability framework (Source: Baker, 2009, p. 84) 74

Figure 3.5: Accessibility as a Subset of Usability (Source: Kapsi *et al*., 2009) 82

Figure 3.6: Usability and Accessibility as Distinct Concepts (Source: Kapsi *et al.*, 2009).......... 82

Figure 3.7: Usable Accessibility (Source, *Kapsi et al.*, 2009) 83

Figure 4.1: Research Pyramid (Souce Jonker & Pennink, 2010, p. 23) 110

Figure 4.2: DSR Cycles (Source: Hevner, 2007, p. 88)... 121

Figure 4. 3: DSR Methodology (Source Peffers et al., 2008, p. 58).. 124

Figure 4.4: DSR Roadmap (Source: Wieringa, 2014 P. 213). 125

Figure 4.5: Percentage of usability issues found by Heuristic Evaluators................................. 131

Figure 4.6: Screenshot of FAE 2.0... 144

Figure 4.7: Screenshot of Responsinator 145

Figure 4.8: Screenshot of Sucuri Sitecheck 146

Figure 4.9: Screenshot of TAW 148
Figure 4.10: Screen shot of Xenu's ink Sleuth 149

Figure 5.1: E-government development and usability of e-government websites........ 160
Figure 5.2: Role of national indicators 161
Figure 5.3: Role of mental models........ 164
Figure 5.4: Policy-ingrained model for advancing e-government website usability in SSA...... 171

Figure 6.1: Dichotomous variables of online services........ 175
Figure 6.2: Documents/publications variable of online services 177
Figure 6.3: Downloadable forms for online services........ 178
Figure 6.4: Communication with officials variable of online services........ 179
Figure 6.5: E-commerce applications 180
Figure 6.6: Employment/tender information 181
Figure 6.7: Correlation between OSI and usability online services scores........ 185
Figure 6.8: Dichotomous variables of user-help & feedback dimension........ 187
Figure 6.9: Non-native language translations 188
Figure 6.10: Search functionality in e-government websites........ 189
Figure 6.11: Dichotomous Variables of Navigation Dimension 193
Figure 6.12: Links to other agencies........ 195
Figure 6.13: Broken links 196
Figure 6.14: Dichotomous variables of legitimacy Dimension 201
Figure 6.15: Privacy policy........ 203
Figure 6.16: Security of SSA e-government websites 204
Figure 6.17: SSA websites with errors and outdated software 206
Figure 6.18: Dichotomous variables of information architecture........ 210
Figure 6.19: Audience-focused areas........ 211
Figure 6.20: Personalised/customizable features........ 212
Figure 6.21: Manual accessibility evaluation 216
Figure 6.22: FAE accessibility evaluation........ 217
Figure 6.23: Correlation between the two usability measures........ 236
Figure 6.24: Correlation between EGDI and the overall usability scores 239

Figure 6.25: Correlation between EPI and the overall usability scores 240

Figure 7.1: A policy-ingrained model for advancing usability of e-government websites in SSA………………..…………………………………………………………………..265

Figure 8.1: General DSR evaluation pattern (Source: Sonnenberg & Brocke, 2012) 298
Figure 8.2: Evaluation activities for DSR artefact 301
Figure 8.3: Graphical representation of published paper 328

Figure 9.1: Four quadrant framework for DSR contributions 341
Figure 9. 2: Contribution of the study - Policy-ingrained model 343

LIST OF ACRONYMS

Acronym	Meaning
API	Application Programmable Interface
CPI	Corruption Perception Index
DOI	Diffusion of Innovation Theory
DOS	Denial Of Service
DSR	Design Science Research
EGAUM	E-Government Adoption and Utilisation Model
EGDI	E-Government Development Index
EPI	E-participation Index
FAE	Functional Accessibility Evaluator
FAQ	Frequently Asked Questions
GAM	E-Government Adoption Model
GCI	Global Competitiveness Index
HCI	Human Capital Index
HCI	Human-computer Interaction
HDI	Human Development Index
ICT	Information and Communication Technology
IS	Information Systems
IVIS	In-vehicle Information Systems
MENA	The Middle East and North Africa
OSI	Online Services Index
PCI	Perceived Characteristics of Innovation
PCI DSS	Payment Card Industry Data Security Standard
PDA	Personal Digital Assistance
SA	South Africa
SPSS	Statistical Package for Social Sciences
SSA	Sub-Saharan Africa

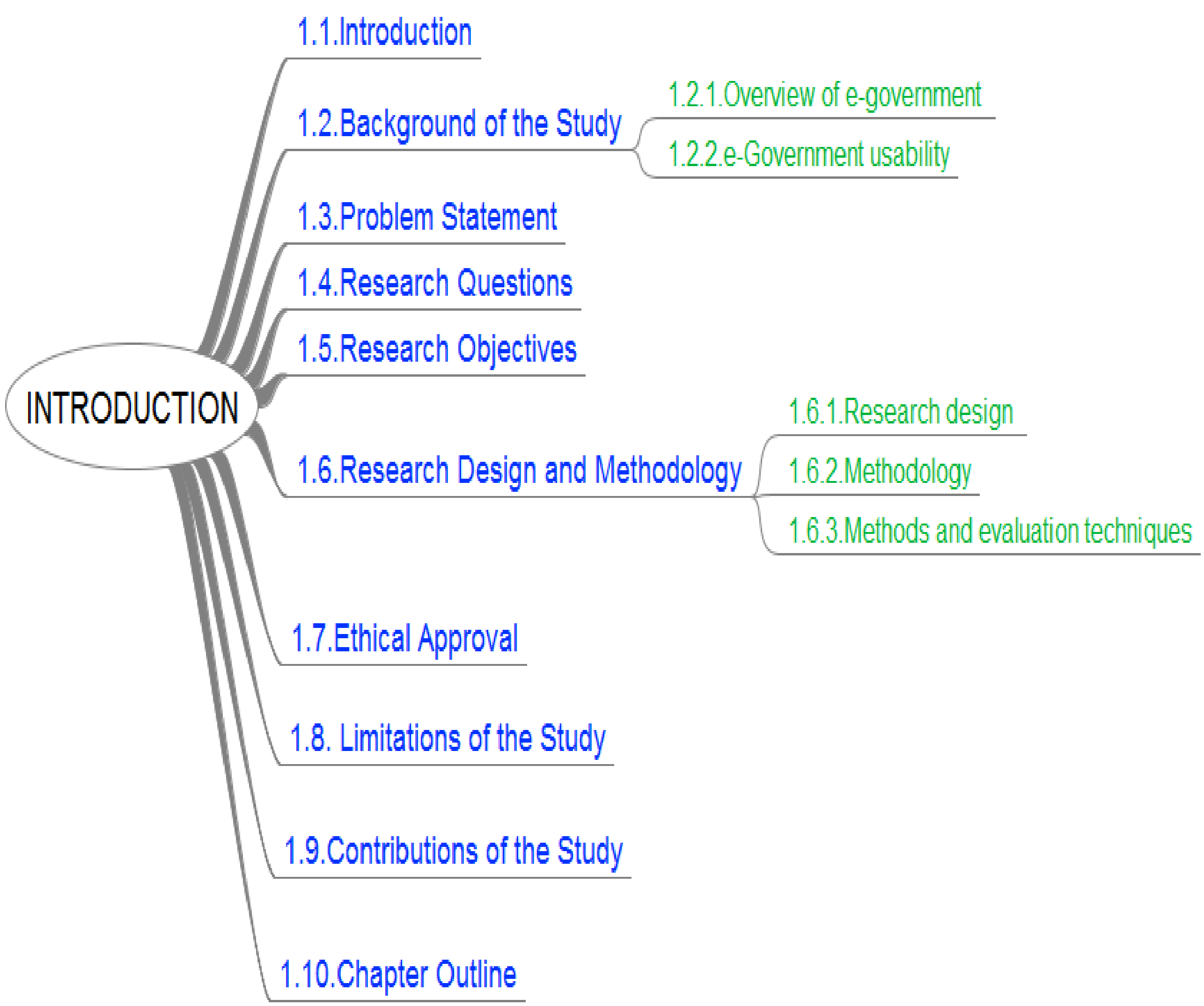
TAM	Technology Acceptance Model
TII	Telecommunication Infrastructure Index
TPB	Theory of Planned Behaviour
TRA	Theory of Reasoned Action
UN	United Nations
UNDESA	United Nations Department of Economic and Social Affairs
UNDP	United Nations Development Programme
URL	Uniform Resource Locator
USA or US	The United States of America
UTAUT	Unified Theory of Acceptance and Use of Technology
UX	User Experience
WCAG	Web Content Accessibility Guidelines
WIPO	World Intellectual Property Organization

CHAPTER ONE

INTRODUCTION

It's not good enough to just keep producing technology with no notion of whether it's going to be useful. You have to create stuff that people really want, rather than create stuff just because you can.

Genevieve *Bell*



1.1. Introduction

Over the last two decades, governments around the world have increasingly adopted Information and Communication Technologies (ICTs) into their mainstream activities as a means of enhancing their overall performance. This espousal of ICTs into government activities has been widely referred to as e-government (Buffat, 2015; De Roiste, 2013; Mates, Lechner, Rieger & Pekna, 2013; Schuppan, 2009). Evidence from around the world indicates that e-government is an extremely valuable strategy for governments to boost their administrative efficiency, gain the trust of citizens, uproot corruption of government officials, and eventually encourage democratic governance (Elbahnasawy, 2014; Jun, Wang & Wang, 2014; Seifert & Chung, 2009; Yang & Rho, 2007). According to Schuppan (2009), the fact that e-government enables the efficient and effective administration of state institutions makes it a vital precondition for a nation's economic and social development. Similarly, Eliassen and Sitter (2007) expound that e-government initiatives have significantly improved resource management in public administration and service delivery to the public. As such, the development of e-government competencies has become a central aspect of most government strategies around the globe (Hui, Xiaolin & Jianying, 2014; Sorrentino & De Marco, 2013).

While it is evident that e-government has exceptional benefits and has been widely adopted around the world, several disparities in its adoption and assimilation still exist between the developed and developing worlds. E-Government in the developing and less developed world lags far behind that of the developed world (Nawafleh, Obiedat & Harfoushi, 2012). Schuppan (2009) argued that most e-government paradigms are conceptualised in developed countries, and have proven not to be automatically transferable to developing countries. This is due to the numerous challenges of implementing e-government solutions in developing countries. Some of the widely known challenges include infrastructure as well as technical, social, political, and cultural factors (Kirui & Kemei, 2014; Nawafleh *et al.*, 2012; Veljković, Dinić & Stoimenov, 2012). One of such developing regions that is lagging behind in e-government is Sub-Saharan Africa (SSA).

SSA is the geographical area in the African continent that lies south of the Sahara Desert (Findt, Scott & Lindfeld, 2014; Mutula, 2013). SSA consists of the 49 African countries that are either fully or partially located south of the Sahara Desert (Cruz-Cunha & Moreira, 2011). The other part of the African continent is referred to as North Africa and is mostly considered to be part of the Arab world (Cruz-Cunha & Moreira, 2011; Findt *et al.*, 2014). Generally referred to as the Middle East and North Africa (MENA), these Arab world countries share various similarities with respect to socio-cultural characteristics, national economics, religious beliefs (predominantly Muslim), national languages (mainly Arabic), form of governance, and affiliation to regional organizations such as the Arab League (Rorissa, Potnis & Demissie, 2010). As such, researchers mostly associate North African countries with MENA when completing regional studies, as their contextual challenges significantly differ from those of SSA (Altschiller, 2014; Haynes, 2010; OECD, 2010; Rorissa *et al.*, 2010; Shehadi & Khoury, 2009). Moreover, the fact that most e-government websites in North African countries are implemented in Arabic, proved to be a key accessibility barrier and accounted for their exclusion from this study.

On the other hand, SSA countries share similar characteristics and have been broadly grouped and studied in terms of e-government initiatives (Mutula, 2008; Ngulube, 2007; Nyirenda & Cropf, 2010; Schuppan, 2009). According to Ifinedo (2006), most e-government literature has focused on e-government systems in the developed world with little attention directed towards the effectiveness of e-government systems in SSA. While e-government initiatives might be growing in SSA at the moment, Burke (2012) argues that the low Human Development Index (HDI) of the region depicts low levels of aspects like education and literacy, which might negatively affect e-government diffusion. Also, the fact that a majority of citizens in this region live in poverty might affect the adoption of e-government solutions, as the cost of using such systems (e.g. internet cost) might make it difficult to ascertain if the services are essential or luxurious (Munyoka & Manzira, 2014). As such, it becomes important to uniquely study the different dynamics of e-government from an SSA perspective in order to advance e-government success in the region. However, it is also important to acknowledge the limitation that one-size fits all approaches might not always be optimal in SSA, as the region also has several distinct characteristics, especially between the Francophone and Anglophone SSA countries (Dabalen, Narayan, Saavedra-Chanduvi & Suarez, 2015; Tyler & Gopal, 2010).

In recent years, SSA has been one of the leading regions in economic growth, having growth rates that are above the world average (Findt *et al*., 2014). In order to maintain this economic growth, it is imperative for public institutions in the region to operate with optimal efficiency and this can be achieved through e-government initiatives (Elbahnasawy, 2014; Jun, Wang & Wang, 2014). Empirical evidence (Lau, 2007; Lianjie, Jongpil & Thorson, 2005; Stoiciu & Popa, 2012) suggests that e-government decreases the administrative burden for businesses and citizens in utilising government services, and this decrease is associated with higher economic growth. It is, therefore, not surprising that many countries around the globe are leveraging e-government to promote economic growth (Sorrentino & De Marco, 2013). As such, in-depth e-government research in SSA is necessary to bridge the existing knowledge gap of e-government in SSA compared to the rest of the world and also to contribute to the development of SSA's context-specific policies and solutions for augmenting the probability of e-government success in the region. This should enable the region to sustain its economic growth momentum.

While the advantages of e-government are abundant, it is also imperative to consider the negative aspects of e-government development when implementing e-government initiatives. One of the negative effects is the resounding evidence indicating that when not implemented properly, e-government can tend to negatively affect the political efficacy of citizens (Coleman, Morrison & Svennevig, 2008). As such, citizen's trust in governments diminishes and they participate less in political activities. Also, the implementation of e-government initiatives come at a huge opportunity cost for developing countries, as the financial resources tailored towards e-government can be used for other pertinent development opportunities (Bwalya & Mutula, 2014; Ha, 2013). Lastly, e-government implementation might further encourage e-exclusion and foster a digital divide whereby people who lack access to ICTs and the internet, in particular, might be more disadvantaged in receiving services from the government and participating in government processes (Bwalya & Mutula, 2014).

Over the years, many e-government initiatives in SSA have failed (Bwalya & Healy, 2010; Heeks, 2002; Nurdin, Stockdale & Scheepers, 2012; Schuppan, 2009). Peppa, Poutoka, and Metaxas (2012) estimated that only about 15% of e-government initiatives in developing countries (including SSA) succeed, while 50% partially fail and 35% fail totally. These failures could arise from several different perspectives given the multifaceted nature of e-government.

However, from an information system (IS) perspective, several researchers (AlFawwaz, 2012; Asiimwe & Lim, 2010; Bwalya & Healy, 2010; Kirui & Kemei, 2014; Ray, 2011) have argued that most of the failures in e-government initiatives are a consequence of poor usability. Usability broadly refers to the extent to which a product can be used to achieve user goals.

Even in the developed world were e-government is at an advanced stage, Zhao and Benyoucef (2014) contend that much needs to be done in terms of usability. Similarly, evidence (Venkatesh *et al.*, 2014) from the Obamacare e-government initiative (healthcare.gov) has shown that such advanced e-government systems in developed countries still suffer from many usability issues, such as navigation, content organisation, and page layout. According to Baker (2009), if e-government systems have poor usability, citizens will not adopt them due to poor satisfaction and thus the advancement of e-government will be thwarted. Consequnetly, even though e-government is a multi-dimensional phenomenon depending on many factors to succeed, usability of e-government platforms is one of the key factors influencing individual adoption of e-government (Ansari, Baqar, Hassa & Saeed, 2016; Asiimwe & Lim, 2010; Baker, 2009; Youngblood & Mackiewicz, 2012).

As previously indicated, since e-government paradigms from the developed world might not readily suit the developing world context (Schuppan, 2009), it is imperative to fully examine the state of e-government usability in SSA as a means of ensuring the general progress of e-government in the region. More so, as e-government initiatives and paradigms in the developed world still suffer from usability issues (Venkatesh, Hoehle & Aljafari, 2014), their direct adoption into the developing world context might do more harm as usability has been known to vary across different cultures (Ahmad, Shoaib & Prinetto, 2015; Clemmensen & Katre, 2012; Douglas, Goulding, Farris & Atkinson-Grosjean, 2011; Sonderegger & Sauer, 2013). Similarly, aspects like the literacy levels of the population and more specifically, ICT literacy, vary greatly between developed and developing countries. This can also account for differences in usability as the user needs will greatly vary (Burke, 2012; Kirui & Kemei, 2014).

Existing literature lacks consensus on the standardisation of usability variables, with different studies across different countries adopting varying usability variables (Baker, 2009). Quesenbery (2005) has also highlighted that several usability guidelines, such as the Web Accessibility

Initiatives, have been created based on the environmental context in the developed world without consideration of the technological environment in the developing world. As such, researchers (Asiimwe, 2010; Choudrie, Wisal & Ghinea, 2009; Kituyi & Anjoga, 2013; Kirui & Kemei, 2014) have argued that there is a need for studies that focus on examining usability issues in the context of developing countries and how such issues can be addressed. This is true for SSA because, despite the importance of usability in e-government, there is still little evidence on the state of usability in SSA (Kirui & Kemei, 2014). It is, therefore, important to start having a deeper understanding of the state of e-government usability in SSA as many governments in SSA are increasingly adopting e-government solutions.

As already mentioned, while developing world countries can benefit a lot from the already available e-government knowledge from the developed world, researchers have identified the need to isolate and study e-government aspects in the developing world context (Alfawwaz, 2012; Choudrie *et al.*, 2009; Kirui & Kemei, 2014). This should not only generate new and unique knowledge, but should also address specific aspects that need to be thoroughly examined in the developing world context to ensure successful e-government implementation (Nawafleh *et al.*, 2012).

Some of the factors that account for the need for separating developed and developing world e-government studies are highlighted in Table 1.1 below.

Table 1.1: Factors influencing e-government development

Factor	**Developed countries**	**Developing countries**
Infrastructure	Good current infrastructure and high internet access for employees and citizens exist.	Bad current infrastructure and low internet access for employees and citizens exist.
History and Culture	Government and economy developed early, economy growing at a constant rate, productivity increasing, high standard of living, long history of democracy.	Government usually not specifically defined; economy not increasing in productivity, economy not growing or increasing productivity; low standard of

		living, short history of democracy.
Technical Staff	Has a current staff, needs to increase technical abilities and to hire younger professionals. Current staff would be able to define requirements for development.	Does not have a staff, or has very limited in-house staff, current staff may be unable to define specific requirements.
Citizens	High Internet access and computer literacy; still has digital divide and privacy issues, more actively participate in the governmental policy- making process.	Low internet access and citizens are reluctant to trust online services; few citizens know how to operate computers, less active participation in the governmental policymaking process.
Government Officers	Decent computer literacy and dedication of resources; many do not place e-government at a high priority.	Low computer literacy and dedication of resources; many do not place e-government at a high priority due to lack of knowledge on the issue.

Source: (Nawafleh *et al.,* 2012, p. 10)

1.2. Background of the Study

This section presents an overview of e-government and a discussion on what e-government usability entails.

1.2.1. Overview of e-government

Prior public administration paradigms focused on three key models of public service delivery, namely: face-to-face, telephone, and postal mail service (Brown, 2003). Following the advancements in technology over the past two decades, a fourth mode of public service delivery, known as e-government, was created (Baker, 2009). E-government has gained substantial popularity over the last two decades, such that almost all countries around the globe have adopted it (Hui *et al.*, 2014; Nawafleh *et al.*, 2012). This has increased the need for developing e-government capabilities in order to ensure the successful diffusion of e-government solutions.

E-government diffusion refers to the development and adoption of e-government solutions (Zhao, Shen & Collier, 2014). An understanding of the issues surrounding e-government diffusion is imperative for the success of e-government initiatives (Hui *et al.*, 2014). E-government is a multifaceted discipline that lies between the IS and public administration disciplines (Bannister & Connolly, 2015). As such, factors accounting for its diffusion have been examined using existing theories from both disciplines. The dominant areas of research on e-government diffusion have focused on e-government technological aspects (e.g. usability of e-government online systems and technology acceptance models), socio-economic factors, government policies/strategies, and infrastructure and resources (Aldrich, Bertot & McClure, 2002; Kaker, 2009; Barzilai-Nahon, 2006; Carter & Bélanger, 2005; Doong, Wang & Foxall, 2010; Kirui & Kemei, 2014; Seng, Jackson & Philip, 2010; Zhao *et al*., 2014). All the above domains of e-government dimensions are valuable in advancing the diffusion of e-government across the globe. However, for the purpose of this study, only the technological aspects of e-government with a specific focus on e-government usability will be examined. This is because usability stands at the centre of most technological aspects of e-government, as can be seen in the technology acceptance models where usability attributes, like perceived ease of use and perceived usefulness, are core dimensions (Bwalya, 2011, Lin, Fofanah & Liang, 2011). Additionally, this usability will be restricted to e-government websites as they have been widely acknowledged as the fundamental platform for interaction between governments and citizens (Hui et al., 2014; Karkin & Janssen, 2014; Nawafleh et al., 2012).

1.2.2. E-government usability

Usability has been widely defined in the field of human-computer interaction (HCI) following the ISO 9241-11 standards in which usability refers to “the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use” (ISO/IEC, 1998). This definition covers a wide range of products and has been customised in some instances to suit a specific context. In accordance with the ISO definition, Venkatesh *et al*. (2014, p. 670) define e-government usability as "the extent to which a website can be used by citizens to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified e-government service context."

Usability has been known to play a central role in the success of any e-government initiative (Youngblood & Mackiewicz, 2012). It is for this reason that e-government usability has been a key research area over the past decade (AlFawwaz, 2012; Asiimwe & Lim, 2010; Baker, 2009; Clemmensen & Katre, 2012; De Róiste, 2013; Donker-Kuijer, Jong & Lentz, 2010; Kirui & Kemei, 2014; Venkatesh *et al.*, 2014; Youngblood & Mackiewicz, 2012; Zhao & Benyoucef, 2014).

Researchers have also focused on the user experience (UX) of e-government systems (Okunola & Rowley, 2013; Pretorius & Calitz, 2014; Youngblood & Youngblood, 2013). According to the ISO 9241-210:2010 standard, UX refers to a "person's perceptions and responses resulting from the use and/or anticipated use of a product, system or service" (ISO/IEC, 2010). UX has also been seen to be an extension of the satisfaction component of usability (Bevan, 2009). Such a view is further supported by note 3 to the ISO 9241-210:2010 standard which emphasises an overlap between usability and UX by elucidating that usability criteria can be used to evaluate aspects of UX (ISO/IEC, 2010). This view has also been applied in e-government research when Youngblood and Youngblood (2013) evaluated UX based on usability criteria.

In differentiating between usability and UX, Tullis and Albert (2013) highlighted that usability is primarily focused on the ability of a user to successfully carry out a task using the device being evaluated, while UX takes a broader view as it tries to capture the entire interaction of the user with the device, including aspects like thoughts, feelings and perceptions. However, a comparison between their reference to usability in their first edition (Tullis & Albert, 2013) and UX in the second edition (Tullis & Albert, 2013) clearly indicates that the authors use usability and UX interchangeable.

Even though many authors in prior literature have used usability and UX interchangeable, this study acknowledges the broader scope of UX and views usability as a subset of UX (Rosenzweig, 2015), given that some aspects of UX are the same as aspects of usability, as highlighted in the ISO 9241-210:2010 standard. Nonetheless, the focus of this study will be solely on usability in order to ensure consolidation with prior literature on e-government usability, given that usability has been identified as a unique factor with numerous implications for e-government progress (Asiimwe & Lim, 2010; Baker, 2009; Kirui & Kemei, 2014; Venkatesh *et al.,* 2014; Youngblood & Mackiewicz, 2012; Zhao & Benyoucef, 2014). Additionally, the evaluation criteria required to provide a detailed assessment of the UX of SSA e-government websites go beyond the scope of this study. As such, the UX related to this study will only be seen from the lenses of usability, given the acknowledged overlap. Moreover, usability has been widely noted in the e-government sphere to be a major contributor to the UX (Downey & Rosales, 2012). As such, even though this study focuses on usability, it will, henceforth, also use the term UX were applicable to denote aspects of UX that are dependent on usability.

1.3. Problem Statement

The exceptional benefits of e-government cannot be over emphasised as it enables the effective and efficient administration of state institutions for enhanced public service delivery. Ensuring the successful diffusion of e-government systems is the key goal of every e-government initiative, and one key factor that has been imperative to such success is the usability of the e-government systems (Youngblood & Mackiewicz, 2012). This has prompted several industries and academic experts to emphasise the need for developers of e-government systems to continuously monitor and improve the usability of these systems as a means of ensuring successful diffusion (Baker, 2009; Bwalya & Healy, 2010; De Roiste, 2013; Scott, 2005; Zhao & Benyoucef, 2014). Also, it is important for e-government services to be accessible by the elderly and people with disabilities, and this can only be achieved through improved usability (Bevan, Petrie & Claridge, 2007). Furthermore, Zhao & Benyoucef (2014) note that even though e-government has seen enormous growth, it will only attain its full potential if existing and emerging usability barriers are identified and addressed. It is, therefore, evident that maintaining high usability standards for e-government systems are the ideal situation for any nation adopting e-government.

Due to the above-mentioned importance of usability in e-government success, many studies have focused on examining methods of evaluating and enhancing e-government usability. Nonetheless, Zhao & Benyoucef (2014) explicate that even though e-government usability studies have brought about useful insights, current e-government systems are still besieged by several usability problems. Examples common to both the developed and developing world include: content that is difficult to understand, erratic formats, poor navigation capabilities, help functions that are difficult to use, broken links, poor reliability, inconsistent colours, disorientation, and poor presentation of information (Huang, Brooks & Chen, 2009; Pretorius, 2012; Youngblood & Mackiewicz, 2012; Zhao & Benyoucef, 2014). These usability issues have been described as constituting some of the main reasons for poor diffusion and underutilisation of e-government systems (Van Dijk, Pieterson, Van Deursen & Ebbers., 2007). As a consequence, many e-government initiatives are failing due to poor usability (AlFawwaz, 2012; Asiimwe & Lim, 2010; Bwalya & Healy, 2010; Kirui & Kemei, 2014; Ray, 2011).

While e-government initiatives in both the developed and developing world continue to record poor usability, the case is worst for developing world countries due to the high failure rates (as already indicated). This thesis is particularly interested in the case of SSA where e-government development is still very low, as recorded by the United Nations (UN) E-Government Development Index (United Nations Department of Economic and Social Affairs, UNDESA, 2014), yet is already plagued by huge usability problems, as evident from existing studies (Asiimwe & Lim, 2010; Bwalya & Healy, 2010; Kaaya, 2004; Kirui & Kemei, 2014; Korsten & Bothma, 2005; Pretorius & Calitz, 2014; Samuel, 2014). For example, in South Africa (SA), researchers (Korsten & Bothma, 2005; Pretorius & Calitz, 2014) have noted that the e-government websites they evaluated were characterised by poor usability. Similarly, Samuel (2014) established that users of e-government systems in Ghana were willing to increase the usage of such systems only when usability has been enhanced. Kaaya (2004) examined 98 e-government websites in Uganda, Kenya, and Tanzania and established that usability was still low, as most of the e-government websites were still in the early stages of development with the developers undergoing learning experience. Six years later, Asiimwe and Lim (2010) examined the usability of four e-government websites in Uganda and established that several aspects of the systems had poor usability, while some were partially usable. Additionally, non-empirical studies

(Bwalya & Healy, 2010; Kirui & Kemei, 2014) have highlighted the poor usability of e-government websites in Africa based on existing e-government website reviews.

Given that e-government development in SSA is still low (UNDESA, 2014), and that poor usability thwarts the development and diffusion of e-government (AlFawwaz, 2012; Harfoushi, AlFawwaz, Obiedat, Faris & Al-Sayyed, 2012; Kirui & Kemei, 2014; Ray, 2011), it becomes imperative to place more emphasis on advancing e-government usability in the region, as the current level of e-government usability has been labelled as unsatisfactory (Asiimwe & Lim, 2010; Bwalya & Healy, 2010; Kaaya, 2004; Kirui & Kemei, 2014; Korsten & Bothma, 2005; Pretorius & Calitz, 2014; Samuel, 2014). Additionally, Kirui and Kemei (2014) have argued that while e-government usability remained an important aspect of e-government development, research in the domain, especially in developing economies like SSA, has been very limited. This becomes a key concern as it is difficult to develop policies and guidelines for advancing e-government usability in SSA without a detailed understanding of the current state of e-government usability in the region. Except for Kayaa (2004), other studies have focused on examining the usability of only one to about six e-government websites. This, however, cannot be representative of the state of e-government usability in SSA, as some countries alone (e.g. Kenya) have over 100 e-government websites. As mentioned before, Kayaa (2004) examined the usability of 98 government websites in three Africa countries. However, the study took place at a time when e-government development in the selected countries was still in its infancy stage, with many key e-government services still lacking. This, therefore, limited the level of usability analysis that could be performed. Over ten years down the line, a lot has changed in the e-government landscape of these countries as Kenya, for instance, only established their formal e-government program in June 2004 (Reddick, 2010) after Kayaa's (2004) study had been completed. The small number of evaluated e-government websites in SSA to date is concerning, as evidence from the developed world clearly shows the need to evaluate a large set of e-government websites to have a detailed picture of the usability posture of these websites in a country or region (Garcia, Maciel & Pinto, 2005; Isa, Suhami, Safie & Semsudin, 2011). Also, the usability of local and national e-government websites might vary significantly (Youngblood & Mackiewicz, 2012), thus necessitating different solutions for advancing national and local e-government websites.

Moreover, the accessibility of e-government websites via mobile devices has become increasingly important and needs to be addressed in the context of e-government website usability (UNDESA, 2014). This domain of e-government website usability has been understudied in SSA, which is worrisome, as many people in SSA access the internet via mobile devices (Keengwe, 2015; Katz, 2011). It is, therefore, important to evaluate the mobile responsiveness of e-government websites in SSA, as this has been known to enhance user satisfaction (a dimension of usability) which some researchers argue to be a crucial factor in the success or failure of e-government services (Keoduangsine & Goodwin, 2009).

User satisfaction in e-government systems is also very important, because it improves the general levels of user trust in e-government (Morgeson, Van Amburg & Mithas, 2011; Rahim & Alharbi, 2014).

Additionally, prior research (Ifinedo, 2012; Perry & Christensen, 2015) has suggested that national indicators influence e-government success and failure. This follows from prior research that had widely associated national income with both e-government development (Hafeez & Sher, 2006; Perry & Christensen, 2015; UNDESA, 2014 & 2016) and the usability and quality of e-government websites (Gaulė and Žilinskas, 2013; Youngblood & Mackiewicz, 2012; Youngblood & Youngblood, 2013). As such, there have been calls for an examination of other national indicators that could have a pertinent effect on e-government success (UNDESA, 2016). Consequently, one way of fostering e-government development and the usability of e-government websites in SSA is by understanding the different national indicators that are significantly associated with both e-government development and the usability of e-government websites. These factors can aid in providing a detailed picture of factors associated with e-government usability in SSA, in order to promote the development of policies and strategies for enhancing e-government usability in the region. In summary, usability has been widey noted to play an instrumental role in fostering e-government success. However, the current usability state of e-government systems in SSA (including e-government websites) is poor, thus necessitating solutions for improving the usability of these systems.

1.4. Research Questions

Research questions usually originate from the identified research problem. According to Wood and Ross-Kerr (2011, p. 2), a research question is "an explicit query about a problem or issue that can be challenged, examined, and analysed, and that will yield useful new information". Having a clear and concise researchable question is the most important factor in shaping a researcher's choice of research design, data collection, and analysis (Brink *et al.*, 2006).

Based on the problem identified, the following main and secondary research questions were formulated to guide this study:

Main Research Question

- How can the current state of e-government website usability in SSA inform the development of a model for improving the usability of these sites?

Secondary Research Questions

- What is the state of e-government diffusion in SSA?
- How is the e-government diffusion rate in SSA comparable to the rest of the world?
- What is the current usability state of e-government websites in SSA?
- What role does usability play in the diffusion of e-government in SSA?
- How important is the usability of e-government websites in SSA?
- How are national indicators associated with e-government development and the usability of e-government websites?
- Are there any noticeable differences in the usability of national and local e-government websites in SSA?
- Which usability models or frameworks are applicable to heuristic evaluation of e-government websites?

1.5. Research Objectives

Research objectives usually stipulate the specific aims of the research (Hanson, 2006). It is always important to clearly state research objectives, as they are active statements depicting how the study will answer the established research questions (Brink *et al.*, 2006; Farrugia, Petrisor, Farrokhyar & Bhand, 2010).

Primary Research Objective

In this study, the primary objective is to develop and test a model for improving the usability of e-government websites in SSA.

Secondary Research Objectives

This primary objective was supported by the following secondary objectives:

- To review the literature on e-government diffusion in SSA.
- To compare the rate of e-government diffusion in SSA with the rest of the world.
- To review the literature on usability with a particular interest in e-government website usability.
- To review the literature on the association of national indicators with e-government development and the usability of e-government websites.
- To conduct a large-scale evaluation of the state of e-government websites usability in SSA.
- To identify dominant usability issues plaguing e-government websites in SSA, and provide detailed guidelines for addressing them within the context of a proposed model.
- To evaluate the role of usability in the diffusion of e-government solutions.
- To examine the differences in the usability of national and local/provincial government websites.
- To identify national indicators with significant associations to e-government development and the usability of e-government websites.

1.6. Research Design and Methodology

1.6.1. Research design

A research design depicts the overall plan of how a researcher intends to address and answer the research questions (Saunders, Lewis, and Thornhill, 2009). This study adopted a combination of the design science research (DSR) and mixed methods evaluations. Dresch, Pacheco, and Antunes (2015, p. 67) defined DSR as “a method that establishes and operationalizes research when the desired goal is an artefact or a recommendation.” As such, a key factor that determines the selection of the DSR is the proposed goal of the study that should be established in a tangible form, either as an artefact or a recommendation. Some of the common DSR artefacts include constructs, design principles, design theories, instantiations, models, methods and technological rules (Gregor & Hevner, 2013). Given the increasing recommendations for institutionalising the usability of e-government systems (Pretorius, 2012; Pretorius & Calitz, 2014), many researchers have argued for a need to develop models for improving the usability of e-government systems (Alfawwaz, 2012; Kirui, Baguma & Kemei, 2016). This is, however, not surprising as the use of models by governments when advancing e-government initiatives is well grounded, as many governments over the years have evaluated their e-government efforts in line with e-government maturity models (Fath-Allah, Cheikhi, Al-Qutaish & Idri, 2014). As such, a model for improving the usability of e-government systems will blend well with the existing efforts by governments to improve e-government systems. According to the arguments outlined by Goldkuhl (2016), models for improving e-government systems and initiatives can be better presented as policy-ingrained artefacts articulated from DRS.

Following from the above argument, the outcome of the research project will culminate in the development of a policy-ingrained model for advancing e-government website usability in SSA. A model is generally defined as “a set of propositions or statements expressing relationships among constructs, and often used to represent phenomena in terms of problem and solution statements” (Vaishnavi & Kuechler, 2015, p. 21). A model is quite similar to a framework which denotes real or conceptual guides of numerous descriptive factors such as concepts and constructs, as well as the associations between them that supposedly accounts for a given phenomenon (Nilsen, 2015; Sabatier, 2007). However, the two differ in intent, as frameworks do not offer explanations and only discuss the empirical phenomena while models in DSR focus on the utility of the artefact by concentrating on what it does (Vaishnavi & Kuechler, 2015; Nilsen, 2015). As such, the intent of a model makes it more suitable for the context of this study, which has as goal to offer utility with respect to improving the current usability state of e-government websites in SSA. Consequently, the DSR design is suitable for this study. However, DSR alone cannot be sufficient given the rigorous evaluations that are necessary for determining the state of e-government usability in SSA. Where such evaluations are necessary, Agerfalk (2013) has suggested the incorporation of mixed methods into the design science to provide substantial evidence for developing and evaluating the artefacts.

A mixed methods research combines qualitative and quantitative research methods in the same research study (Tashakkori & Teddlie 2003; Venkatesh, Brown & Bala, 2013). This research approach was selected because simply using either a quantitative or qualitative methodology will be insufficient to unearth rich insights into the phenomenon under investigation (e-government usability in SSA). Within mixed methods, the triangulation research method was used. When using this method, the research problem is examined through the concurrent combination of quantitative and qualitative methods (Creswell, 2014; Venkatesh *et al.,* 2013). This is one of the most widely used methods in mixed research studies in IS research because of its effectiveness in addressing IS research questions (Aramo-Immonen, 2013; Recker, 2013). The point at which findings from the qualitative analysis converge with the findings from the quantitative analysis is often considered to represent reality (Yeasmin & Rahman, 2012).

1.6.2. Methodology

As indicated above, this study adopted a DSR approach. Consequently, the DSR methodology was also espoused. Rajasekar, Philominathan and Chinnathambi (2013) highlighted that a research methodology outlines the different procedures and processes that a researcher adopts and uses to describe, explain, and predict the phenomena under investigation.

In order to attain the ultimate goal of a DSR project (i.e. the development of an artefact), a researcher needs to follow a set of steps to ensure the rigour of the research study (Peffers, Tuunanen, Rothenberger & Chatterjee, 2008; Vaishnavi and Kuechler, 2013). Figure 1.1 summarises the key steps in a DSR methodology.

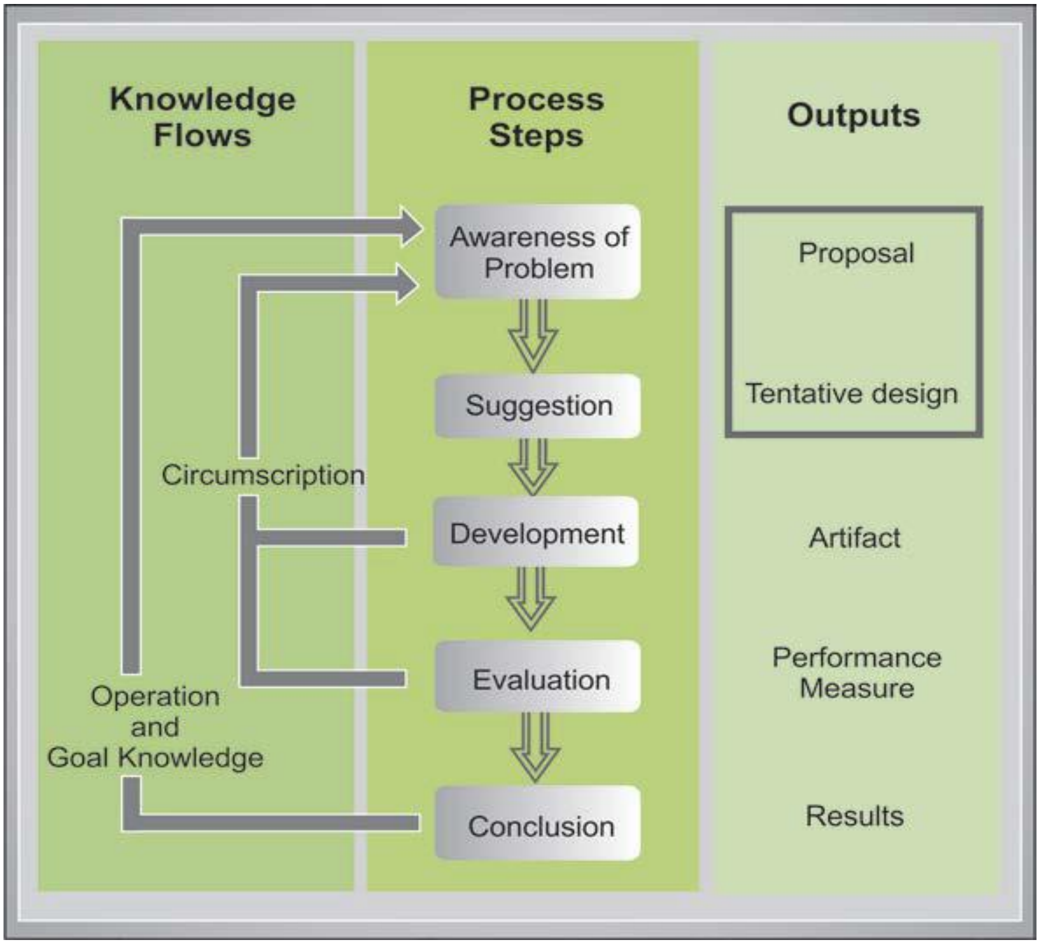


Figure 1.1: High-level view of DSR methodology (Source: Kuechler & Vaishnavi, 2008:489)

The first step of a DSR project is always to create an awareness of the research problem (Hevner, 2014). Section 1.3 above was dedicated to this task of the DSR process. Afterwards, a suggestion of a possible solution needs to be provided. This is often achieved after a detailed review of the existing knowledge base. This is achieved in Chapter 3 and 4 of this study. Afterwards, the development and evaluation of the proposed artefact are conducted (Chapters 5 to 8). Development and evaluation are often iterative processes which need to be sufficiently conducted before the artefact is ready for use. At this stage, the researcher can conclude the study (Chapter 9). A detailed step-by-step DSR methodology was proposed by Peffers *et al*. (2008) and is adopted for use in this study. This methodology is discussed in more detail in Chapter 4 (section 4.4).

1.6.3. Methods and evaluation techniques

A significant part of the analysis in this study will focus primarily on usability evaluation. Usability evaluation methods can be grouped into three categories namely: expert-based methods, automated testing methods, and user-based methods (Jaspers, 2009; Lazar, Feng & Hochheiser, 2010; Tan, Liu, and Bishu, 2009). Expert-based methods comprise of usability experts or novice users following a number of structured guidelines for determining interface flaws (Lazar *et al.*, 2010). Examples include heuristic evaluation, cognitive walkthrough, usability inspection, guideline review, and consistency inspection. Automated testing methods are software based methods that apply a set of predefined guidelines (developed by experts) to an interface and determine where the interface does not comply with the stated guidelines (Lazar *et al.*, 2010). Examples include tools like Functional Accessibility Evaluator, TAW, Responsinator, and Web Accessibility Inspector. User-based testing involves using a representative set of users to perform a representative set of tasks on a system or prototype (Tan *et al.*, 2009). Examples include laboratory testing, cognitive workload assessment, keystroke and log file analysis, user performance measurements, usability surveys, interviews, usability questionnaires, and participatory evaluation. While these are the popular classification of usability methods, it is imperative to note that these methods are sometimes structured differently by different authors (Fernandez, Insfran & Abrahao, 2011).

This study mainly adopted heuristic evaluation and automated usability methods, with heuristic evaluation being the dominant usability evaluation method. Both the heuristic evaluation and automated testing were conducted concurrently and the results triangulated to form an overall usability score. This process is described in detail in Chapter 4 (Section 4.6.3).

Heuristic evaluation has been widely used in e-government usability studies for in-depth usability inspections, because the method has proved to be very effective, easy and quick, especially when evaluating numerous websites (Baker, 2009; Elling, Lentz, Jong & Bergh, 2012; Garcia *et al.*, 2005; Youngblood & Mackiewicz, 2012; Zhao & Benyoucef, 2014). For example, a study by Tan *et al.* (2009) used both heuristic evaluations and user-testing to examine usability problems and observed that heuristic evaluation identified 82% of the usability issues, while user testing only identified 18%. Similarly, after evaluating an e-government website in Malaysia in which 525 usability defects were identified, Sivaji, Addullah, and Downe (2011) noted that 70% of the usability issues were identified through heuristic evaluations, while user testing only accounted for 30%.

With heuristic evaluation, usability problems are always examined and identified based on predefined usability guidelines or heuristics. Several e-government heuristics (Baker, 2009; Botella, Alarcon & Penalver, 2013; Donker-Kuijer *et al.*, 2010) have been developed and were adapted and used in this study. Even though heuristic evaluation is an expert-based method, existing evidence (Botella, *et al.*, 2013; Garcia *et al.*, 2005; Khajouei, Ahmadian & Jaspers, 2011; Zhao & Benyoucef, 2014) indicates that the method can be effectively used by both experts and novices to identify usability problems. Additionally, Fogg (2003) explicates that heuristic evaluations can be performed by a single inspector, although the effectiveness habitually increases with more inspectors. This study, however, used five inspectors in line with recommendations from the general usability literature (Tan *et al.*, 2009).

In addition to usability evaluations, a detailed evaluation of the constructed artefact was also conducted. Artefact evaluation plays an important role in DSR as it helps to rigorously prove the case for the artefact's relevance in practice (Hevner *et al*., 2004; Sonnenberg &, Brocke, 2012). This study adopted the general DSR evaluation pattern by Sonnenberg and Brocke (2012) and evaluated the constructed artefact against a wide set of evaluation criteria, using four evaluation cycles. These evaluation processes are covered in detail in Chapter 6 and Chapter 8.

1.7. Ethical Approval

Conducting research in an ethical manner is always a key priority in order to ensure that potential risks are significantly minimised while striving to attain the research benefits (Sargeant & Harcourt, 2012; Taylor & Francis, 2013).This study was guided by the research ethics code of the University of the Free State. This research received ethical clearance from the Ethical Committee of the Faculty of Natural and Agricultural Sciences at the University of the Free State. The ethical clearance approval letter is presented in Appendix B. The ethical clearance guided the usability evaluations and the entire DSR process followed in creating the proposed model in this study.

1.8. Limitations of the Study

The main limitations of the study were twofold. Firstly, the sample size has its limitations, especially with respect to the generalisation of the findings as only 9 websites were selected from each of the 31 SSA countries. Additionally, some countries in SSA (Angola, Cape Verde, Eritrea, Mauritania, Mozambique, Sao Tome and Principe, Somalia and Sudan) were not included due to language barrier (i.e. having websites that were not in English or French). Nonetheless, the total of 279 websites from 31 SSA countries evaluated in this study were considered sufficient for the scope of the study given the resource and time constraints of evaluations as highlighted by Lanzilotti, Ardito, Costabile and De Angeli (2011).

Secondly, the study used only heuristic evaluations and automated testing methods. As such, there are possible limitations on the identified usability issues as some usability issues can only be identified via user-based methods which were not included in the study. Nonetheless, since user-based methods are time-consuming; most e-government studies that adopt the methods focus only on the evaluation of 1 to 5 e-government websites (Albayrak & Çağiltay, 2013; Alfawwaz, 2012; Darem & Suresha, 2012; Venkatesh *et al.*, 2014). As such, the elimination of user-based methods in this study was justifiable, given the sample size of websites evaluated. Moreover, heuristic evaluation has been known to be effective, and to identify over 70% of usability issues in several studies (Sivaji *et al.*, 2011; Tan *et al.*, 2009).

1.9. Contributions of the Study

Over the past decade, the importance of e-government has been widely acknowledged in academic, public, and industry milieus (Buffat, 2015; De Roiste, 2013; Elbahnasawy, 2014; UNDESA, 2014). Because of the numerous benefits of e-government, governments have been encouraged to continuously increase e-government capabilities and find ways to enhance the success of e-government initiatives. Although significant efforts have been made across the globe to enhance e-government success, evidence suggests that most e-government systems are still failing, and these failures have been associated to poor usability (AlFawwaz, 2012; Asiimwe & Lim, 2010; Bwalya & Healy, 2010; Kirui & Kemei, 2014; Ray, 2011).

While e-government usability plays a vital role in the success of e-government initiatives, there's still very limited knowledge on the usability of e-government websites in SSA (Kirui & Kemei, 2014). This is a critical concern as researchers (Asiimwe, 2010; Choudrie, *et al.,* 2009; Kituyi & Anjoga, 2013; Kirui & Kemei, 2014) have pointed out the need for specific developing world-based studies on examining e-government usability as their challenges differ from those highlighted in existing literature from the developed world.

This study, therefore, aims to make a valuable contribution to the body of knowledge on e-government usability in SSA by providing a comprehensive and empirical analysis of the state of e-government usability in the region. Moreover, a proposed model for improving e-government usability in SSA that focuses on key e-government usability dimensions relevant to the region has been developed and evaluated. The model proposes several general and specific strategies for use in addressing e-government website usability issues in SSA and augmenting the general usability posture of the region's e-government websites.

1.10. Chapter Outline

This thesis comprises nine chapters. Chapter 1 provides a detailed background of the study with a brief overview of e-government and e-government usability in SSA. The chapter further presents the research problem, research questions, research objectives, and an overview of the research design and methodology. Finally, the ethical considerations, limitations and a discussion on contributions of the study, are included.

A review of the existing knowledge is provided in Chapters 2 and 3. E-Government is defined in Chapter 2, along with a detailed evaluation of the state of e-government development in SSA. Additionally, a review of e-government adoption models is presented to depict an underlying view of the factors fostering the adoption and use of e-government solutions. A summary of existing e-government maturity models is preented with the aim of linking the chapter to shifting views towards public values of e-government.

Chapter 3 focuses on reviewing the literature on the usability of e-government websites. The six-dimensional usability framework (i.e. online services, user-help & feedback, navigation, accessibility accommodation, information architecture and legitimacy) is presented as the core theoretical framework for evaluating the usability of e-government websites in SSA. Moreover, a discussion on the overlap between public values and the usability of e-government websites is discussed. Lastly, a presentation and postulation of the possible association of national indicators with e-government development and the usability of e-government websites are presented.

Chapter 4 centres on the research design and methodology used in this study. The research pyramid serves as the guiding framework for the chapter. The DSR paradigm was selected as the paradigm of choice. As such, the DSR methodology is followed. A combination of usability evaluation methods and mixed methods are used in the study. Furthermore, the set of research techniques (i.e. heuristic evaluation tools, automated testing tools, and data sources for national indicators) used are discussed. The chapter culminates with a discussion of the selection process of e-government websites for evaluation.

Chapter 5 discusses the initial version of the constructed model. The model illustrates the integral role of usability in e-government development. Also, the testable propositions regarding national indicators are presented. Additionally, the four mental models necessary for advancing the usability of e-government websites in SSA are discussed.

Chapter 6 presents a detailed evaluation of the usability of e-government websites in SSA, as well as testable propositions on the association of national indicators with e-government development and the usability of e-government websites. This serves as an initial evaluation of the constructed model and provides feedback for further construction of the model.

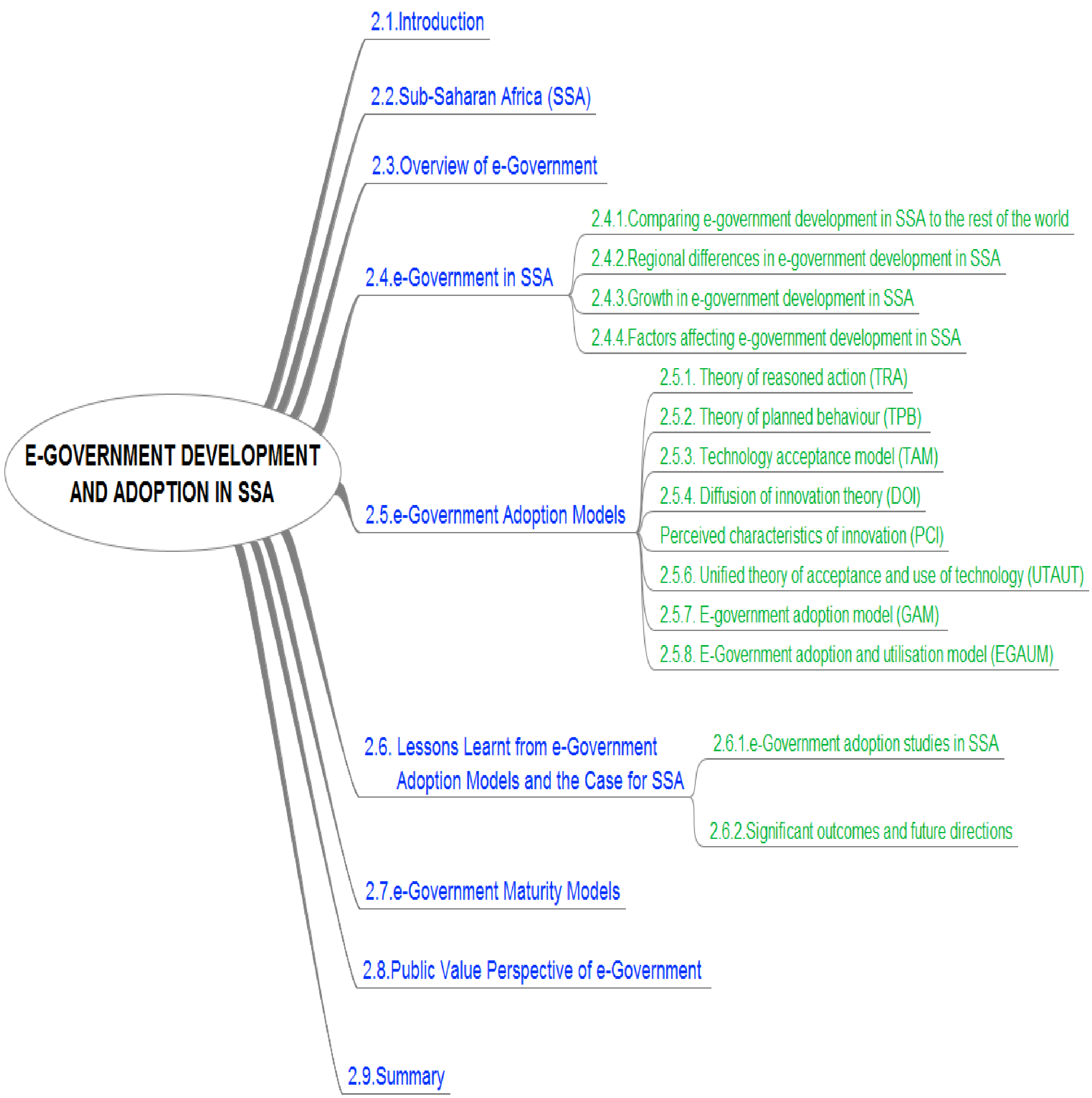
Chapter 7 explicates the refined model, taking into account the evaluations in Chapter 6. In the refined model, detailed guidelines on how to improve the usability of e-government websites in SSA are provided. The guidelines are classified into both specific and general guidelines for each of the mental models. Moreover, considerations for creating a favourable environment for improving e-government development and usability of e-government websites, based on national indicators, are presented.

Chapter 8 describes the complete evaluation of the model. The general DSR evaluation pattern was adopted for evaluating the model. Detailed descriptions of both the ex-ante and ex-post evaluations are presented. The detailed evaluation of the model will validate the rigour of the research process.

Chapter 9 outlines the conclusions to the study. This includes a brief recap of the study, a discussion on how the objectives were attained, a detailed discussion of the contributions of the study, its limitations, and recommendations for future studies.

CHAPTER TWO

E-GOVERNMENT DEVELOPMENT AND ADOPTION IN SSA



2.1. Introduction

This chapter commences with a brief overview of SSA and what e-government entails. It further reviews extant literature on e-government development in SSA and situates the level of e-government development in this region in comparison to other regions. It also introduces the reader to some of the factors accounting for disparities in e-government development. Moreover, existing notable e-government adoption models are discussed in a bid to determine the factors that influence e-government adoption. This is followed by a detailed discussion of the lessons learnt from e-government adoption and development and a review of the factors affecting e-government adoption and development in the context of SSA. Additionally, a succinct discussion on e-government maturity models is presented. The chapter culminates with a presentation of the public value perspective of e-government.

2.2. Sub-Saharan Africa (SSA)

SSA is the geographical area on the African continent that lies south of the Sahara desert and consist of 49 countries. These 49 countries include all African countries that are located either partially or fully to the south of the Saharan desert (Figure 2.1). In other words, SSA can be seen as the set of all African countries, excluding the five North African Arab nations (i.e. Algeria, Egypt, Libya, Morocco, and Tunisia). As previously indicated (Section 1.1), North African countries share a lot of similarities with the Arab world and, thus, are most often classified under MENA (Rorissa, *et al.*, 2010). SSA is historically known as “Black Africa”, a name devised as a means to delineate it from the northern parts of Africa primarily occupied by Arabs (Tyler & Gopal, 2010). World Bank (2016) data estimates the population of SSA at the end of 2015 to be over 1.001 billion people. The most populated country in SSA is Nigeria, with an estimated population of 183 million, while the least populated is Seychelles, with an estimated population of 93 thousand (World Bank, 2016).

From Figure 2.1, the regions coloured in dark green depict the different SSA countries, while the area coloured in gray depict North Africa (a region mostly covered by the Saharan desert). The light green area is Sudan which is often considerd as part of North Africa in UN statistics and part of SSA in World Bank ststistics. The economy of SSA is predominantly focused on four categories namely, oil and mining, agriculture, under-developed manufacturing, and informal sector activities (Olatunji, 2015).

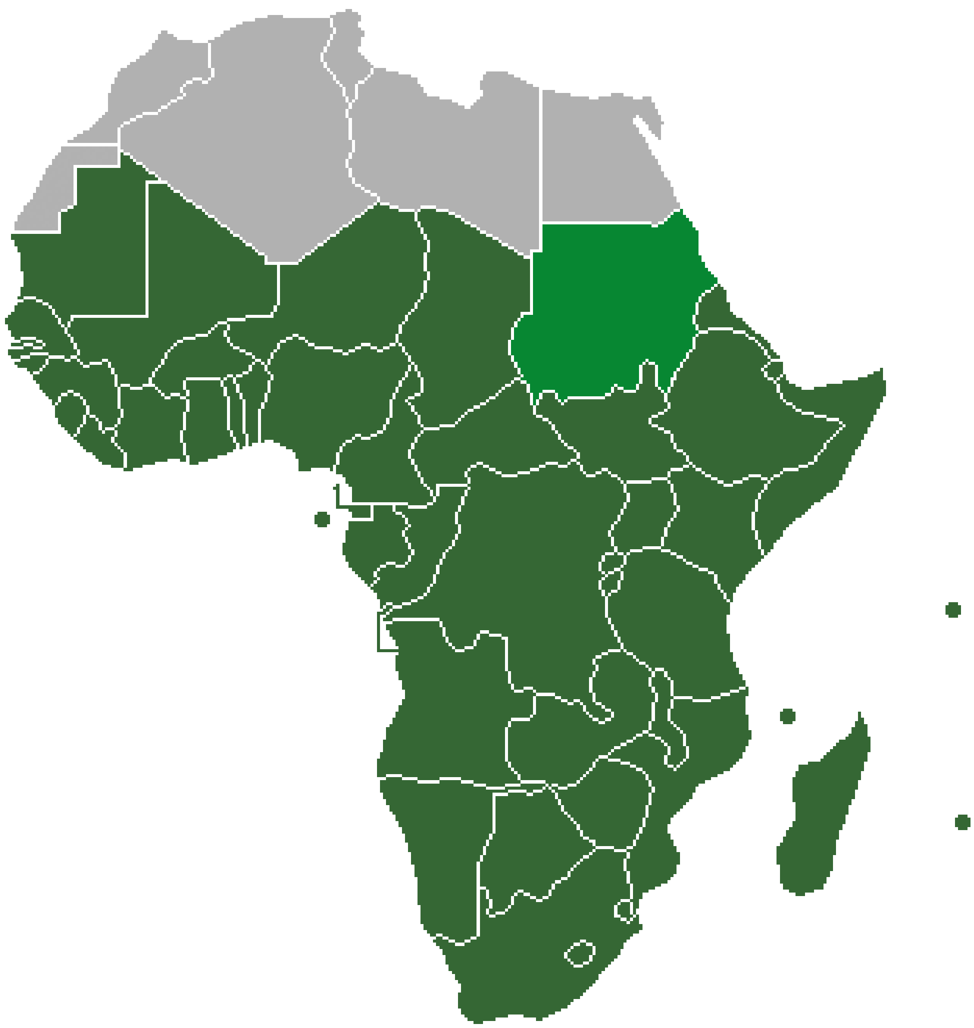


Figure 2.1: African Map Depicting SSA (Source: Segbefia, 2016)

The need for socio-economic development in SSA has been widely emphasised as the region lags behind the rest of the world (Olatunji, 2015; Tyler & Gopal, 2010; Witon, 2015). Even though countries in SSA differ from each other in several aspects, such as size and economic history (Jugurnath, Chuckun &Fauzel, 2015), they mostly share similar characteristics especially in their goals of fostering socio-economic development, investing in education, skills development, agriculture and infrastructure, and fostering job creation and poverty reduction (Manzombi, 2015). These common goals and similarities among SSA countries have made SSA a coherent region that is generally grouped and studied across different fields, including e-government development (Mutula, 2008; Ngulube, 2007; Nyirenda & Cropf, 2010; Schuppan, 2009)

2.3. Overview of E-Government

The term e-government was first introduced in the United States (US) in 1993 (Heeks & Bailur, 2007). Since then, e-government has increasingly become popular to the extent that almost every government around the globe has engaged in some form of e-government activity (Schuppan, 2009). E-Government can be broadly viewed as the incorporation of ICTs into government activities (Buffat, 2015; De Roiste, 2013; Mates, *et al.*, 2013). A more detailed definition of e-government describes it as the use of ICTs by governments to improve the variety and quality of information and services delivered to citizens, businesses, civil society organizations, and other government agencies in an efficient, cost-effective and convenient manner, making government processes more transparent and accountable, and strengthening democracy (Lavanya & Gayatri, 2015; Padmapriya, 2013).

A government is known to engage in e-government when it uses ICTs for delivery of services to citizens, businesses, and other governmental or non-governmental entities (Alzahrani, Al-Karaghouli & Weerakkody, 2016). These ICTs enable governments to transform their traditional operations by making them more effective and efficient in delivering services to various stakeholders (e.g. citizens and businesses). Prior literature suggests that ICTs play a transformational role in public administration in three key areas, namely internal, external and relational (Ndou, 2004). For a government to effectively attain its operational objectives, it must be able to have efficiency and effectiveness in their internal functions. Nowadays, many governments have sought to use ICTs as a means to improve this efficiency and effectiveness (Bwalya & Mutula, 2014; Eliassen & Sitter, 2007). On the external front, governments have an obligation to deliver services to external stakeholders, such as the general public and private sector. The delivery of these government services is often challenged by numerous inefficiencies which, to date, have been mostly addressed by the use of ICTs (Al-Zaabi, 2013; Alshehri & Drew, 2010). Lastly, government departments also play a relational role in integrating services from different government agencies in order to provide seamless service delivery to its stakeholders (Al-Zaabi, 2013; Baležentis & Paražinskaitė, 2012; Ndou, 2004). Such integrations have also been noted to be easily achieved through the use of ICTs.

Different terms have been used over the years to describe e-government. These include terms like digital government, eGov, electronic government, and online government (Alsaeed, Adams & Boakes, 2014; Alshehri & Drew, 2010; Janowski, 2015). E-government has been broadly classified into four main types, namely government-to-citizens (G2C), government-to-business (G2B), government-to-government (G2G), and government-to-employees (G2E). The classification of these different e-government types is primarily based on the stakeholders involved in a given e-government interaction. G2C e-government refers to the electronic delivery of government services to citizens (Bwalya & Mutula, 2014). Citizens are often one of the biggest targets of e-government services thus making G2C e-government the most common form of e-government. These services are mostly delivered via e-government websites (Beynon-Davies, 2013). This is not surprising as e-government websites are increasingly seen as an essential strategic tool that governments can use to facilitate communication with the general public and also the provision of public services (Pratchett, Wingfield & Polat, 2006).

G2B e-government denotes the electronic interactions between governments and the business sector, which can include electronic dissemination of business information, payment of business taxes, registration of businesses and obtaining business licenses and other business compliance transactions (Alshehri & Drew, 2010). G2G e-government encompasses electronic transactions between different government agencies and departments (Baležentis & Paražinskaitė, 2012; Bwalya & Mutula, 2014). These systems can include government intranets that facilitate interaction between different government departments, agencies, and ministries. Lastly, G2E e-government represents the electronic interactions between government and its employees (Baležentis & Paražinskaitė, 2012). G2E often aims at enhancing civil service management. One of the most common G2E e-government services encompasses online training for government employees, as well as the automation of internal government processes (Bwalya & Mutula, 2014).

2.4. E-Government in SSA

The growing importance of e-government in SSA can be seen in the increasing number of governments in SSA rolling out roadmaps for e-government implementation. Some of the SSA countries that have rolled out national agenda's for government include Botswana, Kenya, Mauritius, Mozambique, Namibia, Senegal, Seychelles, and SA. Even though some African countries have not rolled out complete e-government roadmaps, almost all countries have implemented at least one e-government website portal (Rorissa & Demissie, 2010; UNDESA, 2016). Existing classifications (Affisco & Soliman, 2006) of e-government development usually rank the state of e-government in four key categories, namely: (1) publishing (web presence), (2) interacting, (3) transacting, and (4) transforming (integration). While little evidence exists on the state of e–government in Africa, some studies (Dombeu, 2009; Ngulube, 2007; Rorissa & Demissie, 2010; Shuppan, 2009) have made great efforts in documenting the levels of e-government on the continent. A common finding from all these studies is the fact that most of the e-government websites in SSA were at the lower end of e-government development (web presence or interacting). However, in the world of technology, constant change is inevitable and there is a high possibility that e-government websites in SSA have significantly evolved since the last of these studies was done over five years ago.

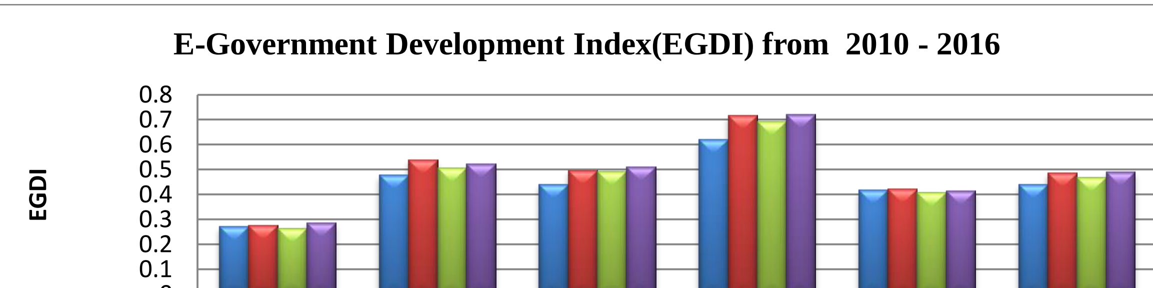
One of the most widely used measures of e-government diffusion is the E-Government Development Index (EGDI) which was composed by the UN through the UN E-Government Development Surveys (Whitmore, 2012; Zhao, Shen & Collier, 2014). The EGDI is composed of three dimensions, namely: Online Service Index (OSI), Telecommunication Infrastructure Index (TII), and the Human Capital Index (HCI). The normalised scores for each of these dimensions are computed and then combined, with each dimension making up one-third of the EGDI. The following equation is used to compute the EGDI:

$$EGDI = \frac{1}{3}(OSI_{normalised} + TII_{normalised} + HCI_{normalised})$$

The computation of the OSI is based on survey information collected from experts around the world who evaluate e-government websites for each of the participating countries. For the current EGDI (i.e. 2016 EGDI) a total of 111 researchers from 60 countries participated in the evaluation of 8 e-government websites from each UN member state country to capture the data for computation of the OSI (UNDESA, 2016). The computation of the TII is based on data supplied by the International Telecommunications Union (ITU) on ICT advancements in a country. This information is broken into five components, namely mobile-cellular subscriptions, fixed-telephone subscriptions, wireless broadband subscriptions, fixed (wired)-broadband subscriptions, and internet penetration rate (UNDESA, 2016). The computation of the HCI is based on data supplied by the UN Educational, Scientific and Cultural Organisation (UNESCO). The HCI is made up of four components, namely the gross enrolment ratio, expected years of schooling, adult literacy, and mean years of schooling (UNDESA, 2016). The EGDI has been generally commended for its easy and direct computation, which makes it easy to understand, use and reproduce (Whitmore, 2012; Zhao et al., 2014). Following from the wide recognition of the EGDI, it was, therefore, selected as the e-government development measure of choice for the purpose of this study.

2.4.1. E-government development in SSA vs. the rest of the world

Evidence from the UN E-Government Development Surveys indicates that Africa as a whole still remains at the bottom of e-government development in the world. Figure 2.2 below presents the average UN e-government development indices for different continents for the period from 2012 to 2016.



	Africa	Americas	Asia	Europe	Oceana	World
EGDI - 2010	0.2733	0.479	0.4424	0.6227	0.4193	0.4406
EGDI - 2012	0.278	0.5403	0.4992	0.7188	0.424	0.4882
EGDI - 2014	0.2661	0.5074	0.4951	0.6936	0.4086	0.4712
EGDI - 2016	0.2882	0.5245	0.5132	0.7241	0.4154	0.4922

Figure 2.2: E-Government Development Index from 2010-2016 (Source: compiled from 2010-2016 E-Government Development Reports)

The data shows that Africa is far below the rest of the regions with regards to its level of e-government development. Also, there has not been any significant improvement in the level of e-government development in Africa between 2010 and 2016. Even though Africa as a whole is below the world average in e-government development, some countries in SSA (e.g. Mauritius, Seychelles, and SA) over the past decade have attained significant progress with their e-government strategic policy creation and implementations. This is also evident in their high levels of EGDI values as reported in the UN E-Government Development reports Reports (UNDESA, 2016). The EGDI is a reflection of the extent of e-government development of the UN member states.

2.4.2. Regional differences in e-government development in SSA

The state of e-government development in SSA as of August 2016 (the last year for which data is available), is presented below (Table 2.1). The table presents the 2016 EGDI, as well as its associated components, namely the online services index (OSI), the telecommunication infrastructure index (TII) and the human capital index (HCI). Each of these three components constitutes a third of the overall EGDI.

The data in Table 2.1 was extracted from the 2016 E-Government Development Survey (UNDESA, 2016) and computed using Statistical Package for Social Sciences (SPSS). Table 2.1 presents a detailed picture of e-government development in SSA as of 2016. The average EGDI for SSA of 0.2711 is far below the world average of 0.4922 and the African average of 0.2882 (Figure 2.2). SSA is also the worst developed region in terms of e-government around the world. Within SSA, the Southern African sub-region is the most advanced in e-government development, followed by Eastern Africa and West Africa respectably, while Middle Africa is the worst. This depicts a slight shift of events between 2014 and 2016, as the average EGDI for Middle Africa was slightly better than that for Eastern Africa in 2014 (Table 2.1).

Even though e-government development is generally low for SSA countries, there are, however, some isolated cases of countries in Eastern and Southern Africa where e-government development stands out above the world average as indicated by the maximum e-government scores in these sub-regions.

Table 2.1: E-government Development in SSA

E-government Index		Sub-Regions				Region
		Eastern Africa (N=19)	Middle Africa (N=9)	Southern Africa (N=5)	West Africa (N=16)	SSA (N = 49)
EGDI	Mean	0.2850	0.2318	0.3988	0.2369	0.2711
	STD.	0.1420	0.0901	0.1076	0.1091	0.1267
	Min	0.0270	0.0789	0.2770	0.0593	0.0270
	Max	0.6231	0.3584	0.5546	0.4742	0.6231
OSI	Mean	0.2948	0.1232	0.3073	0.2197	0.2400
	STD.	0.2131	0.1069	0.1532	0.1393	0.1770
	Min	0.0145	0.0000	0.1377	0.0652	0.0000
	Max	0.7029	0.3478	0.5580	0.4565	0.7029
TII	Mean	0.1323	0.0988	0.2816	0.1612	0.1508
	STD.	0.1281	0.0597	0.1172	0.0769	0.1105
	Min	0.0000	0.0000	0.1601	0.0557	0.0000
	Max	0.4624	0.1713	0.4215	0.3629	0.4624
HDI	Mean	0.4279	0.4394	0.6077	0.3297	0.4163
	STD.	0.1641	0.1497	0.0835	0.1424	0.1650
	Min	0.0000	0.1917	0.5147	0.0498	0.0000
	Max	0.4624	0.6162	0.7253	0.6031	0.7253

Source: (Computed from 2016 E-Government Development Survey)

As previously indicated, these high performing SSA countries that scored above the world average are Mauritius, SA and Seychelles with EGDIs of 0.6231, 0.5546 and 0.5181 respectively (UNDESA, 2016). Similar to the EGDI, Southern Africa also leads the rest of the sub-regions in all three EGDI sub-dimensions (OSI, TII, and HDI).

2.4.3. Growth in e-government development in SSA

Even though e-government development in SSA is still the lowest in the world, Munyoka and Manzira (2013) explicated that many governments in SSA have focused on ensuring growth and continuity in their e-government projects. Table 2.2 below compares data from the last two E-Government Development Reports (2014 and 2016) to determine if SSA countries were making significant progress in their e-government development efforts.

The data used for computing the results in Table 2.2 was extracted from the 2014 and 2016 E-Government Development Reports and a paired sample T-test was computed using SPSS to evaluate significant differences. The data shows that the overall level of e-government development in SSA significantly improved between 2014 and 2016 ($p < 0.001$). This clearly suggests that SSA governments are making necessary efforts to enhance their e-government implementations. However, this significant increase was not recorded for all sub-regions.

Table 2.2: Comparison between 2014 and 2016 EGDI for SSA

SSA Regions	**Mean EGDI Scores**		**Mean Difference**	**T-value**	**P-value**
	2016	2014			
Eastern Africa	0.2850	0.2597	0.0253	2.661	0.016*
Middle Africa	0.2318	0.2221	0.0098	1.143	0.286
Southern Africa	0.3988	0.3726	0.0262	1.823	0.142
West Africa	0.2369	0.2079	0.0289	0.3115	0.007**
Overall SSA	0.2711	0.2474	0.0237	4.573	0.000**

*Significant at 5%; **Significant at 1%.
Source: (Computed from the 2014 and 2016 E-Government Development Reports)

It is seen that only Eastern Africa and West Africa showed significant improvements in EGDI between 2014 and 2016 ($p<0.05$). Also, while the majority of SSA countries saw an increase in their EGDI from 2014 to 2016, 14 out of the 49 SSA countries (i.e. Burkina Faso, Cameroon, Congo, Djibouti, Eritrea, Madagascar, Mauritania, Mozambique, Namibia, Namibia, Niger, Rwanda, Sudan and Zimbabwe) instead scored lower EGDIs for 2016 than they did in 2014 (Table 2.3), indicating instead a backslide in e-government development.

Table 2.3 depicts how each SSA country performed in the 2016 EGDI compared to 2014 EGDI.

Table 2.3: Performance of SSA countries in 2014 and 2016 EGDIs

SSA Country	EGDI - 2016	EGDI - 2014	Change in EGDI	Percentage Change in EGDI*
Somalia	0.027	0.0139	0.0131	94.24
Zambia	0.3507	0.2389	0.1118	46.80
Uganda	0.3599	0.2593	0.1006	38.80
Cape Verde	0.4742	0.3551	0.1191	33.54
Liberia	0.2338	0.1768	0.057	32.24
Guinea	0.1226	0.0954	0.0272	28.51
United Republic of Tanzania	0.3533	0.2764	0.0769	27.82
Togo	0.3096	0.2446	0.065	26.57
South Sudan	0.1791	0.1418	0.0373	26.30
Senegal	0.325	0.2666	0.0584	21.91
Benin	0.2039	0.1685	0.0354	21.01
Democratic Republic of the Congo	0.1876	0.1551	0.0325	20.95
Sierra Leone	0.1594	0.1329	0.0265	19.94
Comoros	0.2155	0.1808	0.0347	19.19
Burundi	0.2277	0.1928	0.0349	18.10
Mauritius	0.6231	0.5338	0.0893	16.73
Chad	0.1256	0.1076	0.018	16.73
South Africa	0.5546	0.4869	0.0677	13.90
Guinea-Bissau	0.1818	0.1609	0.0209	12.99
Nigeria	0.3291	0.2929	0.0362	12.36
Ghana	0.4181	0.3735	0.0446	11.94
Swaziland	0.3412	0.3056	0.0356	11.65
Angola	0.3311	0.297	0.0341	11.48
Mali	0.1817	0.1634	0.0183	11.20
Kenya	0.4186	0.3805	0.0381	10.01

SSA Country	EGDI - 2016	EGDI - 2014	Change in EGDI	Percentage Change in EGDI*
Gabon	0.3584	0.3294	0.029	8.80
Botswana	0.4531	0.4198	0.0333	7.93
Sao Tome and Principe	0.239	0.2218	0.0172	7.75
Côte d'Ivoire	0.2185	0.2039	0.0146	7.16
Equatorial Guinea	0.2403	0.2268	0.0135	5.95
Lesotho	0.277	0.2629	0.0141	5.36
Gambia	0.2396	0.2285	0.0111	4.86
Malawi	0.2398	0.2321	0.0077	3.32
Ethiopia	0.2666	0.2589	0.0077	2.97
Seychelles	0.5181	0.5113	0.0068	1.33
Eritrea	0.0902	0.0908	-0.0006	-0.66
Cameroon	0.2759	0.2782	-0.0023	-0.83
Sudan	0.2539	0.2606	-0.0067	-2.57
Congo	0.2497	0.257	-0.0073	-2.84
Zimbabwe	0.3472	0.3585	-0.0113	-3.15
Mozambique	0.2305	0.2384	-0.0079	-3.31
Namibia	0.3682	0.388	-0.0198	-5.10
Rwanda	0.339	0.3589	-0.0199	-5.54
Madagascar	0.2416	0.2606	-0.019	-7.29
Djibouti	0.1337	0.1456	-0.0119	-8.17
Mauritania	0.1734	0.1893	-0.0159	-8.40
Burkina Faso	0.1598	0.1801	-0.0203	-11.27
Central African Republic	0.0789	0.1257	-0.0468	-37.23
Niger	0.0593	0.0946	-0.0353	-37.32
*This table is sorted in descending order, based on the percentage change in EGDI.				

It is observed that in relative terms, Somalia made the greatest improvements in e-government development by almost doubling its e-government efforts between 2014 and 2015 (i.e. 94.24 % increase). Also, for all the 35 SSA countries that improved their EGDI between 2014 and 2016, 25 of them improved by more than 10%, while the remaining 10 saw increases between 1 and 9%. For the 14 SSA countries that instead decreased in e-government development, Central African Republic and Niger were the worst as their EGDIs decreased by 37.23% and 37.32% respectively.

2.4.4. Factors affecting e-government development in SSA

According to Munyoka and Manzira (2014), countries in SSA that have been known to achieve significant growth in e-government development are those with a resilient political leadership. This type of leadership is often characterised by efficiency in the management of its various ICT ministerial portfolios and backed by solid financial and technical know-how, mostly provided by international donor organisations. However, there are still many countries in SSA that stifle in e-government development due to the high deficiency in visionary leadership, corrupt officials, and ambiguous ICT and e-government policies that are insufficient in addressing the contemporary role of ICTs in government (Cloete, 2012).

A key factor that accounts for the disparity in e-government development between SSA and other regions is the inequalities in national income. Consistent evidence from past UN e-government surveys has identified national income as one of the key national indicators with a strong influence on e-government development, with higher income countries showing greater progress in e-government development (Perry & Christensen, 2015; UNDESA, 2016).

However, some resource poor countries around the globe have made significant progress in e-government development, suggesting that national income is not the only indicator that guarantees e-government progress. Having an understanding of the other indicators that have an impact on e-government development can go a long way to enhance e-government development in SSA. For example, Cloete (2012) has indicated that e-government development is stifled by corrupt officials. Nonetheless, there is still a paucity of empirical evidence examining how corruption affects e-government development in SSA given the high levels of corruption in this region. Using data from the 2014 E-Government Development Survey, Verkijika & De Wet

(2016) showed that there was a significant relationship between corruption and e-government development, with corrupt SSA countries having lower levels of e-government development than those that were less corrupt. These authors suggested the need for e-government development reports to consider exploring the association between e-government development and corruption to possibly determine the disparities that could not be explained by national income. The release of the 2016 E-Government Development Survey in August 2016 introduced the relationship between e-government development and corruption, suggesting that the line of proposition introduced by Verkijika and De Wet (2016) was also under consideration by the research experts in charge of developing the e-government development reports. The findings in the 2016 E-Government Development Survey (UNDESA, 2016) were in line with evidence from Verkijika and De Wet (2016), showing that e-government development had a significant relationship with corruption, with corrupt nations performing low on the EGDI. The relationship is depicted in Figure 2.3.

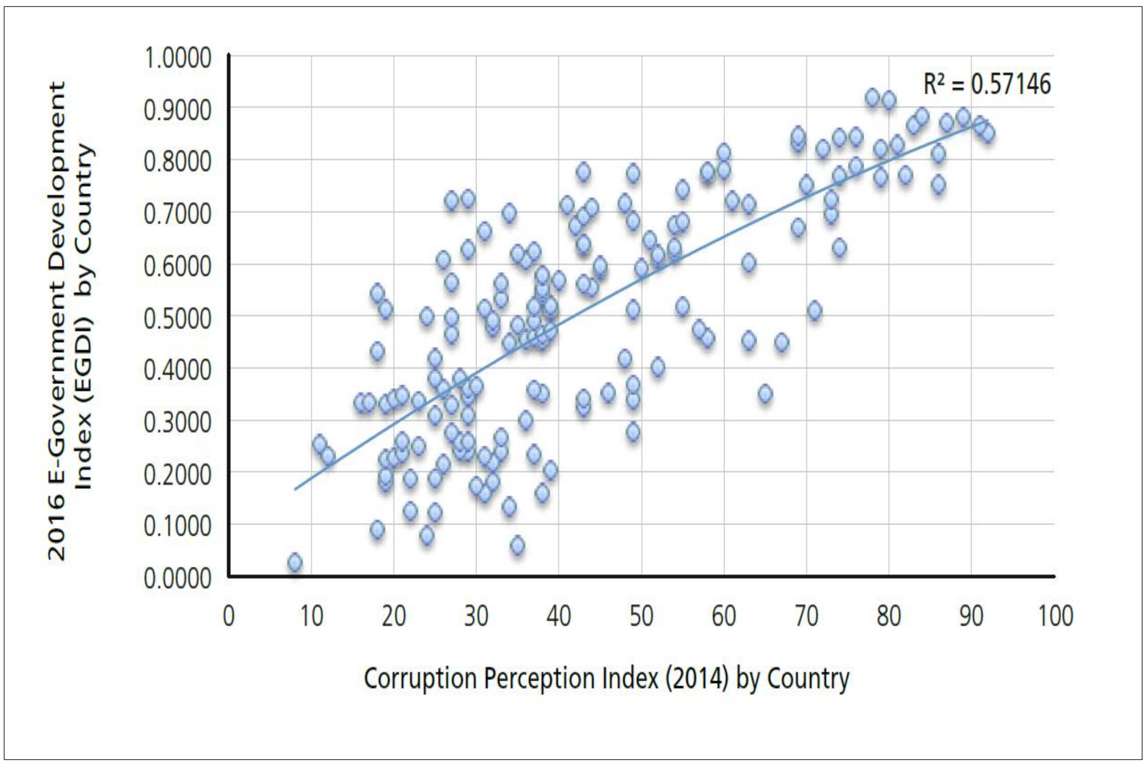


Figure 2.3: Relationship between corruption and EGDI (Source: UNDESA, 2016)

The UNDESA (2016) researchers adopted the 2014 Corruption Perception Index (CPI)[1] as the proxy for measuring corruption. A high CPI depicts a country that is less corrupt. The positive relationship (R^2 = 0.57146) in Figure 2.3, therefore, depicts that countries with high CPI values are more likely to have high EGDIs. In addition to corruption, the 2016 E-Government Development Survey introduced the relationship between a country's global competitiveness and its level of e-government development. This relationship is depicted in Figure 2.4 below:

The Global Competitiveness Index (GCI) was used by the UNDESA (2016) researchers as a proxy for a country's level of global competitiveness. The strong positive relationship (R^2=0.73896) between global competitiveness and EGDI suggests that countries high in global competitiveness are more developed in their e-government efforts than those with low levels of global competitiveness.

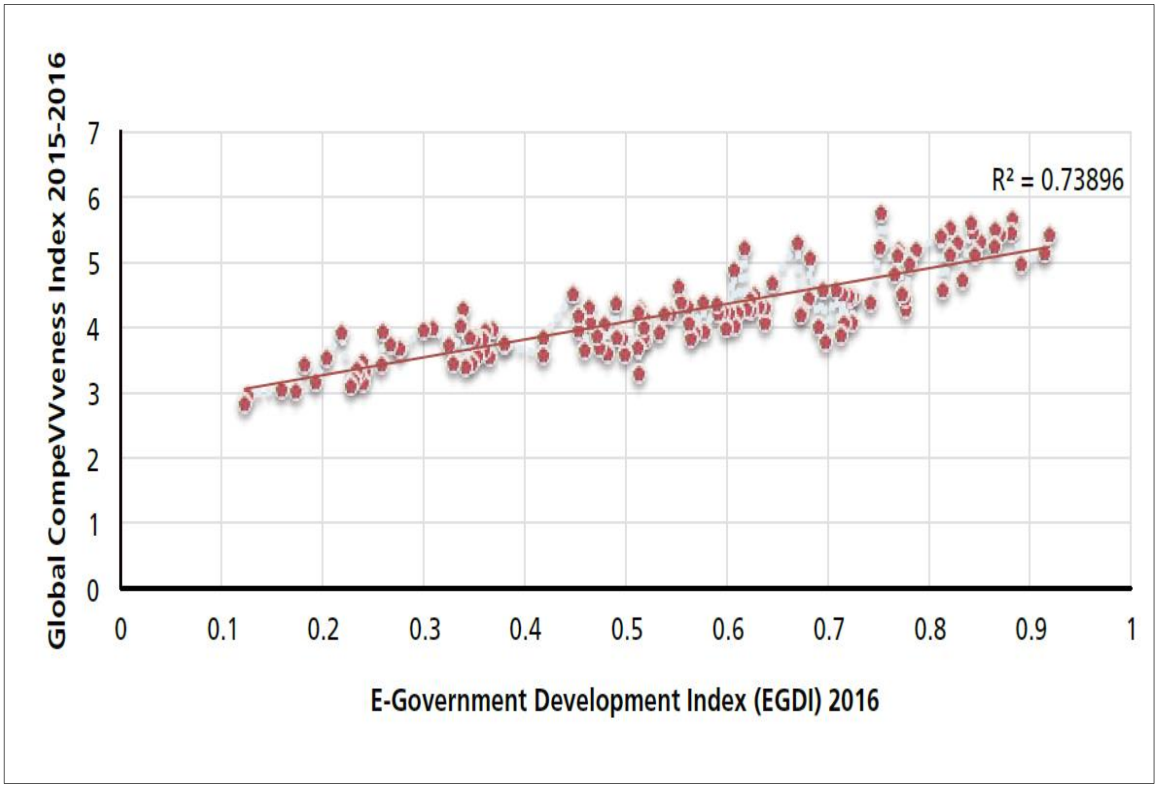


Figure 2.4: Relationship between competitiveness and EGDI (Source: UNDESA, 2016)

[1] CPI is a corruption index that ranks countries based on how its public sector is perceived to be corrupt with scores ranging from 0 (highly corrupt) to 100 (no trace of corruption).

In addition to national income, corruption, and global competitiveness, other national indicators such as innovation, gender equality, cybersecurity, human development, cultural diversity, and the age distribution of a country's population could also be examined to determine their influence on e-government development. The possible rationale on why these factors are likely to influence e-government development is discussed in Chapter 3 (Section 3.7.) The decision for discussing these factors in detail in Section 3.7 is to avoid repetition of existing facts, as these national indicators are also discussed in line with their possible relationship on the level of usability of e-government websites.

While enhancing e-government development is vital for providing the necessary e-government solutions/services, its success is highly dependent on user adoption and utilisation of these e-government solutions/services. As such, to enhance the success and progress of e-government in SSA, it is imperative to have a good understanding of e-government adoption models and how they can best be used to enhance adoption of e-government solutions/services in SSA.

2.5. E-Government Adoption Models

Many e-government researchers (Boon, Ramayah, Ping & Lo, 2013; Bwalya & Healy, 2010; Lin *et al.*, 2011; Rukiza, Karokola, Mwakalinga & Kowalski, 2011; Shajari & Ismail, 2013) have examined the adoption of e-government via existing technology acceptance models, such as the theory of reasoned action (TRA), theory of planned behaviour (TPB), technology acceptance model (TAM), diffusion of innovation theory (DOI), perceived characteristics of innovation (PCI) and the unified theory of acceptance and use of technology (UTAUT). Most of these concepts were adopted from existing literature and evidence from e-commerce adoption due to the close link between e-commerce and e-government solutions. However, some scholars (Alghamdi & Beloff, 2014; Shareef, Kumar, Kumar & Dwivedi, 2011) have argued that models simply adopted from e-commerce literature are not sophisticated enough to fully capture and stipulate the comprehensive nature of citizens' e-government adoption behaviours. Consequently, domain specific e-government adoption models, such as the E-government Adoption Model (GAM) and the E-government Adoption and Utilisation Model (EGAUM) have been developed to address shortfalls of existing technology adoption models (Alghamdi &

Beloff, 2014; Shareef *et al*., 2011). This section discusses how these different models have been used to describe the phenomenon of e-government adoption.

2.5.1. Theory of reasoned action (TRA)

The TRA was originally developed by Fishbein and Ajzen (1975). The authors established a theoretical model (Figure 2.5) that indicated the separation of intentional behaviour from actual behaviour. At the core of the TRA is the view that the behavioural actions of an individual are determined by the person's behavioural intention, which is in turn influenced by the individual's attitudes and subjective norms.

The TRA upholds that individuals often take responsibility for their actions before deciding whether or not to commit themselves to a given behaviour (Zarzuela & Anton, 2015). This model has been widely used in explaining the adoption of internet technologies (Hansen, Jensen & Solgaard, 2004; Loiacono, Watson & Goodhue, 2007; Mishra, Akman & Mishra, 2014; Nor, Shanab & Pearson, 2008; Rehman *et al.*, 2007; Rensel, Abbas & Rao, 2006). However, in the context of e-government specific systems, the TRA has been noted to lack the significant constructs vital for analysing the acceptance and usage of enormous and complex systems like e-government (Alghamdi & Beloff, 2014).

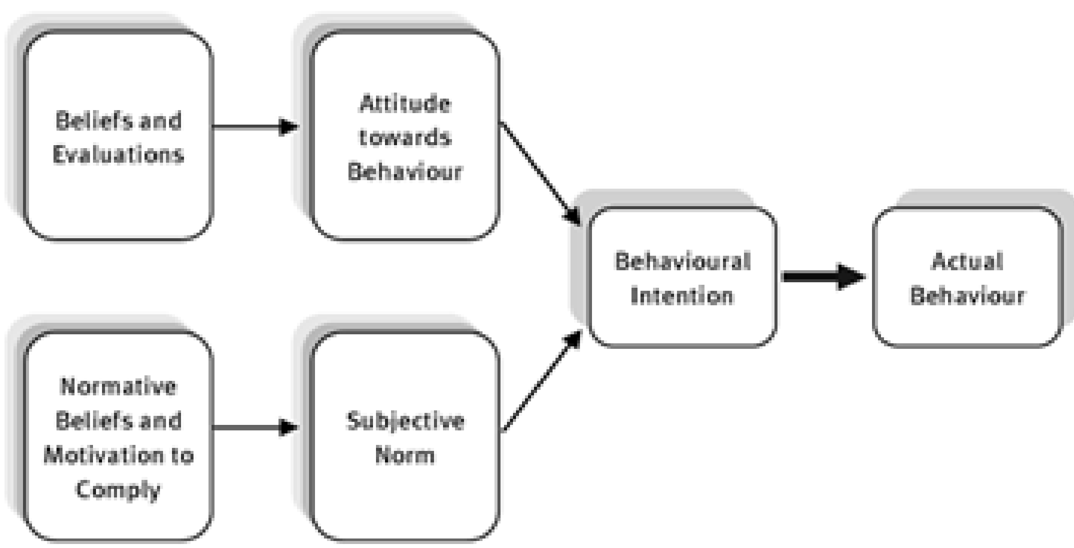


Figure 2.5: TRA Model (Source: Fishbein & Ajzen, 1975, p. 16)

Nonetheless, the TRA remains a very vital and widely reviewed theory in e-government literature as it has been extensively used as the theoretical foundation for the development of most of the notable e-government adoption models (e.g. TAM, GAM, and EGAUM). Additionally, Gracia, Alino, and Blanco (2012) employed the TRA to show that adoption of e-government services in Spain was positively and significantly influenced by attitudes and subjective norms.

2.5.2. Theory of planned behaviour (TPB)

The TPB was developed by Ajzen (1991) as a psychology theory to explain human behaviour. Ajzen (1991) proposed the TPB as an extension of the TRA to provide an understanding of human behaviour in situations where individuals might not have complete control over their behaviour. The main difference between the TRA and the TPB is the addition of the third construct, namely perceived behavioural control. Figure 2.6 below provides a graphical representation of the TPB.

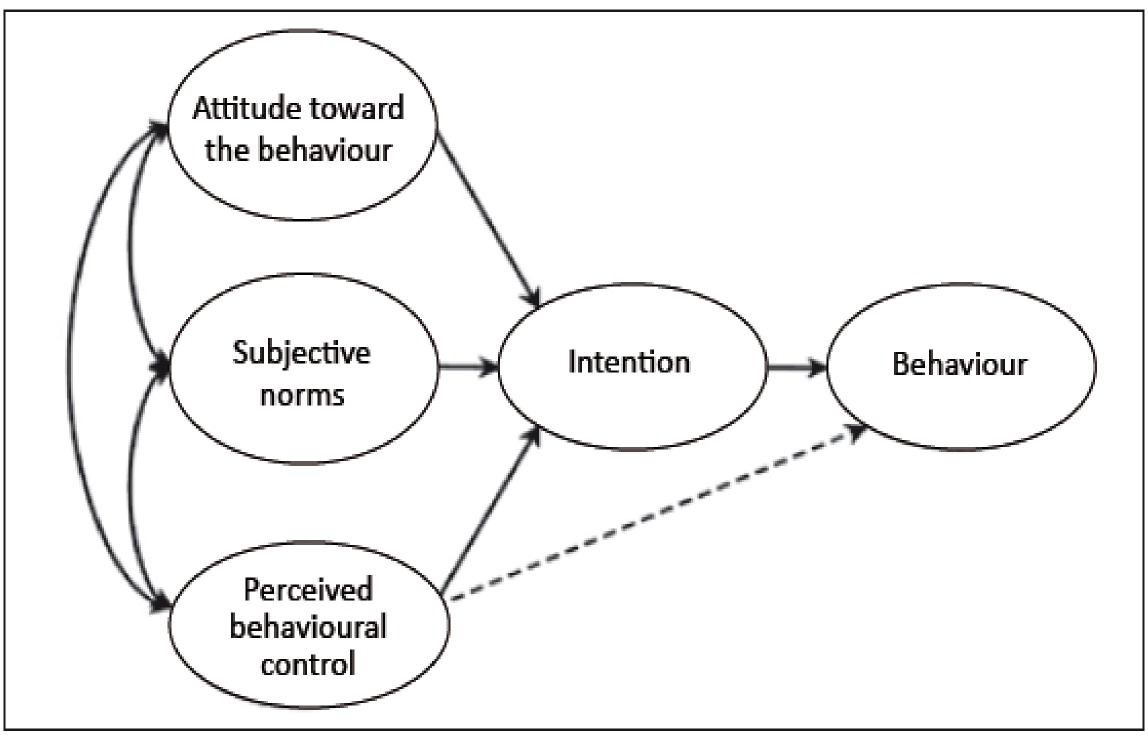


Figure 2.6: TPB model (Source: Ajzen, 1991, p.182)

The TPB has been widely used in IS research to examine and determine technology acceptance behaviour (Nasri & Charfeddine, 2012; Park & Yang, 2012; Pavlou & Fygenson, 2006). In the context of e-government adoption, several studies (Danila & Abdullah, 2014; Gosebo & Obono, 2012; Ozkan & Kanat, 2011) have developed TPB specific models for this purpose. However, most of these TPB models for e-government adoption are only theoretical models yet to be empirically validated. For example, Danila and Abdullah (2014) intended to validate their model with 500 users in future studies.

Similarly, the TPB model developed by Gosebo and Obono (2012) focused specifically on e-government services of municipalities in less developed countries (LDCs) and is yet to be empirically tested. Nevertheless, Ozkan and Kanat (2011) empirically validated their TPB model for e-government and showed that the model was an improvement over the TAM, which has previously been used in many e-government adoption studies. As such, the use of the TPB as an e-government adoption model has not only been based on theoretical viewpoints, but was also validated from an empirical perspective.

2.5.3. Technology acceptance model (TAM)

The TAM is one of the most frequently applied models by researchers in studying the technology acceptance behaviour of users. TAM was introduced by Davis, Bagozzi, and Warshaw (1989) using the theoretical foundations of the TRA. The primary goal of the TAM was "to provide an explanation of the determinants of computer acceptance that is general, capable of explaining user behaviour across a broad range of end-user computing technologies and user populations, while at the same time being both parsimonious and theoretically justified" (Davis *et al*., 1989, p. 985). TAM posits that causal relationships flow in a sequence of beliefs, attitudes, intentions, and behaviours (Lin *et al.*, 2011). A schematic model of TAM is presented in Figure 2.7 below.

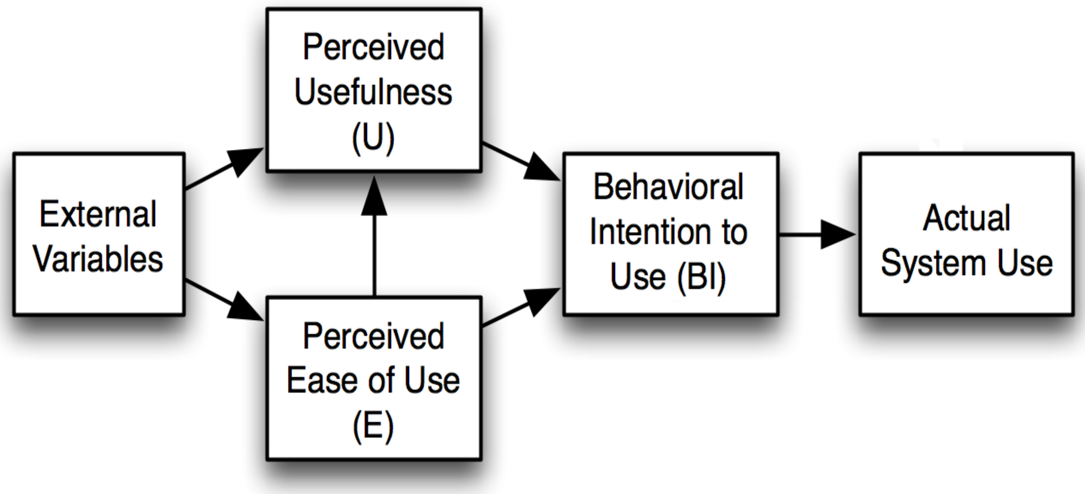


Figure 2.7: TAM (Source: Davis *et al.*, 1989, p.453)

TAM postulates that an individual needs to have a voluntary intention to use a given piece of technology before such an individual can accept to adopt the technology. This voluntary intentionality is driven by two key factors, namely: perceived usefulness and perceived ease of use. Davis *et al*. (1989) defined perceived usefulness as the subjective likelihood with which a user believes that by adopting a given IT system, the system will increase his/her job performance within a given context; while perceived ease of use is seen as the extent to which a user expects to use a given system with minimal effort. TAM also establishes a clear link between perceived usefulness and perceived ease of use where it is highlighted that perceived usefulness is influenced by perceived ease of use. Additionally, both perceived usefulness and perceived ease of use are impacted by external factors to the individual.

The reason why TAM has been widely used in IS research to examine technology adoption is because it can be tailored to fit technology acceptance frameworks in narrow IS areas (Serenko & Bontis, 2004; Zafiropoulos, Karavasilis & Vrana, 2012), as well as be modified to suite novel technologies when they are introduced (Shih, 2004).

Many studies (Al-adawi, Yousafzai & Pallister, 2005; Lin *et al.*, 2011; Shajari & Ismail, 2013) have successfully applied the TAM in predicting e-government adoption. These studies indicated that the two main constructs of the TAM had substantial influences on user intention to adopt e-government solutions. However, not all studies have found support for the core constructs of the TAM. Carter and Belanger (2004a) did not find any significant influence of perceived usefulness on e-government adoption. This could possibly have arisen from the fact that the concept of perceived usefulness, as originally defined by the TAM, is highly restricted to only the absolute gains from job performance. Meanwhile, it is evident that in adopting e-government services, users have the potential to amass several relative and absolute gains, such as cost savings, convenience, efficiency, availability, effectiveness, accessibility from anywhere, and comfort in use of the system (Shareef *et al.*, 2011). As such, even though TAM remains one of the most widely used models in technology adoption (Yi, Jackson, Park, Probst, 2006), researchers have argued that in the specific case of e-government, the TAM fails to capture the complete essence of e-government user behaviour (Alghamdi & Beloff, 2014; Shareef *et al*., 2011). This has resulted in extending the TAM to construct other e-government specific models, like the GAM and EGAUM, that can capture the full essence of e-government user behaviours and overcome the shortfalls of the TAM.

2.5.4. Diffusion of innovation theory (DOI)

Rogers (1995) conceptualised the DOI model to explain the process through which users come to accept and utilise technology. The DOI postulates that when users are exposed to new technology (an innovation), there are several societal, behavioural and individual capability factors that influence their decisions regarding how and when to use the technology. Rogers (1983) presented five factors necessary for successful technology adoption. These factors are relative advantage, complexity, compatibility, trialability, and observability. Table 2.4 below explains these five factors.

Even though the DOI have five factors, empirical evidence has indicated that trialability and observability have no significant effect on user attitudes towards adoption of new technologies (Al-Zaabi, 2013; Sang, Lee & Lee, 2009). As such, e-government researchers adopting the DOI have focused only on the other three factors (relative advantage, complexity and compatibility) that have been noted to have a strong effect on user attitudes towards adoption of new technologies (Agarwal and Prasad, 1998; Alomari, 2014; Carter and Belanger, 2005; Ojha, Sahu & Gupta, 2009; Patel and Jacobson, 2008; Sang *et al.*, 2009; Schaupp and Carter, 2005).

Table 2.4: DOI factors

Factor	Definition
Relative advantage	"The degree to which an innovation is seen as being superior to its predecessor" (Rogers, 2003, p. 15).
Complexity	"The degree to which an innovation is seen by the potential adopter as being relatively difficult to use and understand and use" (Rogers, 2003, p. 16).
Compatibility	"The degree to which an innovation is seen to be compatible with existing values, beliefs, experiences and needs of the adopter" (Rogers, 2003, p. 15).
Trialability	"The degree to which an idea can be experimented with on a limited basis" (Rogers, 2003, p. 16).
Observability	"The degree to which the results of an innovation are visible to others" (Rogers, 2003, p. 16).

2.5.5. Perceived characteristics of innovation (PCI)

The PCI was developed by Moore and Benasat (1991) with the aim to address some of the shortfalls of the DOI. These shortfalls were noted from the inconsistency of the DOI attributes in explaining the adoption and diffusion of innovations (Yaacob & Yusoff, 2014). The key difference between the PCI and the DOI is that while the DOI focused on the characteristics of the innovation itself, the PCI layer emphasised instead the perception of using an innovation. Moore and Benasat (1991) redefined all the characteristics of the PCI in terms of potential adopter use, observation, and trial, and added some new dimensions which were subsequently labelled the PCI (Ojha, Tripathi & Gupta, 2011). As a result, the PCI is comprised of eight factors, which are depicted in Table 2.5 below.

The PCI has been widely used in studying the adoption of e-government solutions (Boon *et al.*, 2013; Carter & Belanger, 2004b; Kumar, Mukerji, Butt & Persaud, 2007) and other ICT solutions (Gayathri, 2014; Richardson, 2009). Boon *et al.* (2013) showed that relative advantage and ease of use were the most important factors in facilitating the adoption of e-government services in Malaysia. However, Cater and Belanger (2004b) instead found relative advantage and image to be strong predictors of e-government adoption, but no significant effect was seen for perceived ease of use. Richardson (2009) noted that except for image, all the other seven characteristics of the PCI were valuable indicators of information technology solutions.

Table 2.5: PCI factors

Factor	Definition
Relative Advantage	The degree to which an innovation is perceived as being better than its precursor
Compatibility	The degree to which an innovation is perceived as being consistent with the existing values, needs, and past experiences of potential adopters
Ease of Use	The degree to which an innovation is perceived as being easy to use
Result Demonstrability	Tangibility of the results using the innovation, including observability and communicability
Image	The degree to which use of an innovation is perceived to enhance one's image or status in one's social system
Visibility	The extent to which one can see an innovation being used in an organisation.
Trialability	The degree to which an innovation may be experimented with, before adoption
Voluntariness	The degree to which use of the innovation is perceived as being voluntary, or out of free will

2.5.6. Unified theory of acceptance and use of technology (UTAUT)

The UTAUT was developed by Venkatesh, Morris, Davis and Davis (2003) to serve as a model for examining the adoption of information technology systems by potential users (even those less likely to adopt and use new technology systems). The UTAUT has been noted to be the most widely used model for studying the adoption of new technologies (Zuiderwijk, Janssen & Dwiedi, 2015). This can be attributed to its theoretical soundness and empirical validity. The UTAUT (Figure 2.8) was developed from the core theoretical understanding of eight leading technology acceptance models namely TRA, TPB, TAM, Combined TAM and TPB, Motivational Model, DOI, Social Cognitive Theory, and Model of PC Utilisation.

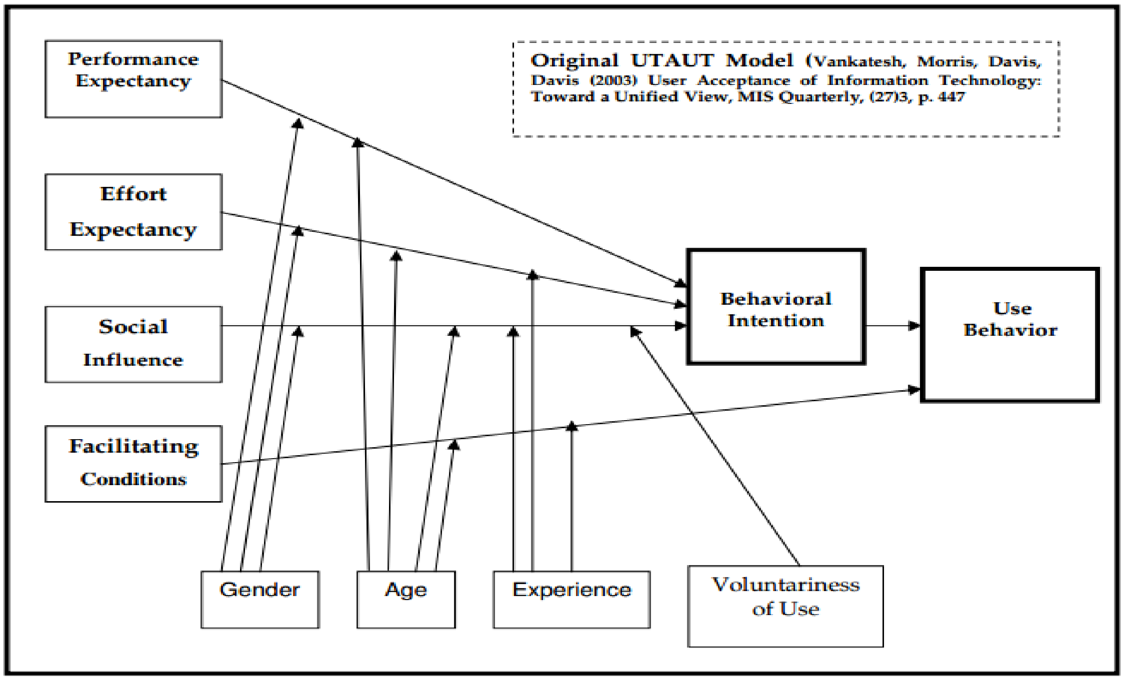


Figure 2.8: UTAUT (Source: Venkatesh *et al.*, 2003, p. 447)

Table 2.6: UTAUT factors

Factor	**Definition**
Facilitating conditions	"The degree to which an individual believes that an organisational and technical infrastructure exists to support the use of the system" (Venkatesh *et al.*, 2003, p. 453).
Performance expectancy	"The degree to which an individual believes that using the system will help him or her to attain gains in job performance" (Venkatesh *et al.*, 2003, p. 447).
Effort expectancy	"The degree of ease associated with the use of the system" (Venkatesh *et al.*, 2003, p. 450).
Social influence	"The degree to which an individual perceives that important others believe he or she should use the new system" (Venkatesh *et al.*, 2003, p. 451).

Venkatesh *et al*. (2003) performed empirical tests and showed that the UTAUT outperformed all the other eight models. After identifying four determinants (Table 2.6) of behavioural intention and usage, Venkatesh *et al.* (2003) also modelled moderator factors that could influence the identified direct relationships. The moderator factors used in the UTAUT are gender, age, experience and voluntary use. To provide a detailed understanding of the UTAUT, the key variables are defined in Table 2.6 above.

As earlier mentioned, the UTAUT is one of the most widely used acceptance models in the study of e-government adoption (AlAwadhi & Morris, 2009; Lessa, Negash & Amoroso, 2011; Sapio, Turk, Cornacchia, Papa, Nicolo & Livi, 2010, Schaupp, Carter & McBride, 2010; Wang and Shih, 2009; Weerakkody, El-Haddadeh, Al-Sobhi, Akhter Shareef & Dwivedi, 2013) and other technology solutions (San Martín & Herrero, 2012; Zhou, 2011; Zhou, Lu & Wang, 2010; Zuiderwijk *et al*., 2015).

Currently, there is an updated version of the UTAUT, known as the UTAUT2, developed by Venkatesh, Thong and Xu (2012). The UTAUT2 introduced three new dimensions to the UTAUT, namely hedonic motivation, price value and habit. Hedonic motivation refers to the fun that users derive from using a system while price value is the trade-off between the cost of using a system and its perceived benefits. Habit refers to a user's self-perception of his/her continuous use of a system (Venkatesh *et al.*, 2012). However, the use of the UTAUT2 in e-government adoption is still limited, with studies carried out after the introduction of UTAUT2 still using the UTAUT model (Rodrigues, Sarabdeen & Balasubramanian, 2016).

2.5.7. E-government adoption model (GAM)

The GAM was proposed by Shareef *et al.* (2011) with the aim of identifying the key factors that influence e-government adoption at different stages of e-government maturity. The authors argued that the GAM was necessary because some key prior e-government adoption models like the TAM, DOI, and TPB were unable to capture the complete essence of e-government user adoption behaviour. Additionally, they argued that the adoption behaviours of e-government solutions differed based on e-government service maturity levels, which were not captured in the prior models. The GAM model, depicted in Figure 2.9, comprises five dimensions that influence e-government adoption, namely attitude to use, ability to use, assurance to use, adherence to use, and adaptability of use.

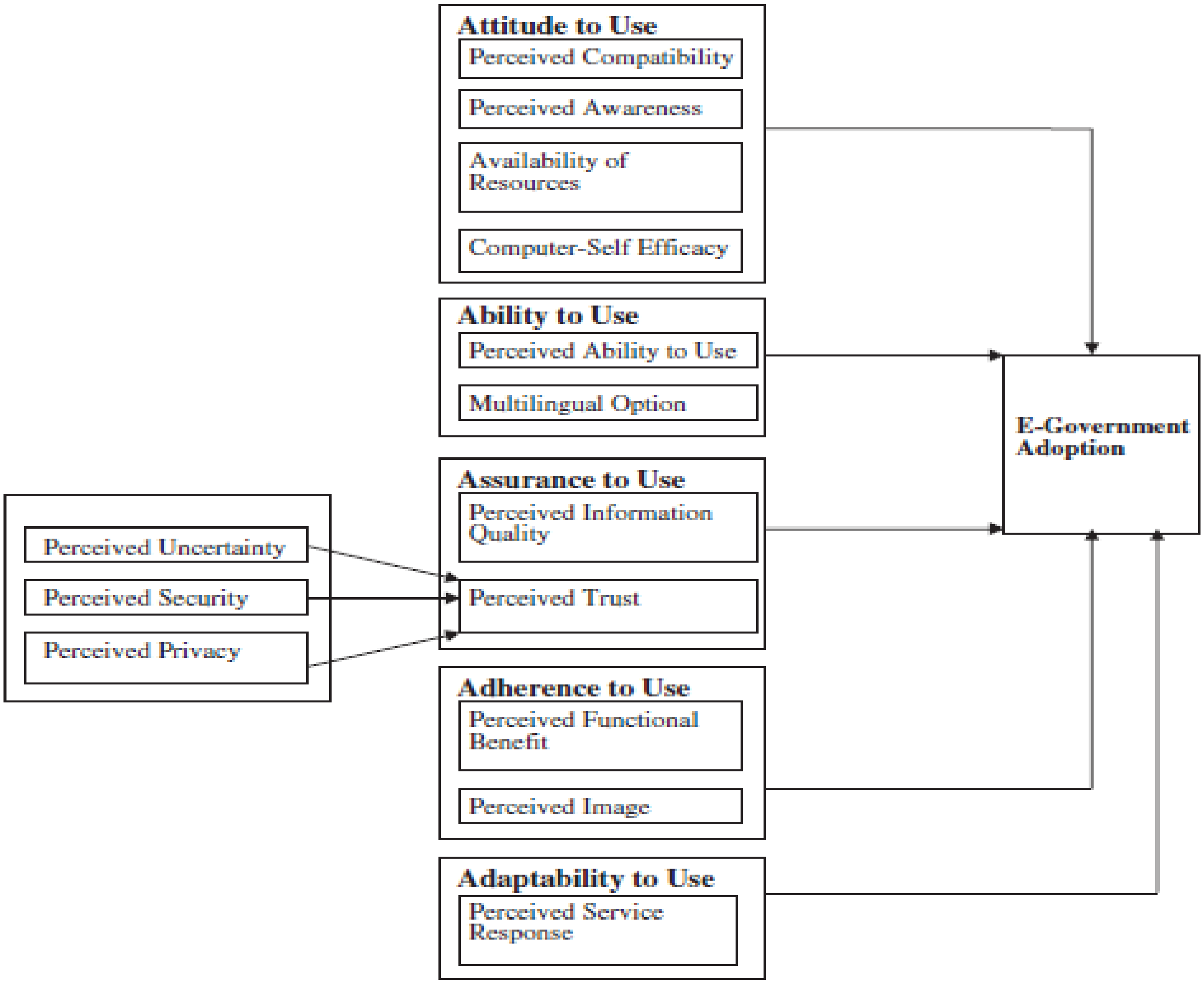


Figure 2.9: GAM (Source: Shareef *et al.*, 2011, p. 30)

Shareef *et al*. (2011) empirically tested the GAM model in Canada and found it to be a useful model for examining e-government adoption. Even though the GAM model has not been widely tested in other settings, Ahmed (2013) adopted the adaptability of use dimension from the GAM and showed that it had a significant influence on e-government adoption in Egypt. This finding indicated the potential use of the GAM in other settings.

2.5.8. E-government adoption and utilisation model (EGAUM)

The EGAUM was introduced by Alghamdi and Beloff (2014) as a means to provide a comprehensive and domain specific framework for examining the factors that influence the adoption and utilisation of e-government systems. The authors substantiated the necessity for such a model on the fact that most of the earlier widely used models for e-government were general technology acceptance and adoption models. A schematic representation of the EGAUM is presented in Figure 2.10 below.

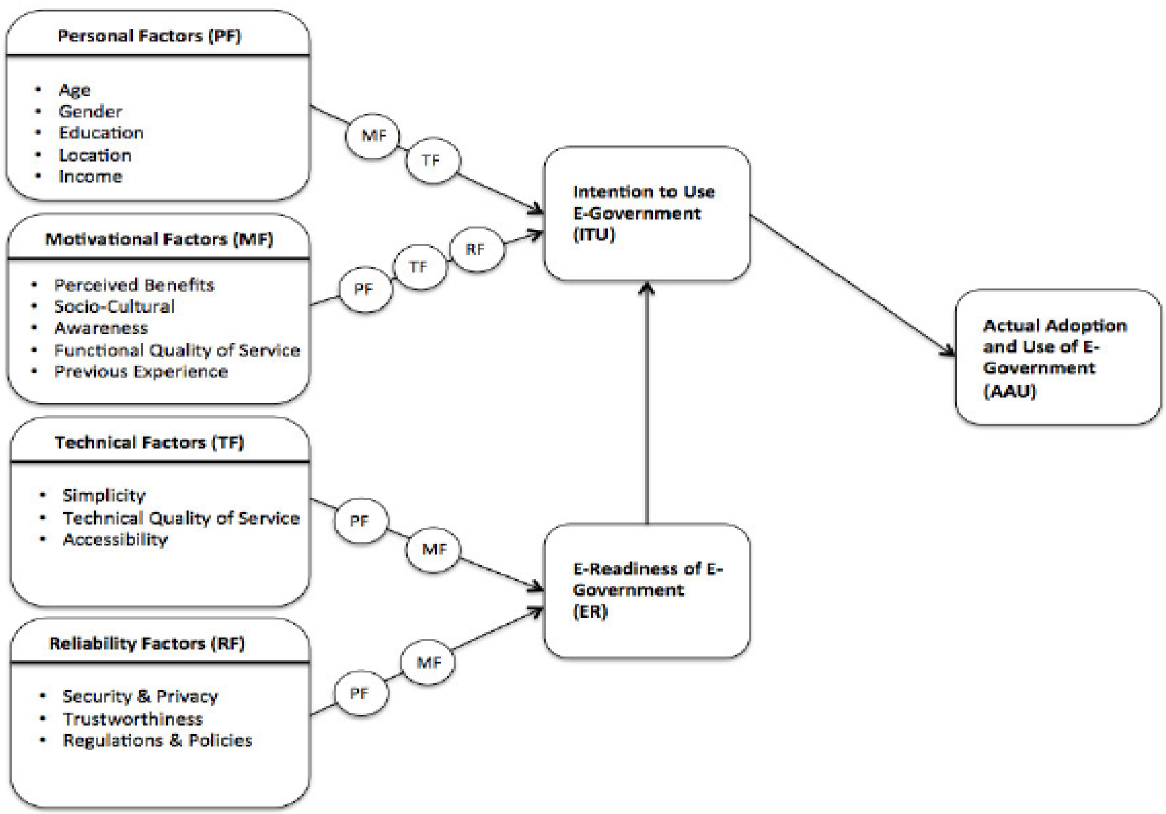


Figure 2.10: EGAUM (Source: Alghamdi & Beloff, 2014)

The EGAUM consists of three dependent variables, namely Intention to Use E-government (ITU), E-Readiness of E-government (ER) and Actual Adoption and Use of E-government (AAU), and four sets of independent variables, namely Personal Factors (PF), Motivational Factors (MF), Technical Factors (TF) and Reliability Factors (RF). Relationships in the EGAUM are depicted in two ways. Arrows are used to show direct relationships, while small circles are used to depict indirect relationships.

The EGAUM adopts several concepts from existing models. For example, the MF factor of perceived benefit was adopted from perceived usefulness in the TAM and relative advantage in the DOI, while the TF factor of simplicity is similar to ease of use in the TAM and effort expectancy in the UTAUT (Alghamdi and Beloff, 2014). Even though the EGAUM was introduced with many new variables that the authors argued to be specific for e-government adoption in the context of developing countries (Cultural Influence, Personal Factors Influence, Awareness, Previous Experience Influence, Functional and Technical Quality of Service, Security and Privacy, Regulations and Policies, and Trustworthiness), the EGAUM has not been empirically validated so far to determine if the factors have a significant influence on e-government adoption in developing countries.

2.6. Lessons Learnt from E-Government Adoption Models and the Case for SSA

The reviewed research on e-government adoption models depicted the various factors that have been posited by researchers to impact on user adoption and utilisation of e-government solutions. Some of the widely recognised factors include perceived usefulness, perceived ease of use, performance expectancy, effort expectancy, facilitating conditions, social influence, gender, education, age, available ICT infrastructure, security, trust, accessibility, simplicity, information access, relative advantage, subjective norm, degree of intrusiveness, perceived benefits, awareness, complexity, and perceived public value (Ahmed, 2012; Akkaya, Wolf & Krcmar, 2012; AlAwadhi & Morris, 2009; Al-Hujran *et al.*, 2015; Al-Shafi & Weerakkody 2010, Bwalya & Healy 2010; Carter & Bélanger, 2004a; Carter & Bélange, 2004b; Huang, D'Ambra & Bhalla, 2002; Hung, Chang & Yu, 2006; Kumar *et al.*, 2007; Mpinganjira, 2012; Rana & Dwivedi, 2015; Rehman, Esichaikul & Kamal, 2012; Shareef *et al*., 2011; Venkatesh *et al*., 2003; Weerakkody *et al.*, 2013).

While most existing e-government models have presented the factors that affect e-government adoption, many of the models have presented the factors at a universal level, which in most cases are not applicable to all regions due to potential country-to-country differences. These differences include aspects such as demographic gaps, education levels, internet usage behaviours, and culture (Weerakkody *et al.*, 2013). Additionally, most of the factors outlined in e-government adoption models were mainly conceptual with very little empirical findings to support their influence on e-government adoption (Beldad *et al*., 2012; Reddick & Turner, 2012; Sriyastaya, 2011; Shareef *et al.*, 2011). Also, most of the existing studies that have presented evidence of the factors affecting e-government adoption have focused primarily on developed countries.

As mentioned before, since not all the factors that affect e-government development in developed countries will have the same influence in developing countries, there is a need to carefully examine specific developing world factors to extend contemporary research and find specific evidence related to the presently understudied developing countries. This is particularly important in SSA, as the region is still characterised by low levels of e-government service usage with very slow rates of e-government adoption and development. The many widespread problems in this region affect the implementation of e-government solutions (Yaghoubi *et al.*, 2011; Ochara, 2010; Rorissa and Demissie, 2010). As such, context specific adoption literature in SSA is necessary for understanding the factors influencing e-government adoption in the region. The section below looks at the specific context of e-government adoption in SSA.

2.6.1. E-government adoption studies in SSA

Several researchers have taken an interest in examining e-government adoption patterns in SSA. A summary of the key studies is presented in Table 2.7 below. From Table 2.7, it can be observed that most of the e-government adoption studies in SSA have focused on Eastern Africa (specifically Tanzania, Uganda and Kenya).

From the ten studies listed in Table 2.7, seven are based on the TAM, while the other three have used random variables. This clearly indicates the shortage of studies in the domain of e-government adoption in SSA, as many of the existing e-government adoption models have not been tested in this region.

Table 2.7: Summary of e-government adoption models used in SSA

Authors	Adopted model/Factors	Type of Study	Country of Study	Significant Factors
Asianzu and Maiga, 2012	Extended TAM.	Empirical. Descriptive Study	Uganda	awareness, accessibility, training, user support, local language, trust, attitudes, benefits, education, and compatibility
Bwalya, 2011	Extended TAM model. Include trust; ICT infrastructure, and computer self-efficacy	Empirical	Zambia	Perceived ease of use; Trust; computer Self-efficacy
Bwalya and Healy, 2010	Extended TAM model. Perceived Ease of Use; Perceived Usefulness, privacy and risk, local culture, ICT infrastructure	Conceptual	SADC	N/A
Jain and Akakandelwa, 2014	Skills, Culture, Citizen participation, unawareness, poor perception	Conceptual	Botswana & Zambia	N/A
Khanyako and Maiga, 2013	Extended TAM. Includes risk local culture, data privacy and security, Trust factors, Information	Empirical. Descriptive Study	Uganda	Information security factors, Trust factors, security and

	Security factors, and security culture factors.			culture factors
Komba and Ngulube, 2015	Extended TAM. Social influence, compatibility, perceived ease of use, perceived usefulness, perceived trust, website/system quality, system quality, relative advantage, and image.	Empirical	Tanzania	Social influence, website/system quality
Lin *et al*., 2011	TAM	Empirical	Gambia	Perceived ease of use
Muraya, 2015	Infrastructure, policy, security, and social factors	Empirical	Kenya	Social factors, security factors, and policy factors
Rukiza *et al*., 2011	TAM	Empirical	Tanzania	Perceived usefulness; perceived trust
Yonazi, Sol and Boonstra, 2010	Perceived organisational preparedness, citizen preparedness, service intrinsic issues, access limitations, and organisational context	Empirical	Tanzania	Perceived organisational preparedness, citizen preparedness, service intrinsic issues, access limitations, and organisational context

Out of the 10 studies in Table 2.7, Bwalya and Healy (2010) and Jain and Akakandelwa (2014) presented conceptual models for e-government adoption in the context of SSA, while the others presented empirically-based studies. The numerous empirical studies conducted on e-government adoption in SSA indicated some vital factors that influence the adoption of e-government services. However, the findings have not been consistent. For example, Rukiza *et al*. (2011) found that the perceived usefulness dimension of the TAM model significantly influenced e-government adoption in Tanzania. Conversely to their finding, Komba and Ngulube (2015) established that the perceived usefulness dimension of the TAM did not have a significant influence on e-government adoption in Tanzania. Similarly, Bwalya (2011) and Lin *et al*. (2011) found perceived ease of use to have a significant influence on e-government adoption in Zambia and Gambia respectively. Conversely, Komba and Ngulube (2015) did not find perceived ease of use to have a significant influence on e-government adoption in Tanzania.

Such disparities in the findings could result from the fact that, although the existing studies in SSA have adopted the TAM and extended it with other factors, they have failed to take into account the role of interaction variables in the adoption of e-government services. The UTAUT, which has been known to be the most widely used model in e-government adoption (Weerakkody *et al.*, 2013; Zuiderwijk *et al.*, 2015), fully takes into account the role of interaction variables, yet, there is still scant information on the use of the UTAUT in e-government studies in SSA. For example, as previously mentioned, the influence of effort expectancy of the UTAUT (which is the equivalence of perceived ease of use in the TAM) on e-government adoption has been noted to be moderated by factors such as gender, age, and experience. Recent e-government models, like the EGAUM, which have been developed based on the TAM and the UTAUT, have also taken the role of moderating factors into consideration. Consequently, it is plausible to assume that the existing disparities in factors influencing e-government adoption in SSA can be addressed by using more robust models that incorporate the roles of moderating factors.

2.6.2. Significant outcomes and future directions

A summary of the key findings from SSA can provide direction to which models should be adopted or developed for use in SSA. Table 2.8 below summarises the key empirical findings on e-government adoption from SSA. From Table 2.8, it is evident that while no one e-government adoption model can capture all the significant factors affecting e-government development in SSA, the GAM and the EGAUM capture most of the factors.

Table 2.8: Significant factors influencing e-government adoption in SSA

Factor	**Studies**	**Relevant Models***
Awareness, perceived benefits, and compatibility	Asianzu & Maiga, 2012	GAM, EGAUM
Computer self-efficacy	Bwalya, 2011	GAM
Perceived ease of use	Bwalya, 2011; Lin *et al.*, 2011	TAM, UTAUT, DOI, PCI, GAM, EGAUM
Perceived security	Khanyako & Maiga, 2013; Muraya, 2015	GAM, EGAUM
Perceived trust	Bwalya, 2011; Khanyako & Maiga, 2013; Asianzu & Maiga, 2012; Rukiza *et al.*, 2011	GAM, EGAUM
Perceived usefulness	Rukiza *et al.*, 2011	TAM, UTAUT, EGAUM
Social influence	Komba & Ngulube (2015); Muraya, 2015	UTAUT, EGAUM
Website/system quality	Komba & Ngulube (2015); Muraya, 2015	EGAUM
**Relevant models are the existing e-government adoption models that can be used to capture the said factor (s).*		

The GAM captures most of the factors, except for social influence and website/system quality, while the EGAUM captures all the factors, except for computer self-efficacy. The prevalence of these two models is highly understandable given that they were developed in recent years based on the existing evidence and robust nature of studies that have been conducted with the other prior e-government adoption models. The EGAUM, for example, is based on the TRA, TAM, UTAUT, and DOI. Most e-government adoption studies to date in SSA have focused primarily on adopting and extending the TAM. However, there are novel models that have incorporated the TAM into more comprehensive e-government adoption models, such as the GAM and the EGAUM, which can be beneficial for use in SSA. It is, therefore, imperative to test these existing models in the context of SSA, given that both were developed in regions other than SSA. Combining the factors from two models (GAM and EGAUM), which have shown significant influence on e-government adoption, can provide a more comprehensive e-government adoption model for SSA.

In examining e-government adoption models, several researchers (Rukiza *et al*., 2011; Shareef *et al*., 2011) have argued that e-government adoption varies across different e-government maturity stages. The next section examines existing literature in terms of e-government maturity.

2.7. E-Government Maturity Models

In order to monitor and benchmark the level of e-government development, many researchers have proposed several types of e-government models, generally termed e-government maturity models. Fath-Allah *et al*. (2014) provided a good overview of 25 e-government maturity models. These models indicate different stages of e-government development. E-Government maturity models usually serve as a means to rank e-government portals based on several stages, from basic level websites to more advanced online services.

Because of the changing nature of e-government over the years, researchers have developed many different e-government models that tried to provide a means of benchmarking e-government development in a given context and point in time. Table 2.9 below summarises these existing e-government maturity models in prior literature. Of all the listed models in Table 2.9, the most renowned model is the Layne & Lee (2001) model, as it has received the most attention in existing e-government literature (Andersen & Henriksen 2006; Ngwenya, 2014; Heeks, 2015; Lee, 2010). However, like the other e-government maturity models, this model also faces many challenges in capturing the changing nature of e-government (Heeks, 2015). As such, there has been a call for the development of e-government models that can provide a fully comprehensive two-dimensional space within which e-government can easily mature and be traced (Heeks, 2015).

Table 2.9: E-government maturity models

Maturity Model	Year	Number of Stages	Names of stages in order of maturity
Accenture	2003	5	Online presence; Basic capability; Service availability; Mature delivery; Service transformation.
Alhomod, Shafi, Kousarrizi, Seiti, Teshnehlab, Susanto, and Batawi	2012	4	Presence on the web; Interaction between the citizen and the government; Complete Transaction over the web; Integration of Services.
Almazan and Gil-Garcia	2008	6	Presence; Information; Interaction; Transaction; Integration; Political Participation.
Andersen and Henriksen	2006	4	Cultivation; Extension; Maturity; Revolution.
Cisco	2007	3	Information interaction; Transaction efficiency; Transformation citizen centric.
Chandler and Emanuel	2002	4	Information; Interaction; Transaction; Integration
Chen, Yan and Mingins	2011	3	Catalogue; Transaction; Vertical integration
Deloitte and Touche	2000	6	Information publishing; Official-two way Transactions; Multipurpose portals; Portal Personalization; Clustering of common services; Full integration and enterprise transaction
Gartner group	2000	4	Web presence; Interaction; Transaction; Trans-formation
Hiller and Belange	2001	5	Information; Two way communication; Transaction; Integration; Participation.
Howard	2001	3	Publish; Interact; Transact
Kim and Grant	2010	5	Web presence; Interaction; Transaction; Integration; Continuous improvement.

Maturity Model	Year	Number of Stages	Names of stages in order of maturity
Layne and Lee	2001	4	Catalogue; Transaction; Vertical integration; Horizontal integration.
Lee and Kwak	2012	5	Initial conditions; Data transparency; Open participation; Open collaboration; Ubiquitous Engagement.
Moon	2002	5	Simple information dissemination; Two-way communication; Service and financial transactions; Integration; Political participation.
Siau and Long	2005	5	Web presence; Interaction; Transaction; Transformation; E-democracy.
Shahkooh, Saghafi, and Abdollahi	2008	5	Online presence; Interaction; Transaction; Fully integrated and transformed e-government Digital democracy.
Reddick	2004	2	Cataloguing; Transactions
The UK National Audit	2002	5	Basic site; Electronic publishing; E-publishing; Transactional; Joined-up e-governance
UN	2012	4	Emerging information services; Enhanced Information services; Transactional services; Connected services.
Wescott	2001	6	Setting up an email system and internal network; Enabling inter-organisational and public access to Information; Allowing 2-way communication; Exchange of value; Digital democracy; Joined-up government.

Maturity Model	Year	Number of Stages	Names of stages in order of maturity
West	2004	4	Bill-board; Partial-serviced delivery; Portal; Interactive democracy.
Windley	2002	4	Simple Website; Online government; Integrated Government; Transformed government
World Bank	2003	3	Publish; Interact; Transact.

However, UNDESA (2014, p. 14) argued that “the view of an e-government maturity model no longer holds as e-government goals are constantly evolving to meet emerging challenges and increase public value.” Governments are now adopting several disruptive technologies in an adaptive and scalable manner to deploy a portfolio of e-services that span functions, business units, geographies, and different local and municipal levels (UNDESA, 2014). Consequently, researchers (Cordella & Bonina, 2012; Hui & Hayllar, 2010; Karkin & Janssen, 2014; Karunasena & Deng, 2012; Sufna & Fernando, 2016) are continuously interested in understanding the public value perspective of e-government to better e-government development and delivery of e-government services/solutions that citizens want to adopt and use.

2.8. Public Values Perspective of E-Government

As highlighted above, the view of e-government maturity is considered obsolete with more emphasis now being placed on providing public value (UNDESA, 2014 & 2016). Public value, in general, can be seen as the overall value that is created by a government for its different stakeholders (e.g. citizens and businesses) through the delivery of public services, enactment of legislations, and other government undertakings (Karunasena & Deng, 2012). Also, public value has been defined as “context-specific preferences of individuals concerning, on the one hand, the rights, obligations, and benefits to which citizens are entitled, on the other hand, obligations expected of citizens and their designated representatives” (Bozeman, 2007, p. 13). According to Cordella and Bonina (2012), no single definition of public value encompasses all that public value entails. As such, in the domain of e-government, public values creation is generally referred to as the public values perspective of e-government (Hui & Hayllar, 2010; Karkin &

Janssen, 2014; Karunasena & Deng, 2012). The public values perspective of e-government can be seen as government's use of ICTs to increase the delivery of services that the public wants (UNDESA, 2016).

E-government researchers over the years mostly preferred using the term "public values" instead of simply "public value", as the e-government perspective of public values represents a set of numerous different values (Jorgensen & Bozeman, 2007; Karkin & Janssen, 2014). Following these prior e-government studies, the subsequent sections of this study will use the term "public values". For the context of this study, the public value perspective of e-government is limited to public values associated with e-government websites. One of the most widely recognised public value of e-government websites is the accessibility of the websites (Jorgensen & Bozeman, 2007; Karkin & Janssen, 2014; Karunasena, Deng & Singh, 2011). Website accessibility refers to the capability of making websites accessible to a wide array of possible users regardless of their technical aptitude or possible disabilities, thus ensuring that all users have equal access to information and functionality (Olalere & Lazar, 2011; Reis, Barroso & Goncalves, 2013). E-government websites are, therefore, expected to be inherently accessible, as their primary goal is to provide government services and information to the general public without any exceptions (Kopackova, Michalek & Cejna, 2010). The concept of website accessibility is further developed in Chapter 3 (Section 3.4.4) as it forms an integral part of e-government usability.

Other key public values of e-government website dimensions include citizen engagement, development of trust (i.e. transparency/openness and security/privacy), responsiveness, dialogue, and the quality of information and services (Karkin & Janssen, 2014; Karunasena & Deng, 2012). These public values of e-government websites are described below.

- **Citizen engagement** entails the ability of a website to provide content and interactive capabilities that facilitate citizen participation in civic life (Coleman, Lieber, Mendelson & Kurpius, 2008; Karkin & Janssen, 2014). Citizen engagement via e-government websites encompasses the tools available on the website through which citizens can use to interact with government entities, such as satisfaction questionnaires and tools for submitting requests, such as policy proposals and citizen feedback on government initiatives.

- **Development of trust** is a composite dimension of e-government public value perspective as trust can be gained in numerous ways. However, two commonly used public value dimensions of development of trust are transparency/openness and security and privacy (Karkin & Janssen, 2014; Karunasena & Deng, 2009; Ha, 2016).
    - ***Transparency/openness*** broadly refers to aspects of an e-government website that can allow citizens to gain trust in the government. This includes aspects like the dissemination of vital information, such as online tenders, live broadcast of meetings, financial statements of government agencies/departments, legislative information, policy strategy, regular reports of government activities and projects, contact information of public officials, and ability for citizens to submit complaints online (Bertot, Jaeger & Grimes, 2010; Karkin & Janssen, 2014; Karunasena & Deng, 2012).
    - ***Security and privacy*** refer to how well governments are able to secure public information and maintain the privacy of citizens' personal information and other confidential information (Ha, 2016). Ensuring the security and privacy of citizen information is vital in maintaining trust, as citizens will not adopt and use e-government websites that pose a security threat to their privacy (Bwalya, 2011; Khanyako & Maiga, 2013).
- **Responsiveness** in e-government websites describes how well governments respond to communication and other interaction from citizens (Karkin & Janssen, 2014). This could include automated responses to emails and online submissions, tracking capabilities (e.g. tracking the status of an online application), and response to online inquiries (Karunasena & Deng, 2012). Also, the use of social media by governments has emerged in recent years as a valuable means of government responsiveness (Dekker & Bekkers, 2015; Lorenzi *et al*., 2014; Panagiotopoulos, Barnett & Brooks, 2013). Social media is mostly used by governments because of its ability to reach many citizens easily and speedily (Kumar, Singh & Gupta, 2016). It is common nowadays to find governments incorporating links of their official social media handles on their websites or even incorporate the social media plugins into their web pages to also display their social media communication via their e-government websites.

- **Dialogue** encompasses the ability of e-government websites to provide tools that capture citizen comments as well as options for citizens to subscribe to government information and receive regular updates (Karkin & Janssen, 2014). There are similarities between citizen engagement and dialogue. However, Karkin and Janssen (2014) noted that the key difference is that citizen engagement focuses on a broader set of functions, while dialogue is based on capturing online comments.
- **Quality of information** encompasses the accuracy, timeliness, and importance of the information on government websites, while the **quality of services** focuses on the availability of interactive online services, applications with online payment capabilities, and ability for citizens to download forms (Karunasena & Deng, 2012).

The increasing need to deliver public values via e-government initiatives has created a growing interest from researchers in evaluating the public values of e-government websites (Karkin & Janssen, 2014; Karunasena & Deng, 2012; Sufna & Fernando, 2016). Most public values of e-government websites highly overlap with the concept of e-government usability as operationalised in prior e-government studies (Baker, 2009; Bouazza & Chebli, 2016; Dan, Yahel & Nitzan, 2013; Kaan, 2007; Roach & Cayer, 2010). As such, the fact that a public value perspective is taking centre stage in e-government development supports the existing views that usability plays a central role in e-government advancement. The concept of e-government usability is discussed in the next chapter.

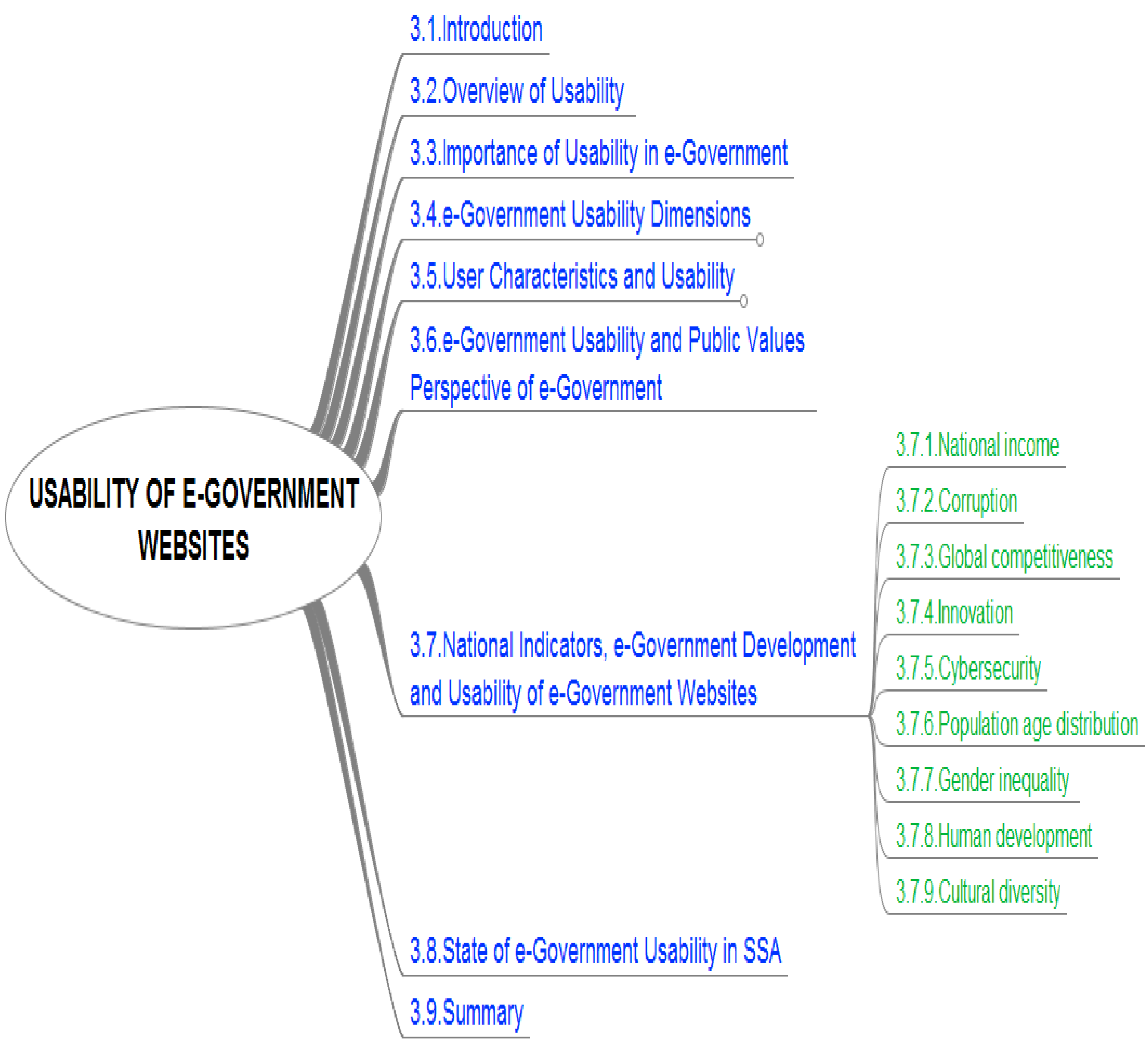
2.9. Summary

This chapter provided a background description of SSA, including a graphical representation of the region. Next, an overview of e-government and the state of e-government development in SSA were presented to equip the reader with the regional context on which this study is based. A detailed review of existing e-government adoption models was presented in order to understand the factors that affect e-government adoption, as successful e-government initiatives depend on their adoption and usage. Also, lessons learnt from e-government adoption models were highlighted, with specific emphasis on SSA. This resulted in identifying the factors that affect e-government development in SSA and the possible e-government models (i.e. GAM and EGAUM) that could be used to study and understand the adoption and utilisation of e-government solutions/services in SSA. Moreover, the concept of e-government maturity models was presented along with the shifting views towards government's focus on creating public value. Lastly, the public value perspective of e-government was presented with a focus on the public values created via e-government websites.

A review of the factors influencing e-government in SSA showed that usability played an influential role in fostering the adoption and usage of e-government solutions/services in SSA. Several researchers (Huang & Brooks, 2011; Bwalya, 2009; Venkatesh et al., 2014) have emphasised the significant role of usability on e-government adoption. Additionally, dimensions of the public value perspective of e-government websites were noted to overlap with existing e-government website usability dimensions operationalised in prior studies (Baker, 2009; Roach & Cayer, 2010). With usability being a key cause of e-government failures in SSA (Asiimwe & Lim, 2010; Bwalya & Healy, 2010; Kirui & Kemei, 2014), it is imperative to understand the state of e-government usability in SSA and how it can be enhanced to better increase the adoption and usage of e-government solutions. Consequently, the next chapter is dedicated to the topic of e-government usability.

CHAPTER THREE

USABILITY OF E-GOVERNMENT WEBSITES



3.1. Introduction

Chapter 3 presents the underlying nature of e-government usability. The chapter commences with an overview of usability and concise background on the concept of usability. Following this, the importance of usability in the domain of e-government is outlined. The chapter also provides a detailed review of the different dimensions of e-government usability and a review of the association between user characteristics and usability. Additionally, the overlap between e-government usability and public values of e-government websites is described. Moreover, national indicators with a pertinent association with e-government development and the usability of e-government websites are discussed. The chapter concludes with a discussion on the state of e-government usability in SSA.

3.2. Overview of Usability

Usability has been increasingly recognised as an indispensable aspect of the design and development of software and systems for use in all domains, including business, government, education and research (Hammond, Gross & Wesson, 2002). Usability is one of the central concepts in the field of Human-Computer Interaction (HCI). The concept of usability can be traced to the notion of "user friendliness", which was introduced in the domain of HCI by Bevan, Kirakowski, and Maissel (1991). Since then, several definitions of usability have been presented in HCI literature. The most widely adopted definition of usability is provided by the International Standards Organisation (ISO). The ISO 9241-11 defines usability as "the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use" (ISO/IEC, 1998). The ISO definition of usability is broadened and illustrated in Figure 3.1 below.

Usability also broadly refers to the ability of users to learn, comprehend, and operate a software product while also considering it attractive (Fernandez, Insfran & Abrahão, 2011). Chou and Hsioa (2007) viewed usability as the degree to which a computer and a user can clearly interact via the computer interface. Krug (2014) argued that usability simply means the ability to make something work well, such that someone with average or even below average ability and experience can be able to use it smoothly without being frustrated.

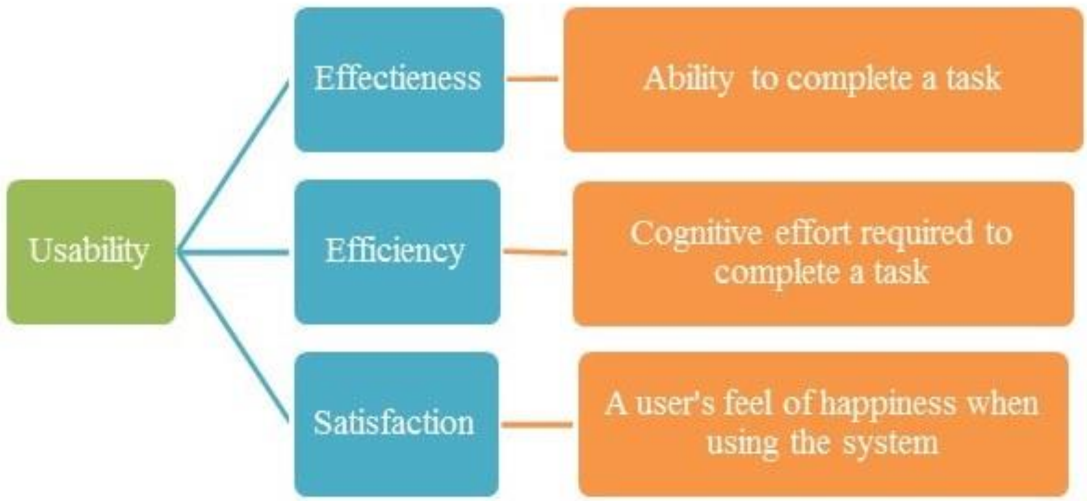


Figure 3.1: ISO Usability Dimension

Another important view of usability was presented by Nielsen (1994) in which he explained usability as the quality attribute of a system that examines how easy it is to use the system. Nielsen (2012) further defined usability in terms of five key quality components as indicated in Figure 3.2 below.

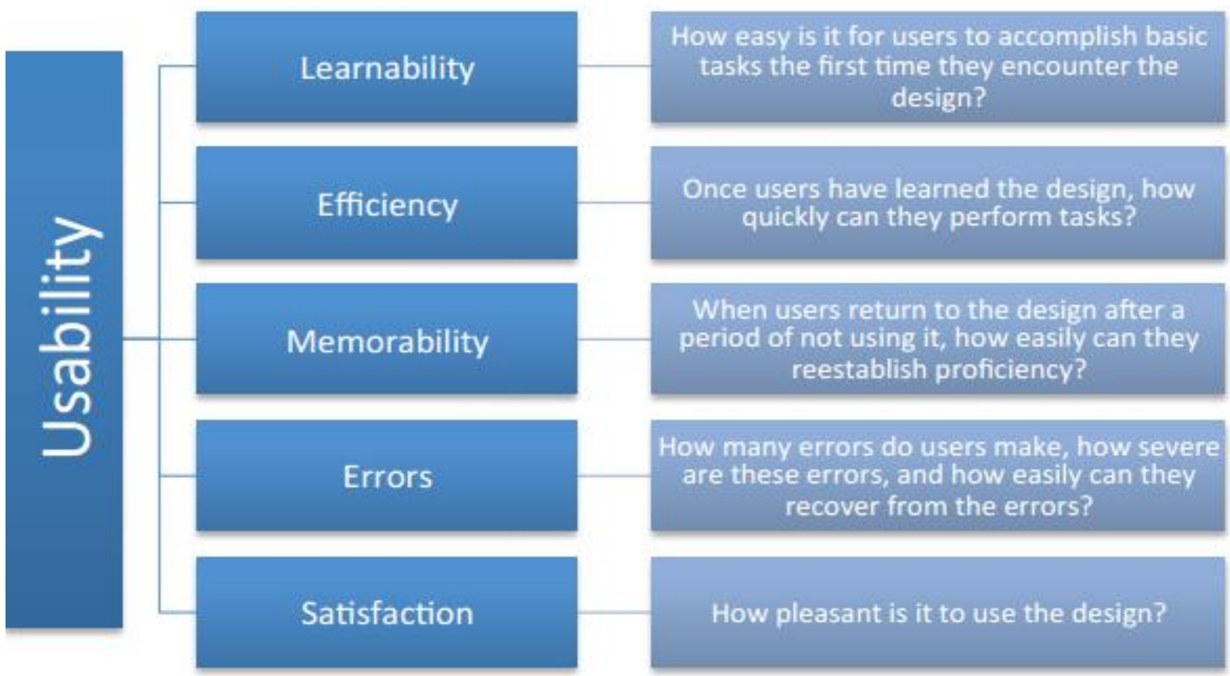


Figure 3.2: Five Quality Components of Usability (Source: Cai, 2010, p. 25)

Although researchers have come up with various components in the past, five quality components of usability, as suggested by Nielsen (2012) and widely used, play a vital role in determining the usability of a system. However, it is important to acknowledge the fact that not all users will perform at the same level with a given system. For example, the number of errors a third-year Computer Science student can commit while interacting with an e-government system might be smaller compared to the errors made on the same system by an elderly person with no computer experience. Because such disparities are bound to happen, good usability is often considered to be the general scenario in which a system can be used by the majority of users regardless of their human abilities (Alfawwaz, 2012; Carmien & Mohamad, 2008). Additionally, the remaining portion of users should be able to complete tasks successfully on the system with minimal assistance.

This concept of making systems usable to the majority of users is vital for systems such as e-commerce websites and e-government websites that often have a wide and diverse variety of users. This is often referred to as inclusive design, and usability is a central part of inclusive design. Inclusive design is defined as the design of artefacts that are accessible and usable to a wider as possible group of users without the need for special design or adaptation (British Standard Institute, 2005; Cremers, Jansen, Neerinex, Schouten & Kayal, 2014). Nordby (2003) provided a usability pyramid model (Figure 3.3) that is depicted using the inclusive design concept to ensure that ICT solutions are accessible to as many people as reasonable possible.

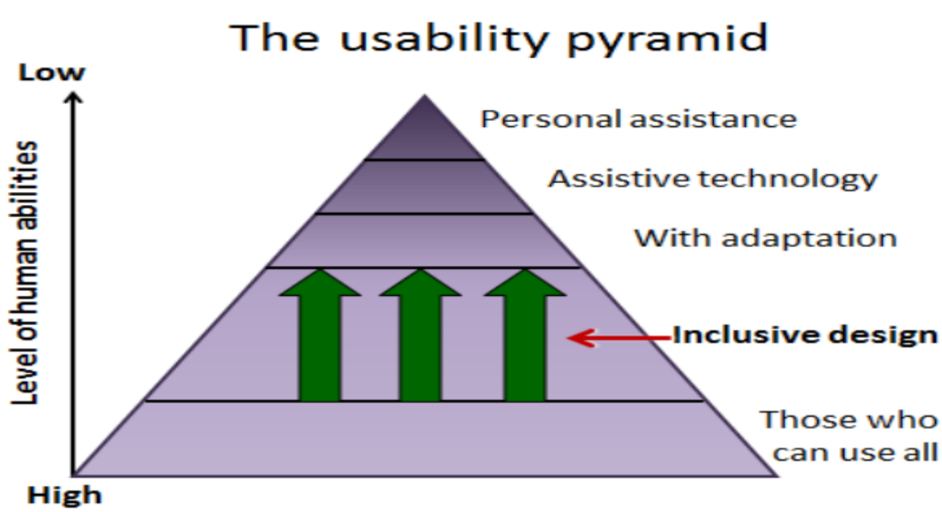


Figure 3.3: The usability Pyramid (Source: Nordby, 2003)

Since the fundamental definitions of usability often generalise the system being examined, researchers in different domains habitually adopt the existing standard definitions and customise them accordingly to define the specific kind of system or product under investigation. For example, Baker (2009) defined website usability as the comparative ease with which an inexperienced user can manoeuvre an actual website and successfully complete a given task.

Harvey, Stanton, Pickering, McDonald and Zheng (2011) define the usability of in-vehicle information systems (IVIS) based on thirteen usability criteria relevant to the specific context of IVIS. In the e-government domain, Venkatesh *et al.* (2014) defined e-government website usability as the degree to which an e-government website can be utilised by citizens to achieve stated goals with effectiveness, efficiency, and satisfaction in a specified e-government service context. The next section presents the importance of usability in e-government

3.3. Importance of Usability in E-Government

Researchers (Ansari et al., 2016; Donker-Kuijer et al., 2010; Venkatesh *et al.*, 2014) have argued that usability remains one of the most important concepts in assessing the success of an e-government website. Usability plays an important role in e-government because it affects the acceptance and usage of e-government systems by citizens, and also influences their day to day interaction with e-government websites (Clemmensen & Katre, 2012). This has been continuously shown in e-government adoption literature where ease of use has been shown to play a significant role in e-government adoption and utilisation. For example, as mentioned before, ease of use was shown to be one of the most critical factors in the adoption of e-government services in Malaysia (Boon *et al*., 2013). Likewise, researchers in SSA (Bwalya, 2011; Lin *et al*., 2011) have found the ease of use to be a significant factor that influences the adoption and usage of e-government services in the region.

When users find it difficult to easily navigate an e-government website and to complete the task they intended to perform successfully, they are likely to lose interest in the system and never return to use it again because of their initial negative experiences (AlFawwaz, 2012; Baker, 2009). It is for such reasons that usability has been noted to be vital for the survival of websites (Nielsen, 2003), of which e-government websites are no exception (Alfawwaz, 2012; Donker-

Kuijer *et al.*, 2010). Baker (2009) argued that if e-government websites were not optimally designed from a usability perspective, they were likely to prevent less knowledgeable citizens from having satisfactory contact with their government and this will stifle the advancement of e-government.

Additionally, usability is vital in enhancing citizens' trust in e-government (Youngblood & Mackiewicz, 2012). This is important because as citizens' trust in e-government websites increase, they will increase their frequency of visiting these websites, thus enhancing governments' responsiveness. This would, consequently, result in more process-related trust between citizens and government (Tolbert & Mossberger, 2006). Teo, Srivastava, and Jiang (2008) highlighted that where there was no trust in e-government, users would revert to using traditional approaches of interaction with government and this will negatively affect the progress of e-government. This is also supported by existing empirical evidence (Asianzu & Maiga, 2012; Bwalya, 2011; Khanyako & Maiga, 2013; Rukiza *et al.,* 2011) which indicates trust as a key factor that influences the adoption of e-government.

Usability also plays a vital role in improving user performance and satisfaction with e-government (Zhao & Benyoucef, 2014). Horan, Abhichandani, and Rayalu (2006) elucidated that simply providing government services to users online was not enough. It is also imperative to ensure that the delivery of the e-government services satisfies the user. User satisfaction with e-government has also been recognised as a critical factor that influences the repeated utilisation of e-government services and is also critical as a determinant of the success or failure of e-government initiatives (Alawneh, Al-Refai & Batiha, 2013). Since user satisfaction is highly dependent on the effectiveness and efficiency of the e-government system, it is, therefore, evident that usability is a vital precondition for the success of e-government initiatives.

Lastly, e-government can only thrive if its services are useful to citizens (Rukiza *et al.*, 2011). The role of usefulness is particularly important here because of the fundamental relationship between usefulness and usability. Early usability researchers (Davis 1989; Lund 2001) developed standardised usability measures for examining the perceived usefulness of systems. These researchers presented usefulness as a component of usability. However, evolving research in HCI has now widely recognised usefulness as a composite concept, composing of two dimensions namely usability and utility (Li, 2007; Nielsen, 2012; Wechsung, 2013; Monoharan & Holzer, 2012). Utility basically refers to whether or not a system provided the features or functionalities that users require (Nielsen, 2012). The concept of utility and usability are highly interdependent as one can hardly play a vital role in the success of a system without the other. To be more precise, Siegal and Dray (2005, p.58) explicated that "utility requires usability, and usability is meaningless unless it is usable for something worthwhile." As such, it is not surprising that usefulness and usability are highly interdependent (Buchanan & Salako, 2009). Existing e-government literature (Horst *et al.*, 2007; Lean *et al.*, 2009; Lin *et al*., 2011; Rukiza *et al*., 2011; Shajari & Ismail, 2013) has shown that perceived usefulness is one of the significant factors that affect the adoption of e-government solutions. The fact that usefulness is highly dependent on usability further necessitates the need for usability of e-government systems as a means of fostering e-government adoption.

As a consequence of the above discussion, it is reasonable to accentuate that good usability remains imperative for the survival and success of e-government initiatives. The only way for e-government initiatives to succeed is for users to adopt and use the developed e-government systems. When this fails to happen, the development and progress of e-government stifles and fails. Since usefulness is noted to be dependent on usability, and both usability and usefulness have been identified as key factors that significantly influence the adoption and utilisation of e-government systems, advancing e-government usability, therefore, becomes imperative. In order to clearly delineate the context of e-government usability, Section 3.4 discusses the different dimensions of e-government usability as the basis for benchmarking and advancing e-government usability.

3.4. E-Government Usability Dimensions

Measuring usability often involves specific users conducting specific tasks in a specific context. The concept of usability is composed of multi-faceted dimensions in which certain dimensions are only suitable in a given context. Any given dimension of usability needs to be evaluated for suitability in any given context before being used in that context. The context is based on how the system is used and the circumstances surrounding its usage. Moreover, in a specific context, a given usability dimension might be more or less important (Chamorro-Koc, Popovic, Emmison, 2008; Harvey *et al.*, 2011).

Consequently, this study focused only on the range of usability dimensions relevant to e-government. Additionally, the method of usability evaluation also determines the type of dimensions that can be covered, as some usability issues can also be examined by user testing, while others could be examined by expert-based methods. As indicated earlier, usability evaluation in this study is based on heuristic evaluation and automated testing. As such, it was important to consider usability dimensions that were suitable for e-government and could be evaluated via heuristic evaluation and automated testing.

Extant literature on the usability of e-government websites has mostly focused on two well-formulated sets of heuristics, namely Nielsen's usability heuristics (Nielsen, 1994; Nielsen & Molich, 1990) and the six-dimensional framework (Baker, 2009). The heuristics initially developed by Nielsen and Molich (1990) and further refined by Nielsen (1994), have been widely published and used for usability evaluation. These heuristics consist of 10 items that were primarily developed for the usability evaluation of user interfaces. These items include the visibility of system status, match between system and the real world, user control and freedom, consistency and standards, error prevention, recognition rather than recall, flexibility and efficiency of use, aesthetic and minimalist design, help users recognise, diagnose, and recover from errors, and help and documentation (Nielsen, 1994).

However, since its creation over two decades ago, these heuristics have been shown to be applicable to a wide range of ICT systems (Donker-Kuijer *et al*., 2010; Huang & Brooks, 2011). Nonetheless, researchers over the years have increasingly found the need to modify or extend the original Nielsen heuristics in order to increase their applicability in different contexts, including e-government websites (Ansari et al., 2016; Chotisarn, Plengvittaya, Sanpote & Ratchakom, 2016; Delopoulos, 2015; Garcia et al., 2005; Huang & Brooks, 2011; Mahajan, 2012).

Unlike the Nielsen heuristics, the six-dimensional framework was developed specifically for heuristic evaluation of e-government websites (Baker, 2009). The development of this framework was based on the aggregation of numerous usability variables over the years (Baker, 2004, 2007 & 2009; Roach, 2007; Stowers, 2002). This framework was first introduced by Stowers (2002) and later modified by Baker in 2004, 2007 and 2009.

This framework is illustrated in Figure 3.4 below. The dimensions included in the framework are online services, user-help and feedback, legitimacy, navigation, accessibility, and information architecture (Baker, 2004, 2007 & 2009; Bouazza & Chebli, 2016; Cai, 2010; Dan *et al.*, 2013; Kaan, 2007; Roach, 2007; Roach & Cayer, 2010; Stowers, 2002; Youngblood & Mackiewicz, 2012).

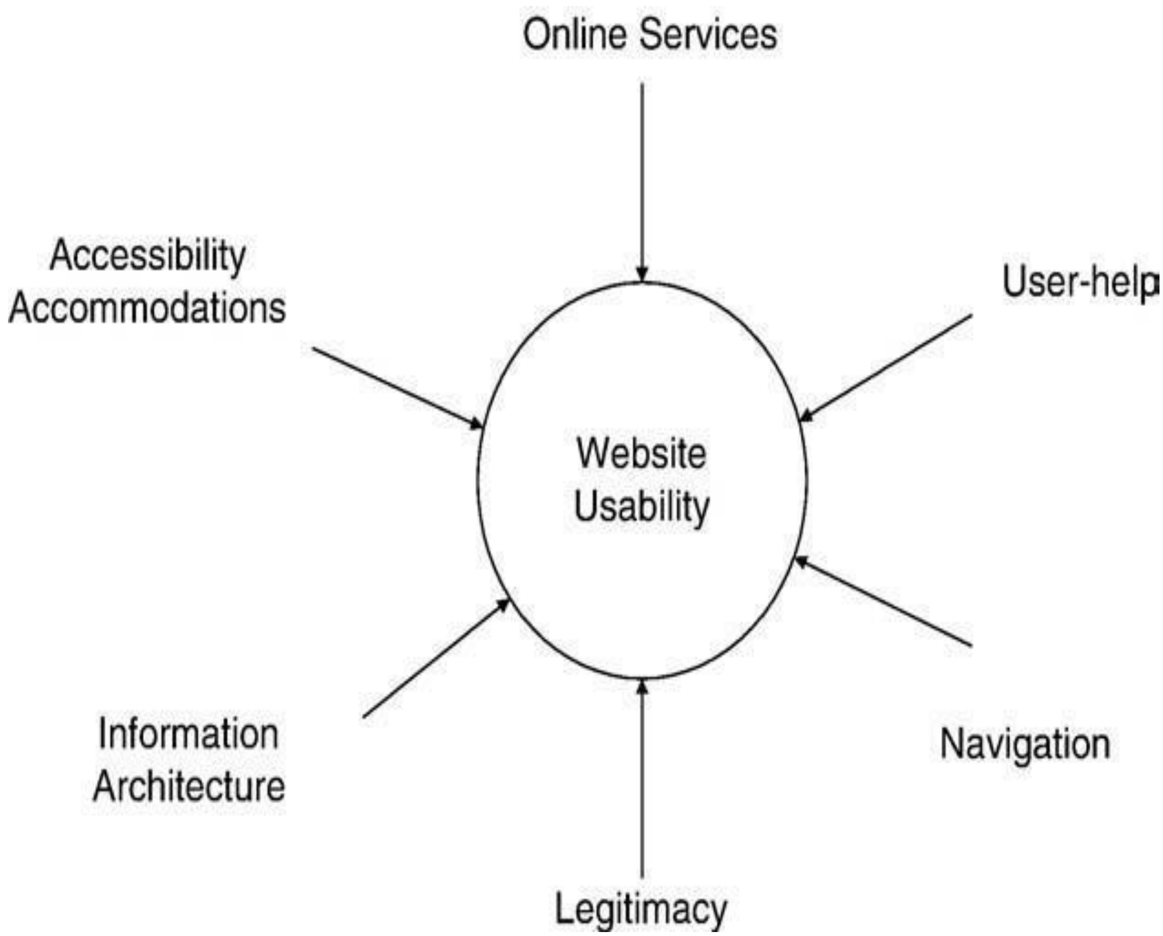


Figure 3.4: Six-dimensional usability framework (Source: Baker, 2009, p. 84)

Even though not all e-government website usability studies have directly followed this six-dimensional framework approach as provided in Figure 3.4, the different usability heuristics that such studies adopted (e.g. Al-Khalifa, 2010; Al-Soud & Nakata, 2011; Asiimwe & Lim, 2010; Byun & Finnie, 2011; Eidaroos, Probets & Dearnley, 2009; Harfoushi *et al.*, 2012; King &

Youngblood, 2016; Kinsell & DaCosta, 2014 Kituyi & Anjoga, 2013; Maheshwari, Kumar, Kumar & Sharan, 2007; Venkatesh *et al.*, 2014) were often subsets of these six dimensions, as can be seen in Table 3.1.

Table 3.1: E-government website usability studies that used heuristics associated with the sis-dimensional framework

Study	**Dimensions associated with selected heuristics**	**Usability evaluation method**
Al-Khalifa (2010)	Navigation, user-help & feedback	Heuristic evaluation
Al-Soud & Nakata (2011)	Accessibility accommodation, navigation, online services, user-help & feedback	Automated testing and content evaluation
Asiimwe & Lim (2010)	Legitimacy, User-help & feedback	Feature inspection
Baker (2007)	All six dimensions	Heuristic evaluation
Bouazza & Chebli (2016)	All six dimensions	Heuristic evaluation
Byun & Finnie (2011)	Navigation, online services, user-help & feedback	User testing
Cai (2010)	All six dimensions	Heuristic evaluation
Dan *et al*. (2013)	All six dimensions	Heuristic evauation
Eidaroos et al.(2009)	Accessibility accommodation, legitimacy, navigation, online services, user-help & feedback	Heuristic evaluation
Harfoushi *et al*. (2012)	Information architecture, navigation, user-help & feedback	Heuristic evaluation
King & Youngblood (2016)	Accessibility accommodation, user-help & feedback	Heuristic evaluation and automated tetsting
Kinsell & DaCosta (2014)	Navigation, online services, user-help & feedback	Usability checklist
Kituyi & Anjoga	Accessibility accommodation, navigation,	Usability survey

(2013)	online services, user-help & feedback	
Maheshwari *et al*. (2007)	Accessibility accommodation, legitimacy, navigation, online services, user-help & feedback	Conceptual model
Roach & Cayer (2010)	All six dimensions	Heuristic evaluation
Roach (2007)	All six dimensions	Heuristic evaluation
Venkatesh *et al*. (2014)	User-help & feedback	User suervey based on selected heuristics
Youngblood & Youngblood (2013)	Accessibility accommodation, navigation	Heuristic evaluation and automated testing

The comprehensiveness of the six-dimensional framework and its specific focus on e-government website usability makes it a suitable theoretical framework for evaluating the usability of e-government websites in SSA. Additionally, Web Content Accessibility Guidelines (WCAG) 2.0 incorporated Nielsen's heuristics (Moreno, Martinez & Ruiz-Mezcua, 2009). Therefore, if the accessibility dimension of the six-dimensional framework is evaluated based on the WCAG 2.0 standard, then Nielsen's heuristics would have been incorporated into the six-dimensional framework. In this way, the two most widely used heuristics for e-government website evaluation would have been taken into account. Consequently, this study focused on the six-dimensional framework for examining e-government usability, with the accessibility dimension based on the WCAG 2.0 standard. Each of these factors is discussed below.

3.4.1. Navigation

Navigation is the attribute of an e-government website that allows a user to explore the website towards specific locations. Navigation can also be viewed as the ability of users to efficiently and effectively access and find information within a system (Venkatesh *et al*., 2014). With e-government websites, this often includes clicking on the different hyperlinks to access e-government services and information. It is imperative to ensure that websites are designed with organised menus through which users can easily navigate (Lee & Kozar, 2012; Venkatesh *et al*., 2014). Shelly, Napier, and Rivers (2009) explicated that when the navigation system of a website is well designed and easy to understand, it enables visitors to the website to become more engaged with the website and explore the different web pages to obtain the information or services that will satisfy their needs and expectations. Good website navigation is known to be user friendly because it enables the users to easily determine where they currently are on the system, the sections which they have already visited, and the areas of interest they might want to explore next (Baker, 2009; Bishop, Shuman & Vodnik, 2015; Nielsen & Pernice, 2010). Stowers (2000) elucidated that good navigation of a website makes it easy for website visitors to determine quicker routes to access the services they require.

Some of the notable variables that have been used by researchers (Baker, 2009; Kaan, 2007; Stowers, 2002; Roach & Cayer, 2010) in examining the navigation of e-government websites include e-government services, links to contact information, links to other agencies and navigation tools. These navigation variables are presented in Table 3.2.

Poor navigation is one of the factors that have been noted to plague e-government websites around the globe (Zhao & Benyoucef, 2014). When information and e-services are uploaded into e-government websites, they are meant for public consumption and so the purpose of these systems will be defeated if users are unable to access the information and e-services.

Table 3.2: Navigation variables

Navigation Variables	**Operational Definitions**
E-government services	E-government services enabled through direct links to execute various online functions or transactions
Link to contact information	Direct links readily available to e-mail host agency
Link to other agencies	Ability to directly make contacts through links with other government agencies
Navigation tools	The number of navigation tools provided to the user.

Source: (Dan *et al.*, 2013)

Additionally, e-government systems will not be useful to citizens if they are unable to find the information they require from these websites. Consequently, the development of e-government will be impeded as citizens will prefer to go to the physical government offices to access the e-government services and information that they require.

It, therefore, remains important to always evaluate the navigation of e-government websites and to ensure that it is well designed to easily facilitate the discovery and access of information by users. Good navigation will serve as a roadmap that users can follow to manoeuvre through the e-government websites and thus increase the users' overall browsing experience.

3.4.2. User-help and feedback

User help and feedback is the usability dimension that supports a user's usage of the system by providing assistance on how to use the system and how to access the required information and services. Factors that have been attributed to user help and feedback in prior literature (Baker, 2009; West, 2004) include information about the site, e-mail us, feedback, foreign language, index, personal digital assistant (PDA)/wireless, and search. These variables are explained in Table 3.3 below.

Table 3.3: User-help & feedback variables

User Help & Feedback	Operational Definition
About the site	Elementary data link about the site, designed for novice user
E-mail us	Self-addressed e-mail template for site help
Feedback	Site comment link
Foreign language	Translation site version(s) for non-native users
Index	Novice oriented, site alpha information listing
PDA/wireless	Mobile internet device access capability
Search	Specific site content locator

Source: (Baker, 2009)

The inclusive assumption of e-government websites entails ensuring that citizens with different ICT skills and abilities are all potential users of the websites. As such, it becomes necessary for e-government websites to incorporate adequate help and feedback features to guide novice users.

According to Roach and Cayer (2010), it is vital for all government websites to have helpful information that can provide users with step by step guidance as they use the website.

Without the availability of user help and feedback, users become easily frustrated when they encounter problems with the website (Baker, 2009). This happens when they are unable to determine how to resolve the issues they encounter while trying to access or use e-government services. An e-government website with good usability needs to have a visible online help function on all the web pages (Huang & Benyoucef, 2014). Likewise, the search functionality needs to provide precise information along with helpful clues to support user searches (Venkatesh *et al*., 2014).

Providing user help and effective feedback are vital to ensure that users stay engaged with the website. Accessing e-government services have the advantage of being available 24/7. However, if users cannot have help 24/7 then they might not effectively or efficiently use the system after working hours when there is no one at the office to respond to real-time queries. Nonetheless, user help on e-government websites could additionally provide a self-help approach to allow users to easily learn how to overcome any issues they are facing with the system.

3.4.3. Online services

The online services dimension of e-government usability concentrates on the value of the content and information available to users, as well as the ability of users to complete a required task on the website. Baker (2009) describes the online services dimension as the task that e-government users can complete electronically via an e-government website 24/7 using the internet. The type of online services provided by an e-government website is very important as it determines the perceived value of the website.

For example, an e-government website that allows users to file tax returns online will have a higher value than one which only provides information about taxes and still requires users to queue at the tax offices to manually complete tax returns and file their tax claims. Leist and Smith (2014) showed that user satisfaction with online e-government services was considerably greater than was the case with paper-based services.

Table 3.4: Online Services variables

Online Services variables	**Operational Definitions**
Basic information	Elementary data identifying website and host agency
Chat areas/message boards	User venue(s) for communication-oriented/organised around a common interest
Communications with officials	Contact information for elected and management individuals responsible for agency
Documents/publications	Official printable material from host agency
Downloadable forms	Printable on user demand for official business
E-commerce applications	Individual commerce and citizen transactional
E-mail updates	Registration for e-mail update service for user interest items
Employment information	Online access to public job information on demand
Interactive databases	Online access to public databases on demand
Interactive forms	Online form completion and submittal on demand
Multimedia applications	Online access to videos, or audio clips on demand

Source: (Dan *et al.*, 2013)

Researchers (Baker, 2009; Holzer & Kim, 2004; Roach & Cayer, 2010; Stowers, 2002; West, 2006) have outlined some of the variables associated with this dimension to include basic information, chat areas/message boards, communications with officials, documents/publications, downloadable forms, e-commerce applications, e-mail updates, employment information, interactive databases, interactive forms, and multimedia applications. The operational definitions for these online services variables are presented in Table 3.4 above.

The list of online services in Table 3.4 encompasses a generic set of services that users access on an e-government website. Roach and Cayer (2010) emphasise that users access e-government websites mainly to access information and services. As such, it is imperative for the online services provided by governments to offer real value to the users. For e-government websites to have a real value for the users, the users need to be able to access the online services they need (Baker, 2009). This is an attribute of perceived usefulness of e-government services that has been widely operationalised as a key dimension in the e-government adoption literature. The type and number of online services provided by an e-government website determine the value and potential usefulness of the website to citizens. This is particularly important for e-government as the perceived usefulness of e-government websites have a positive influence on user adoption and use of e-government services (Horst *et al.*, 2007; Lean *et al.*, 2009; Lin *et al.*, 2011; Rukiza *et al*., 2011; Shajari & Ismail, 2013).

Even though the dimension of online services can include a wide range of e-government services, the key goal is to ensure that the provided services offer real value to the citizens in such a way that they find it useful enough to adopt and continuously use it.

3.4.4. Accessibility accommodation

Website accessibility refers to the capability of making websites accessible to a wide array of possible users, regardless of their technical aptitude or possible disabilities. This should ensure that all users have equal access to information and functionality (Olalere & Lazar, 2011; Reis, Barroso, and Goncalves, 2013; Shi, 2007). According to Alexender (2003, p. 70), website accessibility can be defined as "an approach to web design that aims for maximal inclusion, both in terms of people who use websites, and the technologies that are utilised in the process". This implies that every citizen wishing to use an e-government service should be able to access the system regardless of their age, culture, disability, religion, income, and education (Kapsi, Vlachogiannis, Darzentas & Spyrou, 2009; Shi, 2007; Witt & McDermott, 2004); and irrespective of the platform they use to access the system, such as personal computers, laptops, tablets, mobile phones, or the different browser platforms used for accessing the website, such as Google Chrome, Internet Explorer, Netscape and Mozilla Firefox. Consequently, accessibility has been particularly important in the domain of e-government usability because of the need to ensure that government services are equally available to all citizens, including those with disabilities.

Prior literature has presented three different notions of web accessibility. The first approach considers accessibility to be a subset of usability. An illustrative diagram of this notion is depicted in Figure 3.5.

Figure 3.5: Accessibility as a Subset of Usability (Source: Kapsi *et al*., 2009)

Researchers (Desikan & Ramesh, 2006; Ellcessor, 2016; Jordan, Buranapunsri & Berge, 2006; Stephanidis, 2009) presenting this approach have based their theoretical underpinnings on the ISO 9241-11(1998) definition of usability. This definition includes references to making interfaces accessible to people with disabilities and the use of assistive technologies. Consequently, when a web interface meets accessibility criteria, it also automatically meets certain usability criteria.

Another line of thought considers usability and accessibility to be two separate notions. An illustrative representation of notion is presented in Figure 3.6. This school of thought bases its arguments on the notion that usability issues and accessibility issues are distinct by nature (Borsci, Kurosu, Federici & Mele, 2014; Kapsi *et al.*, 2009; Petrie & Kheir, 2007). These authors argue that while usability problems affect all the users of an interface, accessibility problems only affect a small group of people with disabilities.

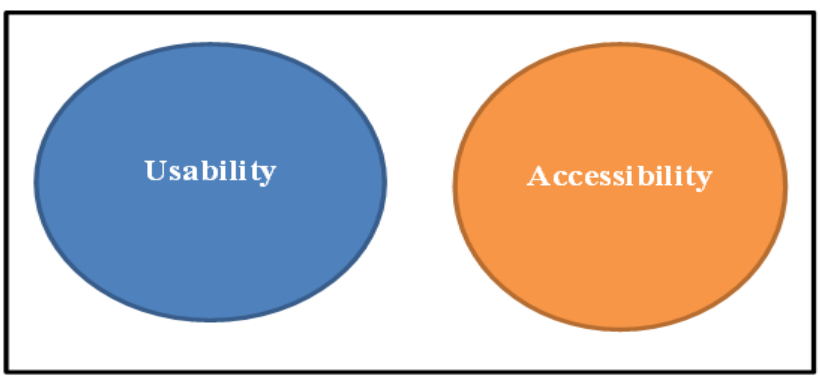


Figure 3.6: Usability and Accessibility as Distinct Concepts (Source: Kapsi *et al.*, 2009)

The last school of thought introduces the term “usable accessibility”, which is the intersection between usability and accessibility. Usable accessibility can be defined as the design of interfaces that are usable from a usability perspective while also addressing the needs of all users in the user-centred design process, with key consideration for users that experience any form of cognitive or functional limitations (Javahery, Gower, Sinnig & Forbrig, 2011). The concept of usable accessibility is presented in Figure 3.7 below.

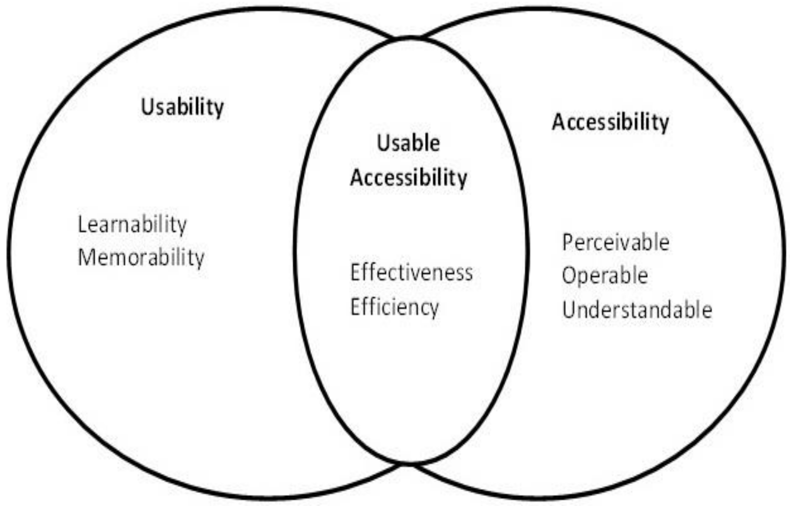


Figure 3.7: Usable Accessibility (Source, *Kapsi et al.*, 2009)

The approach of usable accessibility considers the overlap between the usability heuristics presented by Nielsen (1995) and the WGAC 2.0 presented by the World Wide Web Consortium (W3C, 2008). WCAG 2.0 success criteria are presented in Table 3.5, while the overlap of factors between usability (Nielsen heuristics) and accessibility (WCAG 2.0) is presented in Table 3.6 below.

Table 3.5: WCAG 2.0 guidelines (Compiled from W3C website)

Guideline	**Description**
1. Perceivable	
1.1. Text alternatives	Provide text alternatives for any non-text content so that it can be changed into other forms (formats) that people need, such as large print, braille, speech, symbols or simpler language.
1.2. Time-based media	Provide alternatives for time-based media.
1.3. Adaptable	Create content that can be presented in different ways (for example

	simpler layout) without losing information or structure.
1.4. Distinguishable	Make it easier for users to see and hear content, including separating foreground from background.
2. Operable	
2.1. Keyboard accessible	Make all functionality available from a keyboard.
2.2. Enough time	Provide users with enough time to read and use the content.
2.3. Seizures	Do not design content in a way that is known to cause seizures.
2.4. Navigable	Provide ways to help users navigate, find content, and determine where they are.
3. Understandable	
3.1. Readable	Make text content readable and understandable.
3.2. Predictable	Make web pages appear and operate in predictable ways.
3.3. Input Assistance	Help users avoid and correct mistakes.
4. Robust	
4.1. Compatible	Maximise compatibility with current and future user agents, including assistive technologies.

Table 3.6: Overlap between usability heuristics and WCAG 2.0 success criteria

Usability Heuristics	WCAG 2.0 Success Criteria	Specific subcategory*
Visibility of system status	2.4	2.4.2/2.4.3/2.4.4/2.4.6/2.4.8/2.4.9/2.4.10
Match between system and the real world	3.1 and 3.2	3.1.2/3.1.3/3.1.4/3.1.5/3.1.6/3.2.3
User control and freedom	1.4 and 2.2	1.4.2/1.4.4/1.4.8/2.2.1/2.2.2/2.2.4
Consistency and standards	3.2	3.2.3/3.2.4
Error prevention	3.3	3.3.1/3.3.2/3.3.4/3.3.6
Recognition rather than recall	1.3 and 2.4	1.3.1/2.4.2/2.4.6/2.4.10
Flexibility and efficiency of use	2.4	2.4.1/2.4.3
Aesthetic and minimalist design		

Help users recognise, diagnose, and recover from errors	3.3	3.3.3
Help and documentation	3.3	3.3.5
*Notes: to access the specific subcategories, visit the WCAG 2.0 guideline published by the W3C at https://www.w3.org/TR/WCAG20/.		

Source: (Moreno *et al.*, 2009)

After a review of the three different approaches to accessibility, this study adopts the first approach which defines accessibility as a subset of usability. This approach fits directly into the domain of e-government usability, as e-government websites are always created to offer services to a diverse group of users from different backgrounds and cultures, academic levels, income levels, cognitive and functional capabilities, and different age groups. Additionally, this has been the approach adopted by prior studies on e-government usability (Baker, 2009; Bowazza & Chebi, 2016; Dan *et al*., 2013; Roach & Cayer, 2010; West, 2004).

Most of the studies to date on e-government website accessibility have emerged from the developed world (Faouzi, Basel & Emad, 2014; Kuzma, 2010; Olalere & Lazar, 2011; Youngblood, 2014; Youngblood & Mackiewicz, 2012). One common finding from these studies has been the fact that many of the e-government websites had several accessibility issues. In countries like the US, it has been mandatory for all government websites to meet the accessibility guidelines as outlined in Section 508 of the Rehabilitation Act (Olalere & Lazar, 2011; Youngblood, 2014). However, many e-government websites in the US still fall short of attaining optimal accessibility (Olalere & Lazar, 2011; Shi, 2007; Youngblood & Mackiewicz, 2012). This suggests that accessibility might not be very easy to attain. However, the only way to enhance the accessibility of e-government websites is by examining their current state of accessibility in order to pinpoint the exact accessibility problems that plague these websites in a given country or region.

3.4.5. Information architecture

The information architecture of a website encompasses the underlying structure that allows all parts of the website to sit harmoniously together (Fenn & Hobbs, 2014). As such, many aspects of the information architecture are often hidden in the end-product. Basically, the information architecture binds together and defines the relationship between a website's content and its functionality (Cardello, 2014). Most aspects of information architecture, thus, could be found within the internal system design not visible to the end users, but that enables the users to tacitly experience the design, content, and functionality of the website (Cox, 2014; Fenn & Hobbs, 2014). As such, the entire information architecture of a website cannot be evaluated without access to the website's internal components. Baker (2009) based the concept of information architecture in the six-dimensional framework only on aspects of the user interface that can be evaluated without access to the website's internal components. Consequently, the use of information architecture in this study is limited to information architecture components of the user interface of e-government websites.

The concept of information architecture in e-government usability (based on the six-dimensional framework) concentrates on the aspects relating to organising, shaping, and classifying/categorising information in an effective way. This depicts the organisation of information in an e-government website and how it first appears to the user (Baker, 2009; Stowers, 2002). According to Rauch (2007), information architecture refers to the fundamental organisation and presentation of a website, especially in presenting the services and functions of the website. In a broader sense, information architecture refers to the organisation of information products in a system by synthesising aspects like labelling, navigation, and search functions such that it enhances the usability, findability, and understanding of the system (Rosenfeld, Morville & Arango, 2015).

When the information architecture is effectively designed, it will allow users of an e-government website to easily find the information they need, as well as complete tasks easily. Information architecture also enables users of an e-government website to fully understand how items relate to one another in the system. The factors associated with information architecture include agencies/departments, audience-focused/centric, branch of government, branding/ structure/metaphor, personalised /customisable features and services (Baker, 2009; Dan *et al.*, 2013; Roach & Cayer, 2010; West, 2006). The operational definitions of these factors are presented in Table 3.7 below.

Table 3.7: Information architecture variables

Information Architecture Factors	Operational definition
Agencies/departments	Agency or government ministry listing
Audience-focused/ centric	User-centric approach and outlook on the site especially targeted for new users and those with little knowledge about ICTs and government agencies
Branch of government	Identification of type or kind of government represented - e.g. ministry, department
Branding/structure/metaphor	Publicly recognisable identity or image or symbol communicated - e.g. national coat of arms, national flag, logo
Personalised/ customisable feature	Features customised to satisfy users' preferences within reason
Services	Agency or government ministry's functions noted for novice users

Source: (Dan *et al.*, 2013)

Without proper organisation of information in an e-government website, it makes it difficult for users to find what they need. Rosenfeld *et al.* (2015) emphasised the need to carefully organise information in a website to make it easy for users to use the system. Users generally abandon a system if they struggle to use it. Additionally, since information architecture influences the ease of use of a system, it is vital in e-government, as ease of use has been noted to be a significant factor that influences e-government adoption and utilisation (Bwalya, 2011; Boon *et al.*, 2013; Lin *et al.*, 2011).

The information architecture is very important because it is the backbone of other key dimensions, like navigation and online services. Without proper information architecture, it will be difficult to effectively design website navigation or search functionalities, which in their own right are also vital for enhancing the websites' usability. For example, providing breadcrumb trails to guide user navigation is dependent on the proper design of the website's information architecture. Even though information architecture is not directly seen in the user interface, it nonetheless guides the user's interaction with an e-government website and thus the user's overall UX. The reason this happens is because information architecture defines the relationships between the content and functionality of the website. Since good information architecture will facilitate usability, findability, and understanding, it remains imperative to ensure that e-government websites are based on good and solid information architecture to provide an acceptable and enjoyable UX. This will ensure that the users are engaged with the system and thus increase the chances for repeated usage of the e-government system by citizens.

3.4.6. Legitimacy

When citizens go online to use an e-government website and perform a given task, they need to be sure that the website they are interacting with actually belongs to the government. This assurance is often provided by the legitimacy features of the e-government website.

Legitimacy provides credible evidence to users that a given website is meant for official government affairs. Roach and Cayer (2010) explicated that legitimacy features assure users that their privacy and security needs are being addressed because the website is authenticated as a credible electronic replica of the physical government office. As such, it is imperative to ensure that legitimacy features are made visible throughout the e-government website. Legitimacy variables used in e-government usability studies include: authentication password/digital sign, contact information, disclaimer statements, privacy policy, security policy and webmaster contact (Baker, 2009; Dan *et al.*, 2013; Holzer & Kim, 2004; Roach & Cayer, 2010; Stowers, 2002; West, 2006). The definitions of these legitimacy variables are presented in Table 3.8 below.

If legitimacy is not established in an e-government website, users will not build the trust that drives them to substitute physical services for e-services. Prior e-government literature (Al-Khattab, Al-Shalabi, Al-Rawad, Al-Khattab & Hamad, 2015; Asianzu & Maiga, 2012; Bwalya, 2011; Horst, Kuttschreuter & Gutteling 2007; Khanyako & Maiga, 2013; Rukiza *et al*. 2011) has indicated the significant influence of trust in e-government adoption and utilisation.

Several e-government services require the user to interact with an e-government website and maybe complete forms with personal data. As such, the public needs to trust the integrity of the website to be assured that their information will go to the right authorised government department.

Table 3.8: Legitimacy factors

Legitimacy variables	**Definition**
Authentication password/digital sign	Visible mechanisms to determine site identity or affiliation
Contact information	Contact information for users to address questions to and to be assured that it is a credible and official government agency
Disclaimer statements	Disclosure data about the site informing users or visitors of what it is about or not about
Privacy policy	Statements about the extent to which privacy is honoured or maintained
Security policy	Statements about the extent to which security is honoured or maintained
Webmaster contact	Recognisable website manager communication

Source: (Dan *et al.*, 2013)

The best way to increase perceived trust in e-government websites is, therefore, to ensure that legitimacy factors are visible on all pages of the website. This indicates the need to examine and determine that e-government websites conform to legitimacy standards.

3.5. User Characteristics and Usability

The usability of a system can be influenced by fundamental user characteristics. Some of the common user characteristics that have been known to affect usability include culture, gender, and age (Sonderegger & Sauer, 2013; Stenstrom, Stenstrom, Saad & Cheikhrouhou, 2008; Wagner, Hassanein & Head, 2014). The influence of these three characteristics on usability is discussed below.

3.5.1. Culture

Culture has always been noted as a highly abstract and complicated concept that means different things to different people. This can be seen in the many definitions of culture that exist across different disciplines, as more than 200 diverse definitions have been recorded in prior literature (Covington, 2008). However, in the context of usability, culture is generally defined as a collective set of values or representations that distinguish members of one group from another (Clemmensen & Katre, 2012).

The relationship between culture and usability, otherwise referred to as "culturability" (Barber & Badre, 1998), has been examined by researchers for over two decades. Usability has been known to vary based on culturally-specific attributes (Ahmad *et al.,* 2015; Clemmensen & Katre, 2012; Douglas *et al.,* 2011; Wallace & Yu, 2009; Sonderegger & Sauer, 2013). Cultural indicators that have been used to examine the relationship between usability and culture include symbols, text and graphic preferences, colour, language, sound, help features, navigation features, icons, metaphors, and fonts (Barber & Badre, 1998; Hsieh, 2014). After examining the impact of cultural preferences on website usability, Sun (2001), established that website users preferred interacting with websites that had cultural indicators from their own culture. Likewise, researchers (Marlow, Clough & Dance, 2007; Nantel & Glaser, 2008) showed that many users will prefer to use websites that accommodate their cultural preferences, either due to necessity or simply out of predilection. Consequently, there has been a need to ensure that the design of websites and software adopt notable cultural denotations (.i.e. cultural design preferences) to meet the expectations of the local users.

Hseih (2014) explicated that when cultural design preferences are successfully applied, it enhances the usability of a website and thus meet the needs of the local culture. As such, understanding how culture affects usability is imperative in determining how best to design systems in a way that addresses cultural factors and meets user preferences. This is particularly important in e-government websites as they serve a wide population that sometimes include both local and international users. For example, while several e-government websites are presented in English to reach a wide population, some users within a given country could be prevented from using e-government services provided by their government in English if local languages are not represented.

3.5.2. Gender

Gender considerations have been noted as one of the aspects to consider when designing personalised websites for individual users. This is because men and women have disparate innate qualities that shape their preferences. For example, researchers (Moss and Colman, 2001; Moss, Gunn & Heller, 2006; Tedesco, Chadwick-Dias & Tullis, 2004) have shown significant gender differences in aesthetical choices and predilections. These researchers showed that men and women designers differed in how they designed web pages in terms of their choices of colour, images, and placement of objects in a website. Likewise, male and female website users differed in their perceived usability of websites and other IT systems. For instance, website navigation systems that are deep (i.e. hierarchical website navigation with many sublevels) are better suited to males (Stenstrom *et al.*, 2008). Moreover, Cyr and Bonanni (2005) showed significant differences in how men and women responded to different aspects of website design, such as the information architecture, animation, and the colours used. Gender differences are, therefore, important when considering the design of e-government websites, as some of these websites might be predominantly directed towards users of a specific gender. A notable example is the Ministry/Department of Women's Affairs which is present in most government structures around the world. E-Government websites for such a ministry/department can, therefore, be mainly directed towards female users and thus, taking into consideration the gender aspects in the design of the system, can be very important for enhancing its usability and subsequent adoption and utilisation.

3.5.3. Age

Age differences in terms of users' perceived usability have been identified across several different technologies (Sonderegger, Schmutz & Sauer, 2016; Wagner *et al.*, 2014). It is often seen that older participants show a lower performance in the use of technology than younger participants (Sonderegger, Sauer & Eichenberger, 2014). Wagner *et al.* (2014) showed that website usability was influenced by a user's age as elderly users had diminishing cognitive skills which influenced their ability to effectively and efficiently use a website. As such, there is always a need to redesign technologies that will be used by the elderly to address specific issues that hinder their use of the systems. The good thing, nonetheless, is the fact that when systems are redesigned to increase effective usage by the elderly, younger users also benefit from these improvements (Chadwick-Dias, McNulty & Tullis, 2003). Consequently, research on website usability for the elderly has been widely conducted with several guidelines being proposed for enhancing website usability for the elderly (Zaphiris, Kurniqwan & Ghiawadawal, 2007).

Since most e-government systems are designed to serve both the young and the elderly, ensuring that the systems are designed to address the needs of the elderly is important, since it will also enhance the UX of the young, as explicated by Chadwick-Dias *et al.* (2003).

3.6. E-Government Usability and Public Values Perspective of E-Government

As indicated earlier in Chapter 2 (Section 2.6), e-government initiatives are increasingly focusing on a public value perspective (UNDESA, 2016). This paradigm shift over the years is important in studying the usability of e-government websites as existing public value dimensions of e-government websites greatly overlap with e-government website usability dimensions, as operationalised in prior e-government usability studies (Baker, 2009; Dan *et al.,* 2013; Roach & Cayer, 2010). A total of six public values of e-government websites were discussed in Chapter 2 (Section 2.6). These public values were accessibility, citizen engagement, development of trust, responsiveness, dialogue, and quality of information and services.

Firstly, accessibility, which is noted as one of the key public value dimensions for e-government websites (Jorgensen &Bozeman, 2007; Karkin & Janssen, 2014; Karunasena *et al.*, 2011), is also a key dimension of e-government website usability (Baker, 2009; Dan *et al.*, 2013; Roach & Cayer, 2010). E-Government websites always target delivery of information and services to all citizens which is why accessibility remains a vital component both in terms of public value and usability.

Secondly, citizen engagement as a public value dimension of e-government websites focuses on the website's ability to provide interactive tools that promote citizens' abilities to interact with governments and provide feedback on government projects. This public value dimension overlaps with user help and feedback and the online services dimensions of e-government website usability. One variable of user-help and feedback dimension is to have feedback mechanisms which are similar with tools for providing feedback in citizen engagement. With regards to online services, two variables (interactive forms and interactive databases) also form the tools that citizens use to interact with government as components of citizen engagement.

Thirdly, developing trust as a public value of e-government websites is composed of two components (transparency/openness and security and privacy). Transparency/openness encompasses the dissemination of vital information, like financial statements, policy documents and regular government reports, which are synonymous to the documents and publications variable of the online services' dimension of e-government website usability. The security and privacy component, on the other hand, relates to the legitimacy dimension of e-government website usability (i.e. specifically the security and privacy policy variables).

Fourthly, responsiveness as a public value of e-government websites focuses on how well governments respond to communication and interaction from citizens. This public value is also evaluated as a usability variable of the online services dimension (i.e. communications with officials).

Fifthly, dialogue as a public value of e-government websites focuses on tools that facilitate capture of citizen comments, as well as provisions for citizens to subscribe to government updates. This dimension corresponds with two variables of the online services dimension of e-government website usability, namely chat areas/message boards and email updates.

Lastly, quality of information and services as a public value of e-government focuses on the availability of interactive online services, including those with payment options and the ability for citizens to download forms. This public value overlaps with the navigation dimension (i.e. e-government services variable) and the online services dimension (i.e. e-commerce applications and downloadable forms variables) of e-government website usability.

In addition to the above public values of e-government websites, researchers (Karunasena & Deng, 2009) have also called for a need for governments to create public values by personalising e-government services and making them available on mobile devices. These services, as public values, will also overlap with the usability variables personalised/customisable (i.e. information architecture dimension) and of PDA/wireless (i.e. user help and feedback dimension) respectively. With e-government development increasingly focusing on delivering public value, it is expected that e-government websites, as primary platforms for government interaction with citizens will mostly focus on delivering public value. Therefore, the momentous overlap between the public values of e-government websites and e-government website usability supports the link between e-government development and usability.

It is, thus, not surprising that poor usability has been highlighted as a reason for most e-government project failures. Basically, a focus on public values when developing e-government websites simply means taking the usability of these websites more seriously. Consequently, it can be expected that e-government development in a given country will highly correlate with the level of usability of the nation’s e-government websites. As such, national indicators, such as national income, corruption, and competitiveness, that have been shown to highly correlate with e-government development, are also likely to correlate with the usability levels of the country’s e-government websites.

The next section will discuss plausible links between national indicators and e-government development and the usability of a country’s e-government websites.

3.7. National Indicators, E-Government Development and Usability of E-Government Websites

As briefly mentioned before (Chapter 2, Section 2.4.4), e-government development has long been associated with national indications, especially the national income (Perry & Christensen, 2015; UNDESA, 2016). In recent years, other indicators like corruption and global competitiveness have also been associated with e-government development (UNDESA, 2016). A national indicator such as national income is not only associated with e-government development, but also with the quality and usability of e-government websites (Gaulė & Žilinskas, 2013; Youngblood & Youngblood, 2013). Therefore, this section reviews the following nine national indicators: national income, corruption, global competitiveness, cybersecurity, innovation, population age distribution, gender inequality, human development, and cultural diversity. These factors are selected based on their pertinent association with e-government and the usability of e-government websites as discussed below.

3.7.1. National income

As previously indicated, national income is one of the most widely used nation indicators for e-government development (Moon & Welch, 2015; Perry & Christensen, 2015; UNDESA, 2016). Research over the years has found a clear pattern aligning national income with e-government development, with high-income countries having greater e-government progress (Hafeez & Sher, 2006; Perry & Christensen, 2015; UNDESA, 2014 & 2016). National income often operationalised in terms of the gross national income (GNI) per capita indicates the level of economic progress in a given nation. High-income countries often have the necessary resources to invest in e-government development and this has been noted as a possible explanation for why European countries advance more in e-government development than African countries which are often characterised by low GNIs (Perry & Christensen, 2015). This is, however, not surprising as lack of financial resources has been noted as one of the challenges for e-government implementation in Africa (Asogwa, 2015).

Financial resources do not only influence e-government development as a whole but also directly affects the development of e-government websites. This has been evident in Alabama when the allocation of more funds towards e-government website development significantly enhanced the usability of the websites (Youngblood & Mackiewicz, 2012). Likewise, Gaulė & Žilinskas (2013) illustrated by using data from Lithuania that richer municipalities had better-developed e-government websites than poor municipalities. Likewise, per capita income has been shown to have a significant correlation with the usability of local e-government websites with websites in higher income municipalities having fewer usability issues (Youngblood & Youngblood, 2013).

Following from the above discussion, it is expected that the national income of a country not only affects e-government development as a whole but also the usability of the country's e-government websites and poor countries are likely to have poor quality e-government websites. This pattern is expected for two reasons. Firstly, richer countries can have more allocation of financial resources needed to develop good quality e-government websites that are highly usable while financial constraints might hamper the quality of websites developed in poor countries. However, there is a room for outliers with this expectation as some resource poor countries depend on donor funding for their e-government projects. Secondly, high-income countries have a higher demand for e-government services (Al-Sobhi & Weerakkody, 2011; Huang, 2009). As such, because e-government development focuses on public value, the focus on supplying the demanded services with a public values interest will directly influence the usability of the e-government websites because of the overlap between public values and usability of e-government websites as depicted in section 3.6.

3.7.2. Corruption

The association between corruption and e-government development was introduced in Chapter 2 (Section 2.4.4). As such, the focus of this section is to build on how this association comes about, as well as the potential association of corruption with the usability of e-government websites. In the domain of public administration, corruption is defined as "the misuse of public power or authority for private gains" (UNDP, 2008). The relationship between corruption and e-government development has always been two ways. Firstly, e-government development has been widely documented as a tool for reducing corruption as electronic transactions will make it difficult for corrupt officials to misuse public power for their private gains (Abu-Shanab, Harb & Al-Zoubi, 2013; Elbahnasawy, 2014; Kim, 2014). Existing empirical evidence supports this view that e-government development reduces corruption (Elbahnasawy, 2014; Kim, Kim & Lee, 2009) and this has been widely viewed as a key benefit for e-government development (Elbahnasawy, 2014; Jun *et al.*, 2014).

On the other hand, some e-government projects do not even start, mature, or succeed because the funds allocated for the projects are mismanaged by corrupt officials. In SSA, Cloete (2012) noted that one of the key factors thwarting the development of e-government was corrupt officials. Likewise, Aladwani (2016) argued that corruption is a significant factor influencing the failure of e-government projects in developing countries. Similarly, pervasive corruption has been argued to be one of the most vital contextual factors that significantly affect the maturity of e-government initiatives (Singh, Das & Joseph, 2007). Consequently, corruption has been widely acknowledged as one of the factors responsible for e-government project failures. The 2016 E-Government Development Survey included corruption as one of the national indicators and showed a strong positive relationship between the CPI and e-government development (UNDESA, 2016). It was reported in the survey that countries with high corruption rates mostly scored poorly in e-government development, which could be attributed to their inability to deliver transparent government services using ICTS (UNDESA, 2016).

Since corruption affects e-government development, it likewise impacts on the development of quality e-government websites, as these websites are a key platform for e-government. Corruption in the public sector often involves the misuse or misdirection of project funds (Hicks, 2011). As such, if funds for developing e-government websites are misused, the limited financial resources are going to result in the development of poor quality websites that have poor usability. Aladwini (2016) presented two common ways through which corruption negatively influences e-government projects in developing countries. These include:

- Public officials that overcharge e-government project contracts and then award the overpriced contracts to IT companies owned by people they know in order to take a portion of the contract profits.
- Public officials who receive bribes from under-qualified IT companies and then award e-government project contracts to these companies.

When either of these two scenarios occurs, the IT companies that receive the corrupt contracts try to cover the hidden cost by employing poorly skilled IT personnel and use outdated tools, which in turn results in the delivery of poor quality e-government projects (Aladwini, 2016).

Also, corruption has been noted to negatively influence the delivery of public value (Graycar, 2016). Thus, corrupt countries are less likely to focus on e-government as a source of creating public values. One aspect of public values is transparency/openness which is not possible with corrupt governments. Since corrupt countries will hardly focus on public values, it is likely that their e-government websites will have less public values and consequently poor usability, as the public values of e-government websites overlap with their usability.

3.7.3. Global competitiveness

Global competitiveness refers to “the set of institutions, policies, and factors that determine the level of productivity of an economy, which in turn sets the level of prosperity that the country can earn” (Schwab & Sala-i-Martin, 2015, p.4). The relationship between global competitiveness and e-government is bidirectional. On the one hand, an increase in global competitiveness within an economy brings about several economic and other benefits that provide a favourable environment for e-government development and progress (UNDESA, 2016). On the other hand, e-government development fosters the creation of new business models and transforms operations in the private and public sector, yielding more investments for future growth and enhanced competitiveness (Abu-Shanab, 2016; Schwab & Sala-i-Martin, 2015). Additionally, adoption of ICTS in general (including e-government) positively impacts on competitiveness within a country (UNDESA, 2016).

As indicated in Chapter 2 (Section 2.4.4), a significant correlation has been established between global competitiveness and e-government development (UNDESA, 2016). Similarly, Abu-Shanab (2016) established a significant positive association between global competitiveness and the EDGI, as well as all its sub-dimensions (HCI, OSI, and TII). As such, it is expected that countries with a high level of global competitiveness will perform better in e-government development. On the other hand, for e-government to have a positive influence on the global competitiveness of a nation, e-government solutions need to be widely adopted and used by its citizens, as indicated by UNDESA (2016).

Since e-government development is increasingly focusing on delivery of public value, and adoption of e-government systems is influenced by usability, it is expected that a positive relationship will exist between usability of e-government websites and global competitiveness. This is because when global competitiveness provides favourable economic conditions for e-government development, as postulated above (UNDESA, 2016), governments will need to develop e-government online solutions that are highly usable. This should ensure adoption by the general public so that it, in turn, can foster competitiveness in both the public and private sectors of the economy.

3.7.4. Innovation

Innovation has been noted to play a vital role in fostering e-government development (Anthopoulos, Reddick, Giannakidou & Mavridis, 2015). Innovation generally refers to the transformation of an invention to usable products or processes for creating superior ways of adding value for customers (Anthopoulos *et al.*, 2015). Innovation plays a momentous role in government's overall e-government processes, especially in the initiation of e-government projects and the continuous improvement of existing e-government solutions (Kim, Pan & Pan, 2007). Cheng, Wen, Li, and Lin (2012) explicated that innovations in government are always a reflection of ICT solutions within a given country's private sector. This can also be seen in the increasing dependence on public-private partnerships as a means for long-term e-government development (Ampah & Sudan, 2016; Ruuska & Teigland, 2009; Taher, Yang & Kankanhalli, 2012). As such, the general level of innovation in a country will provide public sector entities with available technological advancements for improving on their e-government offerings. A good example in SSA is the e-tax systems widely adopted by governments in several SSA countries due to the availability of innovative mobile money payment solutions developed by the private sector. The fact that e-government in itself is even seen as a form of technological innovation (UNDESA, 2010) clearly depicts the importance of innovation in e-government development. As such, the level of innovation in a given country is expected to highly correlate with the country's level of e-government development.

Furthermore, it is also expected that innovation will influence the usability of e-government websites, as innovations targeting e-government solutions will primarily focus on delivering public value. More so, since usability has been widely highlighted as a necessary precondition for e-government adoption (Boon *et al.*, 2013; Bwalya, 2011; Donker-Kuijer *et al.*, 2010; Lin *et al.*, 2011), there is a high likelihood that new and improved innovations intended for e-government service delivery will focus on providing better usability in order for it to be used by the general public. This is to be expected, as some governments, even in SSA (e.g. Mauritius and Namibia), have already included usability as a condition for systems in their e-government strategy documents. Consequently, it is expected that a higher national level of innovation will have a positive relationship with e-government development and usability of the country's e-government websites.

3.7.5. Cybersecurity

Cybersecurity is broadly defined as "the protection of cyber-systems from cyber threats" (Refsdal, Solhaug & Stolen, 2015, p. 29). Cybersecurity is important in e-government development, because most e-government systems are cyber-systems. Cyber threats significantly affect e-government development as both ICT infrastructure and e-government services remain vulnerable to exploitation by cyber criminals (Asogwa, 2015). Information security remains a vital aspect of e-government cybersecurity efforts, as security and privacy concerns influence adoption of e-government systems (Alghamdi & Beloff, 2014; Khanyako & Maiga, 2013). Information security can, in the context of e-government systems, be seen as the necessary measures for protecting the confidentiality, integrity, and availability of sensitive information that is processed, stored and transmitted between e-government systems. E-Government systems are faced with several security threats with the denial-of-service (DOS) attacks being the most common (Mitrokotsa & Douligeris, 2008). Existing security threats to privacy, identity, and data systems significantly affect citizens' trust in e-government systems and this plays a vital role in influencing governments' and users' willingness to adopt and use e-government solutions (Jacobi, Jensen, Kool, Munnichs & Weber, 2013; Khanyaako & Maiga, 2013).

Cybersecurity incidents are becoming rampant with e-government systems. For example, in June 2015, numerous Canadian government websites and servers were taken down in a cyber-attack. Similarly, early in 2015, there was a wave of cyber-attacks that targeted government-related websites in Ghana, Nigeria, and Senegal (Cordell, 2015). Since perceived security is vital for e-government adoption (Jacobi *et al.,* 2013), it remains important to ensure that e-government solutions are highly secured to encourage user adoption and its subsequent development. As such, governments with an inclination for e-government development are likely to develop strong cybersecurity measures prior to e-government system implementation so that the systems remain protected from cyber threats. It is, therefore, expected that high cybersecurity measures within a country will highly correlate with positive e-government development.

Strong cybersecurity measures can also be used by governments to enhance citizen adoption of e-government services due to the increased privacy, security and trust from cybersecurity measures. Karunasena and Deng (2009) highlighted that development of trust (i.e. public value including privacy and security) could be achieved via the implementation of strong cybersecurity measures. Given that security and privacy are variables of the legitimacy dimension of e-government, it is, therefore, expected that countries that implement cybersecurity measures for e-government systems will most likely have websites that perform well in the legitimacy dimension of e-government website usability. Additionally, e-commerce applications for governments are most probably going to thrive more in countries with high cybersecurity measures as their likelihood of usage will be high, thus increasing the performance of e-government websites from such countries in the online services dimension of e-government website usability. Consequently, an association is expected between a country's cybersecurity measures and its level of e-government website usability.

3.7.6. Population age distribution

In Section 3.5.3, it was observed that age differences at an individual level influence the usability of websites in general. This provided a sufficient basis for associating the collective population age distribution in a country with the demand and supply of e-government websites especially as usability is vital for e-government adoption as previously shown. The link between population age distribution and e-government services have been widely discussed in the literature (Baker, Al-Gahtani & Hubona, 2007; Gaulė & Žilinskas, 2013; Xu & Asencio, 2015; Wigand, 2011). The age group that characterises most of a country's population can highly influence the demand for e-government services and thus its subsequent development. For example, evidence from Alabama indicated that the development of e-government was negatively associated with the age group of people younger than 18 years and those older than 65 years (Xu & Asencio, 2015). In Saudi Arabia, Baker *et al.* (2007) found that older users were less likely to engage in e-government activities because of resistance to change. This could be supported by the view that older users have several limitations that affect their computer usage (Hanson, 2009). Wigand (2011) indicated that, while younger citizens (younger than 50 years) preferred the internet, older citizens (older than 65 years) preferred telephone and face-to-face interactions. As such, a nation with a high population of older citizens might have less demand for e-government services. Similarly, children might also have little use for e-government services and so demand will decrease with an increase in the younger generation. However, the middle age group, between 15 and 64 years, as classified by the UN, is the age group that prefers the internet and might have high demands for e-government services. This study hypothesises that a country with a high percentage of young children (younger than 15 years) and senior citizens (older than 65 years), will have little demand for e-government services and the country will, thus, have poor e-government development. On the other hand, a nation with a high population of active citizens

(15 – 64 years) will have a greater demand for and adoption of e-government services, and thus higher e-government development.

Regarding development of e-government websites, Gaulė and Žilinskas (2013) established that, while the development of e-government websites was not associated with the elderly population, it actually had a significant positive correlation with the percentage of active citizens. Since the elderly population hardly use the internet, e-government websites might not be a suitable medium for delivering public values to them. As such, countries or municipalities characterised by a high percentage of elderly citizens are more likely to have poor quality websites with poor usability. On the other hand, since the active citizens are currently the predominant users of e-government services (Xu & Asencio, 2015) and their percentage of use is positively correlated with the development of e-government websites (Gaulė & Žilinskas, 2013), it is expected that the percentage of active citizens will positively correlate with high e-government website usability. This is because e-government websites are an appropriate means of delivering public values to this population group.

3.7.7. Gender inequality

Existing literature on technology adoption has highlighted the significant gender differences in the adoption and usage of technologies (Dwivedi, Papazafeiropoulou & Gharavi, 2006; Venkatesh *et al.,* 2012). In most developing world countries, women are mostly found at the bottom end of the gender gap in technology use.

In the context of e-government solutions, Al-Shafi and Weerakkody (2010) showed that there were significant gender differences in the adoption of e-government in Qatar. Similarly, Ambali (2012) showed that gender has a profound moderating effect on the impact of several factors, for example, ease of use, perceived usefulness, security, intention to use and facilitating conditions on e-government adoption. According to Sarabdeen and Rodrigues (2010), most e-government initiatives have been implemented without taking into consideration the existing gender-based differences in technology usage and behaviour. This could result in the poor adoption of e-government solutions and thus account for the subsequent failure of e-government initiatives. However, when there is a high gender balance in terms of skills and competencies, the adoption of e-government becomes consistent for both men and women (Moreno, Molina, Figueroa &

Moreno, 2013). As such, it is expected that e-government development will be high in countries that have low gender inequality, as such countries will have high e-government adoption and thus more demand for e-government services.

Also, as depicted in Section 3.5.2, gender plays a vital role in usability and should be a key consideration for e-government websites, especially those targeting a female-dominated audience. Countries low in gender inequality are more likely to have a combination of both men and women in their e-government website development teams, thus increasing the chances of taking gender differences into consideration when developing e-government websites. Consequently, such gender balanced websites are likely to have better usability. Additionally, high e-government adoption in gender balanced countries, as indicated by Moreno *et al*. (2013) may result in increased supply of public value via e-government websites and consequently enhancing the usability of the websites. It is, therefore, expected that countries with low gender inequality are more likely to have e-government websites that are high in usability compared to those with high gender inequality.

3.7.8. Human development

Human development basically refers to the quality of life in a given country or region (Deneulin & Shahani, 2009), and is measured using the UN's Human Development Index (HDI). Human development includes areas such as education, health, and social services, and governments are increasingly using ICT solutions to service communities in these areas (UNDESA, 2016).

The level of human development in a given country has been noted to stimulate both the supply and demand of e-government (Stier, 2015). Prior literature (Abdelsalam, Reddick & Elkadi, 2012; Holzer & Manoharan, 2009; Stier, 2015) indicated that human development significantly promotes e-government development. Stier (2015) showed that a one point increase in HDI significantly increased e-government by 0.28 to 0.48 points.

Also, countries with high levels of human development have been noted to pay more attention to e-inclusion by providing more e-government services to vulnerable groups, like persons with disabilities and the elderly (UNDESA, 2014). This suggests that countries with high levels of human development have focused on delivering public value to all citizens through their e-government efforts and are more likely to have usable websites to attain this. The reason is that accessibility of e-government websites is a vital aspect of e-inclusion (Hafeez & Sher, 2006). Thus, it is expected that countries high in human development will be more advanced in e-government development and also have websites that perform better in terms of usability than countries with low human development.

3.7.9. Cultural diversity

As earlier noted in Section 3.5.1, culture refers to the collective set of values or representations that distinguish members of one group from another (Clemmensen & Katre, 2012). Cultural diversity, on the other hand, broadly refers to the existence of distinctly different cultural groups within one society (Romanenko, 2012). Culture has always been noted as an influential factor in the adoption and usage of ICTs (Aida & Majdi, 2014; Al-Hujra, Al-dalahmeh & Aloudat, 201; Kovacic, 2005, Nguyen, 2016). In the context of e-government, Kovacic (2005) showed that e-government readiness within a given country was highly associated with its culture. Likewise, Ali, Weerakkody and El-Haddadeh (2009) highlighted that cultural differences between countries had an influence on the level of e-government development. Prior e-government literature has shown that national culture plays a vital role in the adoption of e-government solutions (Aida & Majdi, 2014; Al-Hujra *et al.*, 2011; Arslan, 2009; Nguyen, 2016; Zhao & Khan, 2013).

High levels of cultural diversity can become problematic for e-government development as it is difficult to address all cultural needs of every subcultural group in a country. One common cultural diversity issue in e-government development is the language for disseminating e-government information, as some countries have as much as 23 national languages (Kuster, 2007). Cultural diversity has been noted as a key issue in e-government development in Europe, with several strategies being used for the standardisation of e-government features across the region to ensure inclusiveness in service delivery (Kuster, 2007). This suggests that increased cultural diversity might negatively influence e-government development due to the difficulty of developing e-government solutions that address the diverse cultural groups. For example, the cost of providing numerous translations of an e-government website has been noted as a key barrier delivery of e-government information in non-native languages (Rozis, Vasiļjevs &

Skadiņš, 2016). However, as previously indicated, language is just one aspect of culture that needs to be addressed in the context of e-government development and usability.

Cultural diversity is expected to influence the usability of e-government websites, as prior literature indicated a clear link between cultural preferences and usability (Ahmad *et al.*, 2015; Clemmensen & Katre, 2012; Van Dam, Evers & Arts, 2005; Hseih, 2014; Sonderegger & Sauer, 2013). Van Dam *et al.* (2005) evaluated the usability of local e-government websites with a sample of users from different cultural backgrounds (i.e. Moroccan, Surinamese and Dutch) and found that the identified usability issues differed by cultural background. As such, the design of e-government websites is required to take into consideration cultural differences in order to appeal to all potential users and increase adoption and usage rates (Al-Badi, 2009; Nguyen, 2016). This can be difficult to attain for countries with high levels of cultural diversity due to the many different cultural preferences. Therefore, countries with high cultural diversity might have websites that are poor in usability compared to countries with less diversity. However, this relationship can be moderated by national income, as rich countries with high levels of cultural diversity can afford the cost of taking most of all key cultural differences into consideration when developing their e-government websites.

3.8. State of E-Government Usability in SSA

Usability remains an important factor in fostering the successful adoption and utilisation of e-government, yet, there is limited evidence on the state of e-government usability in SSA - the region least developed in terms of e-government around the world. However, over the past 15 years, several researchers have attempted to examine the level of e-government usability across several countries in SSA.

As earlier mentioned in Chapter 1, Kaaya (2004) evaluated the usability of 98 e-government websites from three African countries. During this time, most of the e-government websites were still in the early stages of development and were plagued by numerous usability issues. The author attributed the poor state of usability to the fact that many of the e-government website developers were still undergoing a learning experience as e-government implementation was new. Kaaya (2004) also attributed some of the usability issues to the lack of permanent IT staff to maintain the e-government websites.

Another study by Asiimwe and Lim (2010) evaluated the state of usability in Uganda by examining four e-government websites (Ministry of Health, Ministry of Education and Sports, Ministry of Justice and Constitutional Affairs, and Ministry of Foreign Affairs). The authors concluded that most usability aspects were poor, while some aspects of the system were partially usable. Some of the lacking features identified included interactivity, accessibility features, search tools, sitemap, help or FAQ pages, and legal policies (Asiimwe & Lim, 2010). Translating these factors to the six-factor dimensional framework for e-government usability discussed in Section 3.4, it can be seen that e-government websites in Uganda are lacking in aspects of online services, accessibility, information architecture, user help, and legitimacy.

Using laboratory usability testing methods to evaluate 12 e-government websites in Kenya, Kinuthia (2013) concluded that e-government website portals in Kenya were characterised by poor usability. Most of the usability issues identified were at the level of the website design. The websites were also reported to have broken links, poor use of fonts and poor text to background contrast. Moreover, the websites had poor navigation and were not regularly updated. Additionally, the users reported poor levels of overall UX on the websites.

Research from SA has also identified poor usability aspects in the websites that were evaluated (Korsten & Bothma, 2005; Pretorius & Calitz, 2014). After examining the usability of the SA Government online portal (www.gov.za), Korsten and Bothma (2005) concluded that the website failed to meet numerous usability criteria and also did not adequately provide a good navigational and architectural system for users to optimally find and access the information they required. However, since then several changes might have occurred as the policy guidelines for SA government websites established in 2012 clearly stipulate that usability guidelines and principles should be followed for all the websites (Government Communication and Information System, 2012). Consequently, there is a need for new studies that can evaluate the current state of e-government usability in SA. However, Pretorius and Calitz (2014) argued that usability standards were not yet implemented as best practices in SA's local, provincial and national government websites.

Nonetheless, some local governments in SA have shown continuous commitment to improve e-government usability. For example, in 2012, the Western Cape Government completed the construction of a usability laboratory devoted to evaluating and enhancing the usability of e-government websites in the province (Pretorius & Calitz, 2014). Likewise, in 2013, the EThekwini Municipality in the KwaZulu-Natal province of SA commissioned a tender for the usability evaluation of the municipality's website (www.durban.gov.za). This indicates a commitment to improving usability in the country, possibly showing that government departments are continuously recognising the importance of usability in the success of e-government.

Also, some studies (Adepoju, Shehu & Baker, 2016; Costa, Fernandes, Neves, Duarte, Hijón-Neira & Carriço, 2013; Kuzma *et al*., 2009) have only focused on the accessibility dimension of e-government websites in SSA. Adepoju *et al*. (2016) examined 34 state-level government websites in Nigeria and found that none of the websites fully met the evaluated accessibility standards. Also, Costa *et al*. (2013) evaluated government websites in three SSA countries (i.e. Angola, Mozambique and SA) and established that government websites in all the three countries were plagued by accessibility issues. Kuzma *et al*. (2009) examined the accessibility of government websites in four SSA countries (i.e. SA, Namibia, Liberia and Kenya) and concluded that all the countries had a large number of errors for each of the accessibility priority levels. Nonetheless, out of the 24 SSA government websites evaluated in these four countries, there were two (one for Namibia and one for Kenya) that met all the accessibility criteria. It is important to note that the study by Kuzma *et al.* (2009) was based on Web Content Accessibility Guidelines version 1.0 (WCAG 1.0) which have become obsolete as a result of numerous calls for governments to upgrade to WCAG 2.0 compliance.

While there are limited or no studies from other SSA countries examining the state of e-government usability, a country such as Mauritius, which is leading in e-government development, have usability recommendations clearly outlined in their e-government strategy.

3.9. Summary

This chapter provided a theoretical background on e-government usability. An overview of usability was presented along with the different definitions of usability to clearly establish the meaning and context of usability in the domain of e-government. The chapter also presented the importance of usability in e-government. This depicted the key role that usability plays in ensuring the successful adoption and usage of e-government.

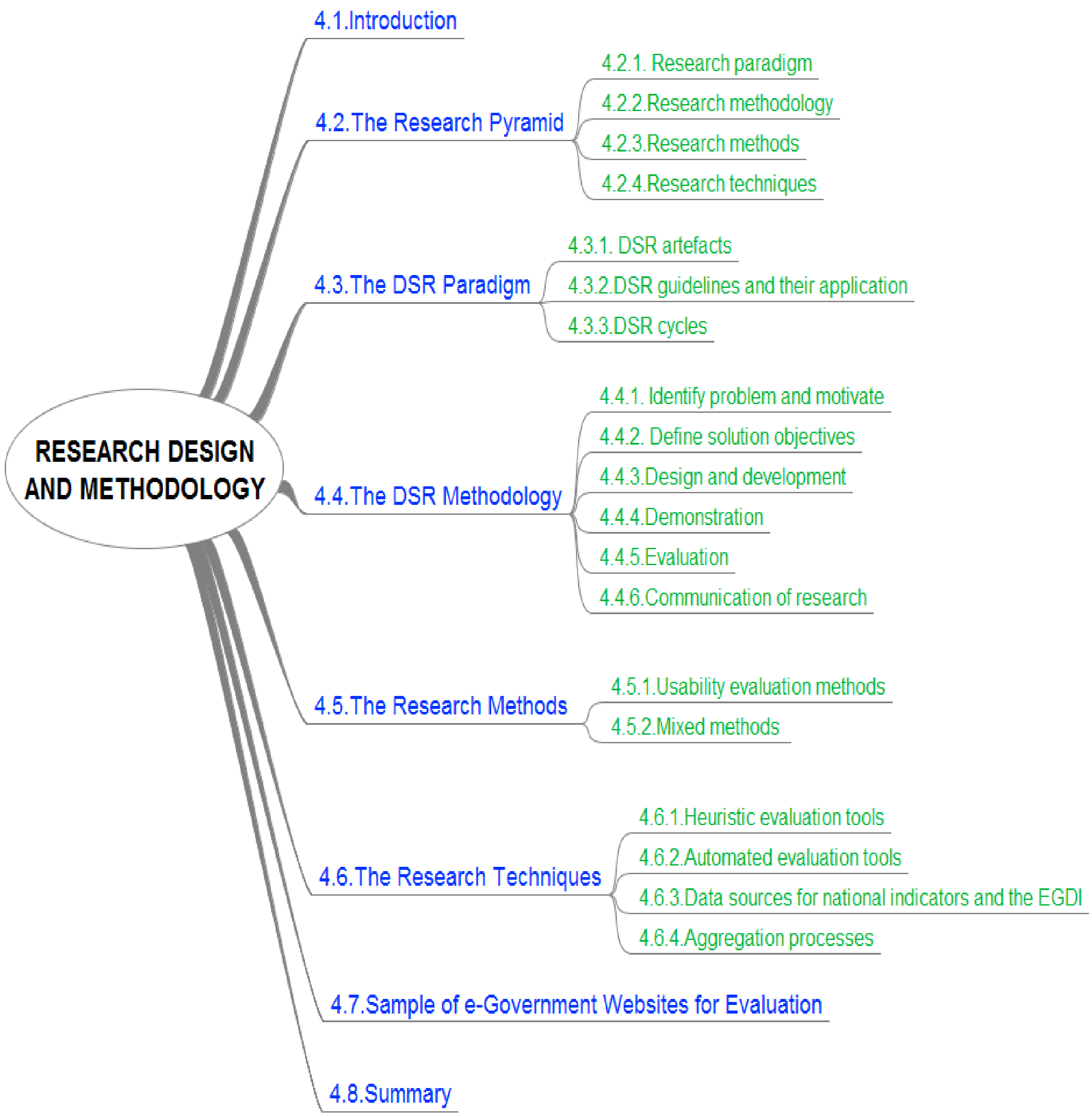
Since the concept of usability is composed of multifaceted dimensions, the specific usability dimensions relevant to e-government were discussed. The six-factor e-government usability framework by Baker (2004) was adopted for this study. The discussed factors included online services, user help, legitimacy, navigation, accessibility, and information architecture. Additionally, the chapter discussed some of the common user characteristics associated with usability such as culture, gender, and age. The link between e-government usability and public value of e-government websites was also explicated, depicting the association between e-government and usability.

Additionally, the chapter presented nine national indicators (national income, corruption, global competitiveness, cybersecurity, innovation, population age distribution, gender inequality, human development, and cultural diversity) associated with e-government development and the usability of e-government websites. Lastly, the state of e-government usability in SSA was reviewed.

In the next chapter (i.e. Chapter 4) a detailed description of the research design and methodology used in this thesis is presented.

CHAPTER FOUR

RESEARCH DESIGN AND METHODOLOGY



4.1. Introduction

In order to create noteworthy research that could make a valuable contribution to the knowledge base of a given research domain, the researcher must clearly delineate and implement an appropriate research design and methodology (Creswell, 2014). This chapter aims at describing and explaining the suitability of the research design and methodology adopted in this thesis.

The chapter commences with the description of the research pyramid as a basis for selecting the appropriate research paradigm, methodology, methods and associated techniques. Next, a description of the DSR paradigm and its applicability in IS research is provided. This includes the DSR guidelines and cycles used for developing an artefact. Also, the DSR methodology is presented along with a discussion on how it is applied in this study. Additionally, the chapter outlines the two key methods (usability evaluation methods and mixed methods) used. The chapter culminates with a discussion of the applicable research techniques and the process adopted for selecting the sample of e-government websites used in the study.

4.2. The Research Pyramid

In order to effectively answer the identified research questions and address the research problem, a researcher needs to make sound decisions regarding the research design and methodology as a means to end up with a study that is sound (Creswell, 2014; Sahu, 2013).

Figure 4.1: Research Pyramid (Souce Jonker & Pennink, 2010, p. 23)

To help researchers in making these decisions amidst the numerous options available, Jonker and Pennink (2010) developed the research pyramid which guides a researcher to make decisions at each stage. The research pyramid (Figure 4.1) consists of four levels, namely: the research paradigms, research methodology, research methods, and research techniques.

The research pyramid represents a logical chain of interconnected measures, starting from a high level of abstraction (i.e. research paradigm) to a more concrete level of application (i.e. research techniques). It enables a researcher to properly structure his/her research approach. This study followed the research pyramid approach to effectively structure the research design and methodology adopted and used in the study. Moving from top to bottom of the research pyramid, specific choices were made regarding the research design and methodology to address the identified research problem.

4.2.1. Research paradigm

A research paradigm refers to an agreed set of values that a research community acknowledges to have produced significant knowledge claims that have been validated over time (Kanellis & Papadopoulos, 2009). These fundamental values of a research paradigm shape the thought patterns and actions of researchers. For many years, three key paradigms, namely: positivist, interpretivist and critical, have dominated IS research (Al-Debei, 2010; Goldkuhl, 2008). These paradigms are presented in Table 4.1 below.

However, over the past two decades, the design science research (DSR) paradigm has emerged as a fourth widely acceptable research paradigm in IS research (Al-Debei, 2010). According to Hevner and Chatterjee (2010, p.5), the DSR is defined as "a research paradigm in which a designer answers questions relevant to human problems via the creation of innovative artefacts, thereby contributing new knowledge to the body of scientific evidence. The designed artefacts are both useful and fundamental in understanding that problem."

In making a decision on which research paradigm to follow, it is imperative for the researcher to have a good understanding of the fundamental beliefs guiding researchers using a given paradigm. These fundamental beliefs are often classified under four factors, namely: ontology, epistemology, methodology and axiology.

Table 4.1: Research Paradigms

Paradigm	Summary
Positivist	The positivist paradigm is based on the notion that reality is independent of the observer and as such, its objectivity can be measured and examined independently of the researcher and research instrument used (Aliyu, Bello, Kasim & Martin, 2014; Avison & Pries-Heje, 2005; Scheffler, 2007).
Interpretivist	The interpretivist paradigm focuses on the subjective understanding of a phenomenon (Johari, 2009). In IS research, the interpretivist paradigm is usually focused on examining and understanding the social context of an information system, including how the information system is influenced by or how it influences its social context (Oates, 2006; Goldkuhl, 2012).
Critical	The critical research paradigm in IS research focuses on recognising power relations, conflicts and contradictions, enabling people to disregard them as sources of alienation and domination (Oates, 2006).

Ontology focuses on understanding the reality surrounding a phenomenon or specifically, the nature of what the researcher is seeking to determine (Kauda, 2012). Epistemology aims at determining those aspects that make up valid knowledge, as well as how the knowledge can be constructed (Klenke, 2016). Methodology relates to the process undertaken by a research to unearth the valid knowledge (Alison & Hobbs, 2012), while axiology focuses on the ethical and moral aspects that shape the beliefs of researchers (Klenke, 2016). Table 4.2 below outlines differences between the different research paradigms based on the underlying beliefs.

After reviewing the distinction between the four key IS research paradigms based on the four fundamental beliefs, the DSR paradigm was selected as the most appropriate for addressing this study's research problem and attaining the desired objectives.

As previously indicated in Chapter 1 (Section 1.5), this study aims at investigating the usability levels of e-government websites in SSA with a focus on enhancing their usability.

Table 4.2: Differences between the most commonly used research paradigms in IS research

Underlying Beliefs	Research Paradigms*			
	Positivist	***Interpretivist***	***Critical***	***Design Science***
Ontology	Single external reality	Multiple realities	Reality is historically instituted	Multiple contextually established alternate world states that are socio-technologically enabled
Epistemology	Objective knowledge generation that can be generalised	Subjective knowledge that is primarily context specific	Knowledge is established from its social context	Knowledge is objectively created through an artefact developed within a specific context
Methodology	Predominantly quantitative with statistical and mathematics methods of inquiry. The researcher is a detached observer	Primarily qualitative	The investigation continuously shapes the values, beliefs and assumptions	Development of artefact
Axiology	Universal truth	Situated understanding	Situated knowledge and understanding	Creation and improvement of understanding
*These research paradigms have been compiled by synthesising literature from several studies (Al-Debei, 2010; Carson, Gilmore, Perry & Gronhaug, 2001; Mack, 2010).				

E-government research in developing countries is more balanced when studied from a socio-technological viewpoint (Khan, Moon, Park, Swar & Rho, 2011; Pereira, Macadar & Testa, 2016), which aligns with the ontology for design science. Also, the study intends to develop a model, which is in line with the development of an artefact relating to the epistemology and methodology of design science. Lastly, the goal is to improve the understanding of the state of usability of e-government websites in SSA, which aligns with the design science axiology. A detailed description of the DSR paradigm and its application in this study is presented in Sections 4.3 and 4.4 below.

4.2.2. Research methodology

The research methodology outlines the way in which a research project is conducted to enable the researcher to gain the expected knowledge. It provides a systematic approach to solving the identified research problem. Rajasekar, Philominathan and Chinnathambi (2013) explicated that a research methodology outlines the different procedures and processes that a researcher adopts and uses to describe, explain, and predict the phenomena under investigation. For the purpose of this study, a methodology based on the DSR guidelines and processes outlined by prior studies was adopted (Hevner *et al.,* 2004; Peffers *et al.,* 2008). The adopted methodology is known as the DSR methodology developed by Peffers et al. (2008). This methodology is described in detail in Section 4.4.

4.2.3. Research methods

The research methods refer to the specific steps of actions that are executed by the researcher (Jonker & Pennink, 2010). All the procedures, processes, and patterns adopted and utilised by a researcher are generally termed as research methods. These include all the theoretical procedures, experimental processes, statistical approaches, etc. that enable the researcher to select samples, gather data and find a solution to the phenomena under investigation (Rajasekar, 2013).

Several research methods have been suggested as being applicable to DSR (Hevner *et al*., 2004). These methods and the adopted method for this study are discussed in detail in Section 4.5. Additional to the methods applicable to DSR, mixed methods design is incorporated in the design science methods to provide a robust artefact, as outlined by prior studies (Agerfalk, 2013; Gacenga, Cater-Steel, Toleman & Tan, 2012). The specific usability methods used in this study were heuristic evaluation and automated usability testing. These usability methods will be discussed in Section 4.5.1.

4.2.4. Research techniques

Research techniques are the concrete part of the research pyramid which represent the practical tools and instruments adopted and used by a researcher to generate, collect, and analyse data (Jonker & Pennink, 2010). Several tools and instruments, which will be discussed in detail in Section 4.6, were used to collect and analyse the required data to address the identified research problem in this study. These tools include the heuristics evaluation tools (i.e. six-dimensional framework and UsabAIPO heuristics) and the automated evaluation tools (i.e. Functional Accessibility Evaluator, Responsinator, Sucuri Sitecheck, TAW, and Xenu's link sleuth).

4.3. The DSR Paradigm

The DSR paradigm was recognised in the IS research community in the early 1990s and since then has been widely adopted as a means of enhancing the effectiveness and usage of IT artefacts in addressing real world problems (Hevner & Chatterjee, 2010). While some disciplines, like architecture and engineering, have proved and valued DSR as a vital approach to academic inquiry, IS researchers were cynical about its value for many years (Dresch *et al.*, 2014; Hevner *et al.*, 2004). Consequently, the diffusion of DSR in the mainstream IS research was very slow within the first decade of it being used in IS (Walls, Widmeyer & El Sawy, 2004).

However, over the past fifteen years, several researchers have successfully defended the validity of DSR in the IS research community (Dresch *et al.*, 2014; Goes, 2014; Gregor & Hevner, 2013; Hevner *et al.*, 2004; Peffers *et al.*, 2008). As a result, IS researchers have started to recognise, value and apply DSR in many different domains of IS research. For example, Geerts (2011) applied DSR in accounting ISs, Mwilu, Comyn-Wattiau and Prat (2015) in business intelligence and Prestopnik (2013) in HCI.

In order to guide IS researchers in effectively applying the DSR paradigm, prior studies (Hevner *et al*., 2004; Peffers *et al.*, 2008) have outlined key aspects that have to be considered, namely the goal of the DSR (which is to develop an artefact), the guidelines necessary for implementing a DSR, and the processes involved in a DSR.

4.3.1. DSR artefacts

The outcome of a DSR is always the development of an artefact. Several types of DSR artefacts are possible, namely: constructs, models, methods, instantiations, and design theories. These artefacts are described in Table 4.3 below.

Table 4.3: DSR artefacts

DSR Artefact	Description*
Constructs	Constructs are the basic vocabulary and symbols that are useful in defining and understand a problem and associated solutions.
Models	This refers to a set of propositions that depict relationships between constructs.
Methods	This includes steps required to complete a goal-oriented task. Methods in DSR also include algorithms and practices.
Instantiations	Instantiations are physical realisations that can be used in the natural world. For example, an instantiation can be fully developed software.
Design Theory	An abstract set of prescriptive knowledge statements that explicate how something needs to be done to attain a specified objective. Design theory often incorporates other forms of artefacts, such as models, methods, constructs, and instantiations.
*The descriptions of these different DSR artefacts have been synthesised from the following authors: Gregor & Hevner, 2013; Hevner *et al*., 2004; Vaishnavi & Kuechler, 2008.	

Hevner *et al.* (2004) explicated that DSR artefacts are not necessarily matured information systems that are directly utilised in practice. Hevner *et al.* (2004, p. 76) also highlighted that

DSR artefacts, instead, comprised of "innovations that define the ideas, practices, technical capabilities, and products through which the analysis, design, implementation and use of information systems can be effectively and efficiently accomplished." DSR artefacts are created from the background knowledge around the problem domain and its rules, values, theories, and symmetries (Goes, 2014).

In order to understand the knowledge type contribution of each of the types of DSR artefacts presented in Table 4.3, Gregor and Hevner (2013) established a framework. These DSR knowledge contribution types are shown in Table 4.4.

Table 4.4: DSR knowledge contribution types (Source: Gregor & Hevner, 2013)

DSR Contribution Types		
	Contribution Types	**Example Artefacts**
More abstract, complete, and mature knowledge	**Level 3**. Well-developed design theory about embedded phenomena	Design theories (mid-range and grand theories)
↕	**Level 2**. Nascent design theory - knowledge as operational principles/architecture	Constructs, methods, models, design principles, technological rules.
More specific, limited, and less mature knowledge	**Level 1**. Situated implementation of artefact	Instantiations (software products or implemented processes)

The type of knowledge contributions from a DSR can be grouped into three levels, from the more specific, limited and less mature knowledge to the more abstract, complete and mature knowledge (Table 4.4). The lowest level of contribution (Level 1) depicts instantiations which are often presented in the form of software projects of processes. The medium level of knowledge contribution (Level 2) represents nascent deign theory which is often operationalised in terms of constructs, methods, models, design principles, technological rules. The highest level of knowledge contribution (Level 3) depicts well-developed design theories presented with artefacts that represent matured abstract design theories.

Since this thesis intends to develop a model for understanding and advancing the usability of e-government websites in SSA, its knowledge contribution can be classified as nascent design theory (i.e. Level 2 in Table 4.4). After determining the type of artefact to be developed in a DSR, the researcher needs to apply the prominent seven guidelines of DSR (Table 4.5) in order to provide valuable knowledge contribution from the designed artefact (Hevner, 2014; Niemoller, Ozcan, Metzger & Thomas, 2014).

4.3.2. DSR guidelines and their application

To ensure research rigour in DSR, Hevner *et al.* (2004) established seven DSR guidelines to guide DSR research studies. The guidelines were developed in the context of IS research to provide an appropriate means through which IS researchers could understand, execute, and evaluate DSR. The DSR guidelines are presented in Table 4.5 below.

Table 4.5: DSR methodology guidelines (Source Hevner *at al.*, 2004; p. 83)

DSR Guideline	Description
Guideline 1: Design an Artefact	DSR must produce a viable artefact in the form of a construct, a model, a method, or an instantiation.
Guideline 2: Problem Relevance	The objective of DSR is to develop technology-based solutions to important and relevant business problems.
Guideline 3: Design Evaluation	The utility, quality, and efficacy of a design artefact must be rigorously demonstrated via well-executed evaluation methods.
Guideline 4: Research Contributions	Effective DSR must provide clear and verifiable contributions in the areas of the design artefact, design foundations, and/or design methodologies.
Guideline 5: Research Rigour	DSR relies upon the application of rigorous methods in both the construction and evaluation of the design artefact.

Guideline 6: Design as a Search Process	The search for an effective artefact requires utilising available means to reach desired ends while satisfying laws in the problem environment.
Guideline 7: Communication of Research	DSR must be presented effectively both to technology-oriented as well as management-oriented audiences.

The first guideline necessitates the need for a DSR to produce an artefact as the output of the research. The different kinds of DSR artefacts were discussed in Section 4.3.1. Of these artefacts, this thesis will produce a model as the artefact. The model will aim to provide guidance on enhancing the usability of e-government websites in SSA. The creation and justification of this artefact are documented in Chapter 5 and Chapter 7.

The second guideline requires the proposed solution to address a relevant business problem. The research problem for this thesis was documented in detail in Section 1.3. It is evident that e-government presents exceptional benefits to citizens and governments. However, for such benefits to be realised, there must be successful diffusion of e-government systems which, to an extent, is highly dependent on the usability of the e-government systems (Asiimwe & Lim, 2010; Bwalya & Healy, 2010; Ray, 2011). Nonetheless, poor usability has plagued many e-government systems and resulted in the failure of e-government solutions. In SSA in particular, e-government development is still in its infancy, yet poor usability is already significantly affecting its successful adoption and utilisation (Kirui & Kemei, 2014). Consequently, there is a need to find ways of enhancing the usability of e-government systems to increase its adoption and utilisation. This is a relevant problem given the potential benefits of e-government. As such, this thesis addresses this problem by providing a model for enhancing usability, more specifically in SSA.

The third guideline is concerned with the evaluation of the artefact. Section 4.4.5 outlines the evaluation mechanisms selected for this thesis. The detailed evaluation of the artefact is documented in Chapter 6 and Chapter 8.

The fourth guideline highlights the need for a clear contribution from the DSR. This thesis attempts to identify a gap in existing e-government research and to formulate an appropriate research methodology (DSR) to examine the state of e-government usability in SSA in order to develop a model that can be adopted and used for advancing e-government usability in SSA. A detailed description of the research contributions is documented in Chapter 7.

The fifth guideline emphasises the need for using rigorous methods in DSR. A thorough literature review of prior IS research was used to establish the basis for empirical analysis in this thesis. In addition to the DSR methods, researchers (Agerfalk, 2013; Gacenga *et al*., 2012) have indicated how mixed methods could be used to enhance the research rigour of the DSR to support the creation and evaluation of the artefact. This thesis incorporated mixed methods combined with DSR to ensure research rigour. The incorporation of mixed methods is documented in Section 4.6.

The sixth guideline emphasises the need to utilise available means to attain the goals of the research in designing an effective artefact. The available means involves the existing knowledge base in a given domain that aids in the creation of the artefact. In Chapter 2 and 3 this study reviewed existing literature in the domain of e-government and e-government usability to establish the base for examining the state of e-government in SSA. This literature review provided the fundamental knowledge for developing the artefact (Chapter 5).

The seventh and last guideline elucidates that DSR must be effectively communicated to desired audiences. The detailed means through which this research will be communicated to the desired audience will be covered in Section 4.4.6.

After identifying the seven basic DSR guidelines, Niemoller *et al.* (2014) explicated that these guidelines need to be implemented in a certain manner for DSR to be complete. Hevner (2007) presented three DSR cycles which are fundamental in order to effectively implement DSR guidelines within a DSR project.

4.3.3. DSR cycles

The need for IS researchers to have a thorough understanding of vital concepts in DSR was raised by Hevner *et al.* (2004) who developed a DSR framework to enable researchers to comprehend, implement and evaluate DSR in IS. Through this framework, Hevner *et al.* (2004) established the seven key guidelines for DSR in IS, as discussed above (Section 4.3.2).

Hevner (2007) further borrowed the framework from Hevner *et al.* (2004) and presented it in a novel form, known as a Three Cycle View of DSR, which reflected the seven guidelines within three fundamental cycles that should be present in any DSR study (Niemoller *et al.*, 2014). These three DSR cycles are presented in Figure 4.2.

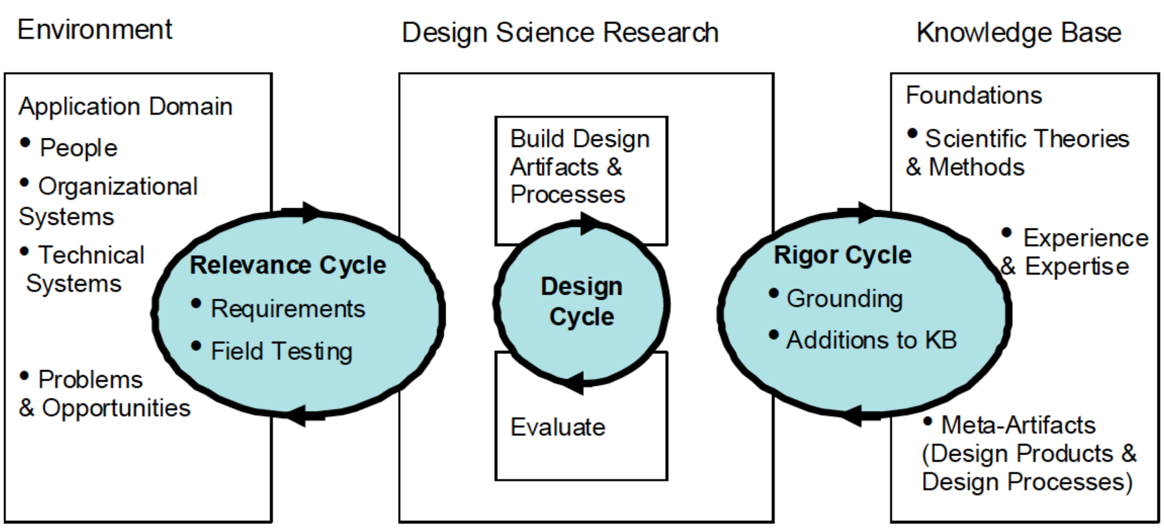


Figure 4.2: DSR Cycles (Source: Hevner, 2007, p. 88)

The three DSR cycles, as depicted in Figure 4.2, are the relevance cycle, the rigour cycle, and the design cycle. The relevance cycle acts as a bridge between the environment of the DSR project and the design activities. The rigour cycle links the design activities with existing knowledge base. The design cycle is the key cycle in DSR and encompasses continuous iteration between the activities related to building and evaluation of the DSR artefact. These three cycles are discussed below.

4.3.3.1. The relevance cycle

The relevance cycle is responsible for initiating a DSR project within a given contextual environment by providing the requirements for the study in terms of identifying the research opportunity and problem relevance (Hevner, 2014). Problem relevance is the key goal of the second guideline for DSR. For this study, relevance was presented in Section 1.3 of Chapter 1. A key question asked during the relevance cycle is: "what is the research question (design requirements)?" (Hevner & Chatterjee, 2010, p. 20). This results in the development of business needs that guide the research. Business needs emerge from the environment, which is characterised by the people, organisations and technology. Markovic (2010) emphasised that it is the duty of a researcher to clearly outline how his/her research activities align with business needs to delineate the relevance of the research.

For this study, the main link to the environment is the technical systems. This study focuses on examining the state of e-government usability in SSA. E-Government systems are technology applications that enable users to interact with governments. Looking at the other environment components in Figure 4.2, the citizens that interact with e-government systems represent the "people" component, while the government entities/departments represent the 'organisations" component. E-government systems link the citizens and the government entities together. However, for this interaction to be fruitful, it is important to ensure that the technological applications (e-government systems) provided by the government entities are usable by the citizens. Without adequate usability, the concept of e-government will stifle and die (Kirui & Kemei, 2014; Ray, 2011). As earlier highlighted (Chapter 1 and Chapter 2), usability is a central aspect of e-government adoption, without which many e-government systems are likely to fail (Bwalya & Healy, 2010).

E-government development in SSA is still in early stages of development, yet it is plagued by numerous usability issues (Kirui & Kemei, 2014). Consequently, for SSA to enjoy the benefits of e-government, significant efforts must be made to enhance the usability of e-government systems in the region, as better usability should foster its adoption and usage by citizens. To achieve this, it is important to develop approaches to enhance the usability of e-government systems in SSA. The relevance of this study is, therefore, based on its ability to contribute in enhancing e-government usability in SSA by developing a relevant artefact that can be adopted and used for advancing e-government usability.

4.3.3.2. The rigour cycle

In order to provide a rigorous DSR, researchers need to draw concepts from an existing knowledge base of scientific theories and engineering methods (Hevner, 2007). In addition to scientific theories and engineering methods, the relevant knowledge base for DSR also includes the experiences and know-how that outlines innovation in the application domain of the research, and the meta-artefacts available in the research domain (Hevner, 2014). The rigour cycle ensures that a DSR project creates new knowledge through the skilled selection and application of appropriate existing theories and methods that can help in the development and evaluation of the DSR artefact (Niemoller *et al.*, 2014). Researchers conducting DSR studies always need to review existing literature that supports the design of the artefact to ensure that it is grounded by relevant knowledge base (Hevner & Chatterjee, 2010).

In this study, the knowledge base was obtained from prior literature in the domain of e-government and usability. The literature review documented in Chapter 2 and Chapter 3 provided a solid foundation that outlined the prior research on e-government and usability to establish the context of this study. This knowledge will be incorporated into the development of the artefact described in Chapter 5.

4.3.3.3. The design cycle

The design cycle iterates between the development and evaluation activities of DSR and is considered as the central component of any DSR study (Hevner, 2014). The design cycle uses input from the relevance cycle (i.e. problem to be addressed and objectives to be met) and the rigour cycle (i.e. existing knowledge base) to ensure the effective development and evaluation of the artefact. Hevner (2007) noted that the design and evaluation of the artefact needed to be influenced by the relevance and rigour cycles, with an equal importance placed on both the designing and evaluation of the artefact. In this study, the design cycle is presented in Chapters 5, 6, and 7. These chapters present the iterations between the design and evaluation activities that led to the development of the artefact.

In order to effectively follow the DSR guidelines and cycles to develop an innovative artefact, researchers need to follow a DSR methodology (Hevner & Chatterjee, 2010). Peffers *et al.* (2008) introduced a DSR methodology which uses the DSR guidelines and a comprehension of DSR cycles to create valuable knowledge contributions through the development of an innovative artefact (Niemoller *et al.*, 2014).

This DSR methodology was adopted in this study and is discussed in detail below (Section 4.4)

4.4. The DSR Methodology

The DSR methodology follows a systematic process that has been outlined by Peffers *et al.* (2008). This methodology is an iterative process that is comprised of six key stages, namely: problem identification, solution objectives, design and development, demonstration, evaluation, and research communication. The DSR methodology is presented in Figure 4.3.

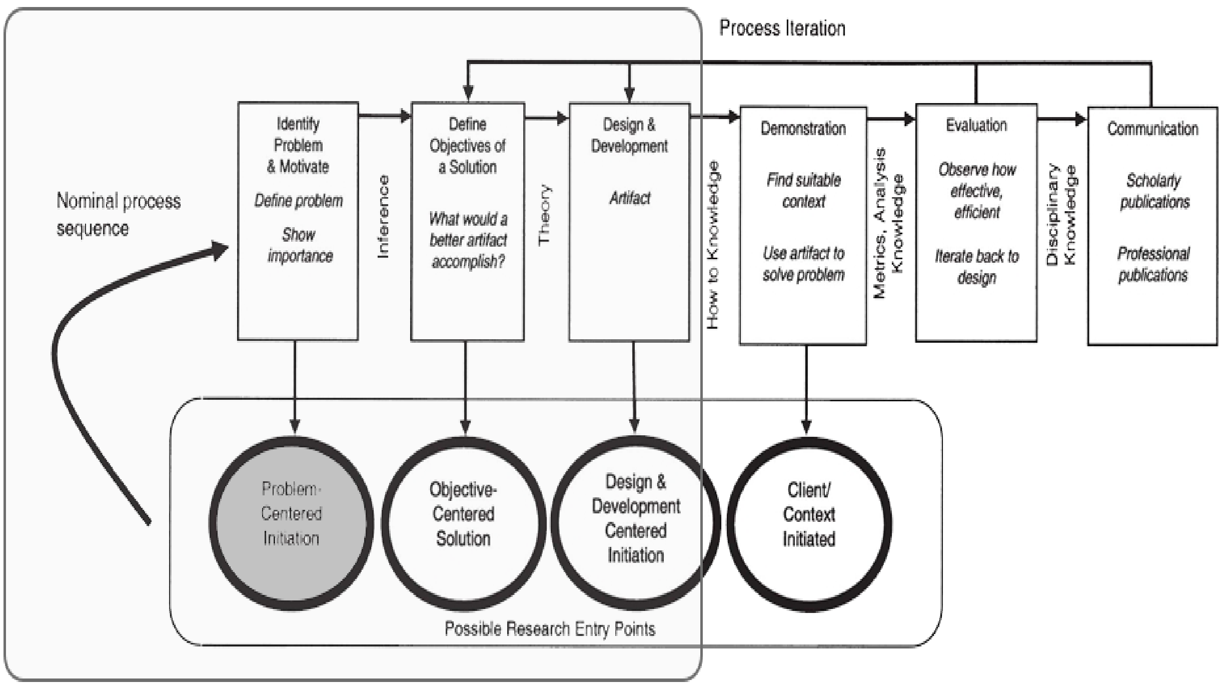


Figure 4. 3: DSR Methodology (Source Peffers *et al.*, 2008, p. 58)

The six key stages and their application to this thesis are discussed below.

4.4.1. Identify problem and motivate

DSR problems are usually broadly classified into two kinds, namely design problems and knowledge questions. Design problems highlight the need for change in the real world and are usually addressed through the analysis of an actual or hypothetical stakeholder goal, while knowledge questions, on the other hand, examine knowledge about the world as it is and provide a proposition to answer the knowledge questions (Aken, 2013). The roadmap for a DSR depends on the type of research question being addressed. Wieringa (2014) provides the roadmap for both design problems and knowledge questions, as depicted in Figure 4.4.

This study focused on knowledge questions. Knowledge questions are usually answered following an empirical cycle, as depicted in Figure 4.4. This implies that knowledge questions are formulated in a way that requires data from the world to address the phenomena under investigation (Wieringa, 2014).

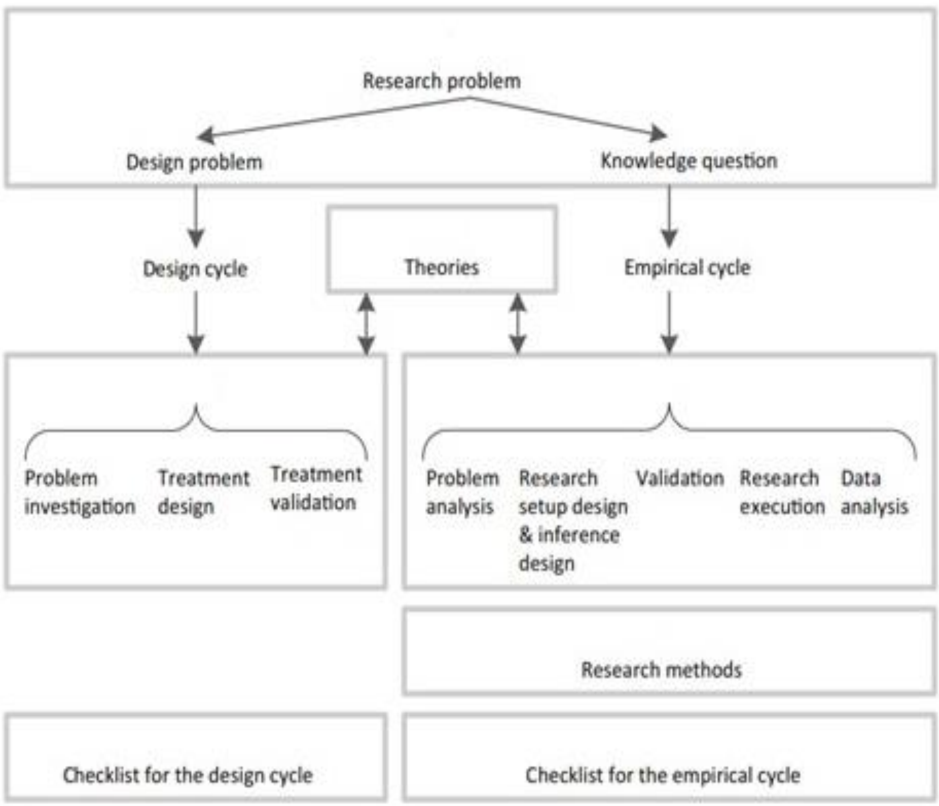


Figure 4.4: DSR Roadmap (Source: Wieringa, 2014, P. 213).

The scope of the problem and research questions that constitute the knowledge questions to be investigated in this thesis have been discussed in detail in Sections 1.3 and 1.4.

4.4.2. Define solution objectives

The second key stage in the DSR Methodology (Figure 4.3) is to define the objectives of the anticipated solution. There are two types of objectives in DSR, namely the design goals and knowledge goals. Since this study aimed at addressing knowledge questions, the formulated research objectives were knowledge goals. The knowledge goals of a DSR project aim at describing and explaining a phenomenon (Baskerville, Kaul & Storey, 2015). In this regard, this study intended to propose a model that can be used for improving e-government website usability in SSA. The complete list of primary and secondary objectives of this study was described in detail in Section 1.5.

4.4.3. Design and development

The design and development stage of the DSR methodology involves the creation of the proposed artefact. Design choices are often made based on the literature in the domain of the study. The design and development of the artefact then translate the defined solution objectives into actual constructs of the artefact. In this study, the literature review in Chapter 2 and Chapter 3 provided the foundation for the design choices.

4.4.4. Demonstration

The next step in the DSR methodology is the demonstration, which entails depicting how the artefact relates to the fundamental concepts of this study. According to Peffers *et al.* (2008), researchers need to use the demonstration phase to clearly articulate how the artefact can be utilised to address one or more instances of the identified research problem. The demonstration phase of this thesis will be presented in Chapter 6.

4.4.5. Evaluation

Artefact evaluation plays an important role in DSR as it helps to rigorously prove the case for the artefact's relevance in practice (Hevner *et al.*, 2004; Sonnenberg &, Brocke, 2012). While there is a general consensus on the importance of evaluation, the type of evaluation of each DSR artefact varies depending on the purpose of the evaluation. For example, the purpose of an artefact evaluation can be to examine how well it is designed to meet its utility expectations (Venable, Pries-Heje & Baskerville, 2016); to demonstrate the quality of knowledge outcomes regarding the usefulness of the artefact in solving a problem or making improvements (Kuechler & Vaishnavi, 2012); comparing the artefact to other artefacts (Venable *et al.*, 2016); or the purpose might be other specific attributes, such as usability, completeness, functionality, performance and reliability (Hevner *et al.*, 2004).

Depending on the purpose of the DSR artefact evaluation, a researcher can select a mix of qualitative or quantitative methods to evaluate the artefact. Hevner *et al.,* (2004) outlined five methods of DSR artefact evaluation. These methods are presented in Table 4.6 below.

Table 4.6: DSR evaluation methods (adapted from Hevner *et al.*, 2004)

Evaluation Method	**Description**
Observational	Case study: Detail study of artefact in a business environment.
	Field study: Monitor use of artefact in multiple projects.
Analytical	Static Analysis: Study artefact for static qualities.
	Architectural analysis: Study how artefact fits into the overall IS architecture of the system.
	Optimisation: Demonstrate the inherently optimal properties of the artefact and show the optimisation limits in the artefact's behaviour.
	Dynamic analysis: Examine the artefact while in use to determine its dynamic capabilities.
Experimental	Controlled experiment: Evaluate the qualities of the artefact in a controlled environment.
	Simulation: Use artificial data to execute the artefact.
Testing	Functional testing (black box): Test artefact interfaces for defects and other potential failures.
	Structural testing (white box): Perform coverage testing with selected metrics with regards to the implementation of the artefact.
Descriptive	Informed argument: Using information from existing knowledge resources (e.g. relevant research) to develop and present a convincing argument regarding the artefact's utility.
	Scenarios: construct detailed scenarios that can be used to demonstrate the artefact's utility.

The purpose of evaluating the artefact developed in this thesis (see Chapter 6) is to demonstrate the quality of knowledge outcomes regarding the usefulness of the artefact in solving a problem or making improvements. The thesis aims at advancing e-government usability in SSA. As such, the artefact will aim at addressing aspects of e-government usability in SSA that can be ameliorated. In this regard, two evaluation methods from Table 4.4 were deemed suitable to address the objective of the artefact evaluation in this thesis. These methods are the observational (specifically the case study) and descriptive (specifically the informed argument) methods.

4.4.6. Communication of research

The last state of the DSR methodology is to communicate the results of the study to appropriate audiences (Hevner *et al*., 2004; Peffers *et al*., 2008). Some of the key aspects to be communicated in DSR, as outlined by Gregor and Hevner (2011), include the problem, the literature, the methodology, the artefact and its evaluation, the discussions and the conclusions of the study. The primary communication of this study is a PhD thesis that will be disseminated via the University of the Free State. Additionally, journal articles and conference presentations of parts of the work will be disseminated to appropriate audiences. A peer-reviewed conference paper has been presented and published, while a journal paper has been successfully peer reviewed and is forthcoming in the international journal electronic government-research (Appendix G).

4.5. The Research Methods

This study adopted two research methods, namely usability evaluation methods, and mixed research methods. These two methods and their application are discussed below.

4.5.1. Usability evaluation methods

Usability evaluation methods generally refer to the different techniques, or set of systematically designed activities, for collecting and analysing data regarding user interaction with a system, or how given attributes of a system help to attain a given level of usability (Fernandez, Insfran & Abrahao, 2011). Following from prior HCI literature (Jaspers, 2009; Lazar *et al.*, 2010; Tan *et al.*, 2009), this study grouped usability evaluation methods into three categories, namely: expert-based methods, automated testing methods, and user-based methods. Each of these categories of usability evaluations has a number of different methods that can be applied for usability evaluation. The subsections below will document the different usability evaluation methods available, as well as those selected under each category. For the purpose of this thesis, expert-based and automated testing methods were used.

4.5.1.1. Expert-based methods

Expert-based methods usually focus on determining flaws in an interface or system based on predefined standards or guidelines. When conducting an expert-based method, two important things need to be considered. The first thing to consider is to determine the type of expert-based method to use, while the second thing is to determine the number and quality of evaluators to use.

4.5.1.1.1. Selection of expert-based usability evaluation method

Some of the most widely used experts-based evaluation methods include heuristic evaluations, cognitive walkthroughs, pluralistic walkthroughs, guideline reviews, and consistency inspection. These different methods are briefly described in Table 4.7 below.

Table 4.7: Expert-based usability evaluation methods

Expert-based Methods	**Description**
Heuristic evaluation	Heuristic evaluation is a usability evaluation method whereby usability experts or other stakeholders appraise a user interface based on some set of predefined rules or principles (Wilson, 2014). The ten heuristics by Nielsen (1995) are the most widely used set of heuristics in usability. While Nielsen's ten heuristics primarily addressed general website usability, they have, however, been adapted and extended in the domain of e-government to address the specific issues relevant to e-government websites (Zhao & Benyoucef, 2014).
Cognitive	According to Smith (2011), a cognitive walkthrough aims at evaluating the

walkthroughs	design of a user interface with a key focus on how easy the interface is to learn, or in other words, how well the system supports exploratory learning. Cognitive walkthroughs generally focus on examining the usability problems that users of a system might experience in their process of learning to use the system and/or completing tasks.
Pluralistic walkthroughs	A pluralistic walkthrough involves both users and members of a product team examining and discussing usability issues of a system interface with regards to the steps to take in completing a task (Wilson, 2014). Pluralistic walkthroughs are always guided by a facilitator who presents the interface and initiates discussions. Pluralistic walkthroughs are very similar to cognitive walkthroughs, with the primary difference being the comprehensiveness of the evaluation team. The evaluation team in a cognitive walkthrough comprises of only human experts. However, in a pluralistic walkthrough, the whole project team, including managers, engineers and programmers, form part of the evaluation team (Preece, Rogers & Sharp, 2015).
Guideline reviews	A guideline review is a usability evaluation method in which an interface is examined against a full list of usability guidelines to verify if the interface meets the stated guidelines.
Consistency inspection	Consistency inspection usually involves system designers from multiple projects who inspect a given system interface to determine if the interface works in a similar manner to their own interfaces. The focus is, therefore, to check for consistency across a family of previously evaluated products. Thus, if a system performs consistently with one that had been previously tested and approved in terms of usability, then the system in also likely to have high usability (Lazar *et al.*, 2010).

After examining all the expert-based evaluation methods as were described in Table 4.8, heuristic evaluation was adopted for this thesis as the most suitable. In addition to the robustness of heuristic evaluations, two other factors accounted for selecting this evaluation method. Firstly, heuristic evaluation is noted to be one of the most cost effective expert-based usability evaluation method that is easy, quick and very effective (Wilson, 2014; Zhao & Benyoucef, 2014). Secondly, heuristic evaluation has been the most widely used and established expert-based method in the domain of e-government usability (Baker, 2009; Elling *et al.,* 2012; Youngblood & Mackiewcz, 2012). A discussion on the selected heuristics for this study is presented in Section 4.6.1, while the list of used heuristics is documented in Appendices D and E.

4.5.1.1.2. Selection of heuristic evaluators

A total of five heuristic evaluators took part in the heuristic evaluation. The number of heuristic evaluators is often a key concern in usability studies. Generally, the more the evaluators, the more usability problems are likely to be found. A heuristic evaluation can actually be performed by one evaluator (Preece *et al.,* 2015; Fogg, 2003), however, the general recommendation in IS literature is to use approximately three to five evaluators (Tan *et al.*, 2009). This is because three to five evaluators have been known to detect about 65-75% of usability problems (Figure 4.5), which is considered satisfactory (Karampelas, 2013).

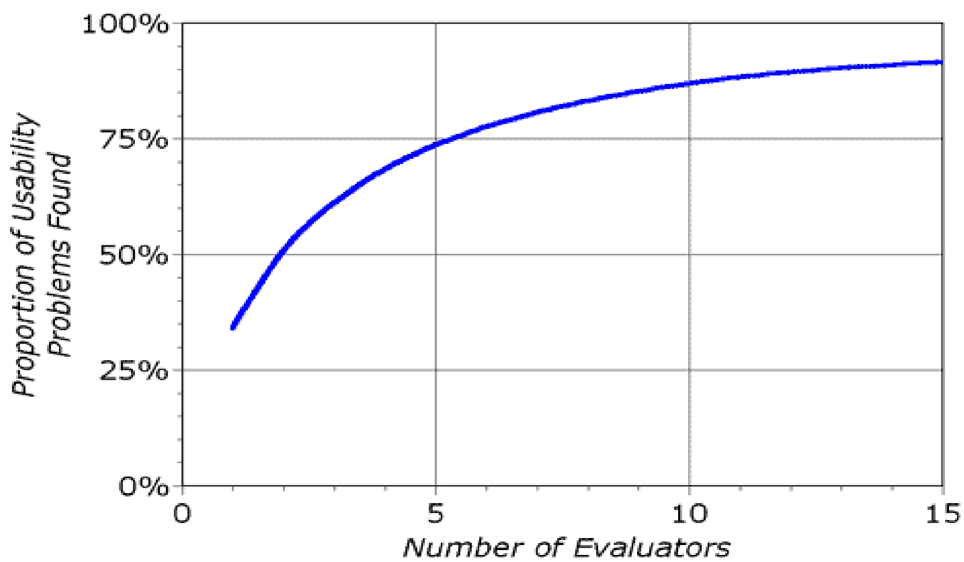


Figure 4.5: Percentage of usability issues found by Heuristic Evaluators (Source: Nielsen, 1994, p. 156)

Even though the recommendation by Nielsen (1994) to use three to five evaluators has been widely accepted in IS literature, it is important to note that the number of evaluators needed for detecting 75% of usability problems depends on the nature of the problems. As such, it is often advised to get as many evaluators as possible as more is better (Preece *et al.*, 2015). However, researchers must consider the cost of hiring evaluators when conducting a study (Lanzilotti et al., 2011).

The cost, measured in terms of time, as proposed by Lanzilotti *et al*. (2011), was the key factor in deciding on the number of evaluators in this study. While the evaluation of a single interface might take as little as ten minutes (Lanzilotti et al., 2011), the case is different when evaluating a large number of interfaces, as it could take a number of days per evaluator, as was the case with Youngblood and Mackiewicz (2012). As such, in line with prior studies (Youngblood & Mackiewicz, 2012; Tan et al., 2009) five evaluators were deemed sufficient for the case of this study. Moreover, the heuristic evaluation was accompanied by automated usability testing tools that have also been developed to examine website interfaces based on existing heuristics.

One of the evaluators was the principal researcher, while the other four were novice evaluators. As already discussed in Section 1.6, existing evidence indicated that heuristic evaluations could be effectively completed by both experts and novice users (Botella *et al.*, 2013; Garcia *et al.*, 2005; Khajouei *et al.*, 2011; Lazar et al., 2010). Molich and Jeffries (2003) emphasised that it is not a necessity for heuristic evaluators to have particular usability knowledge to evaluate a user interface. Nonetheless, this study acknowledges the fact that there is an evaluator effect in heuristic evaluations. An evaluator effect occurs when different usability evaluators analyse the same interface in usability and find different sets of usability issues (Hertzum, Molich & Jacobsen, 2014; Tullis & Albert, 2013). Several reasons contribute to the evaluator effect and a detailed review can be found in Hertzum *et al.* (2014). However, two prominent reasons include differences in domain specific knowledge among evaluators and the fact that usability evaluators need to exercise cognitive judgements. This often results in different viewpoints in the detection and rating of usability issues.

Evaluator effects can be observed both among expert and novice evaluators (Law & Hvannberg, 2008). However, the level of experience and expertise of the evaluators significantly affect the outcomes of the heuristic evaluation, as expert evaluators have been known to find more severe usability issues than novice evaluators (Hertzum & Jacobsen, 2001; Hvannberg, Law &

Larusdottir, 2007; Ling & Salvendy, 2009). While it is ideal to have expert evaluators, the cost of hiring and the availability of expert evaluators for the purpose of this study resulted in the decision to use novice evaluators as well.

The most noticeable downside to using novice evaluators is the fact that these evaluators tend to identify fewer usability issues than experts (Isbister & Schaffer, 2008; Nielsen, 1993). However, prior studies (Hvannberg *et al.*, 2007; Sim & Read, 2015) have shown that this downside of novice evaluators can be mitigated with training on the usability guidelines to use. As such, the four novice evaluators that participated in this evaluation were trained on key aspects of heuristic evaluation.

The training was conducted by the principal researcher who was responsible for compiling all the materials associated with the heuristic evaluation. The content of the training was limited to the heuristics of the six-dimensional framework and the UsabAIPO heuristics (Appendix D & Appendix E respectively). The goal was to provide the evaluators with domain knowledge on evaluating e-government websites with the selected heuristics. Each of the evaluators was trained independently. After the evaluators had accepted to participate in the study and signed the consent form, the contents of the selected heuristics were emailed to them. Each of them was asked to read through the content and then schedule a skype meeting to discuss the content and rating approach. During the skype training meeting, the researcher started by introducing the topic, explaining the general information about the selected heuristics, and explaining each of the heuristic items and rating criteria to the evaluator. The evaluator undergoing training was then given the opportunity to ask questions regarding the content. The researcher then responded to the questions. One dummy e-government website, not included in the list for this study, was used to jointly follow the heuristics step by step to evaluate the website, while discussing any issues not understood in terrms of the evaluation item. The skype meetings took between 1 hour 30 minutes and 2 hours.

The training was made easy by the fact that all the novice evaluators were educated, with all having at least a Bachelor's degree in Computer Science/Information Technology (two with BSc degrees and two with Masters' degrees). Additionally, all the evaluators who took part in this study had taken a course in usability/UX. As such, even though the evaluators were considered novice evaluators, they had significant knowledge in usability compared to someone who would typically be referred to as a novice.

However, they did not qualify as usability experts, as prior usability literature depicts experts as usability professionals with many years of usability experience. A review of prior usability literature by Salgado and Fortes (2016) suggested that usability evaluators have primarily been classified in terms of novice or expert users. In this regard, novice evaluators were seen as the best-suited description for the four additional evaluators used in this study. Nonetheless, the need to broaden this classification was introduced by Botella, Alarcon and Penalver (2014), who proposed a five-level structured approach for categorising usability professionals. These levels are described in Table 4.8 below.

Table 4.8: Classification of usability professionals

Level	Characteristics
Novice	• No university degree • Undertaken short training in HCI • Practised usability evaluation for few hours
Beginner	• No university degree • More than one training course in HCI • Practised usability evaluation for less than 2,500 hours
Intermediate	• Bachelor’s degree in the HCI field • Practised usability evaluation for less than 5,000 hours
Senior	• Masters’ degree in the HCI field • Practise usability evaluation for less than 7,500 hours
Expert	• At least a Masters’ degree in the HCI field • Practised usability evaluation for more than 10 000 hours

Source: (Compiled from Botella *et al.*, 2014)

Considering the classification in Table 4.9, it can be seen that the heuristic evaluators in this study were better classified as intermediate and senior evaluators, as opposed to novice evaluators. As such, they were likely to capture more usability issues than a typical novice evaluators reported in prior literature. This, therefore, also mitigates the limitation of lack of expert evaluators.

It is, however, important to acknowledge that the usability evaluators were not highly specialised heuristic evaluation experts. As such, the usability issues identified might not be the optimal number that heuristic evaluation experts would have determined. Nonetheless, this limitation is mitigated by the use of automated testing methods (see Section 4.7.2) that were also used to examine the same interfaces.

The identified heuristic guidelines were categorised based on the six-factor framework for usability, as was discussed in Chapter 3. A complete list of the guidelines was provided to each of the evaluators along with the protocol to follow in examining the given list of e-government websites (Appendix F). The three stages of heuristic evaluation proposed by Preece *et al*. (2015) were followed in this study. In the first stage, each of the evaluators was briefed by the principal researcher on the different heuristics used for the evaluation. During the briefing, evaluators were also required to provide consent to participate in the study. A consent form (Appendix C) was provided to the evaluators with an explanation of their expected participation. In the second stage, each of the participants was allowed a period of 3 months to complete the evaluation of all 279 e-government websites. Typically, it could take about an hour or less to complete the evaluation of each interface. Evaluators were advised to take two passes through the website as suggested by Preece *et al.* (2015). The first pass helped them to get a general feel of the website, while the second pass was guided by the list of heuristics. In the third stage, the results were aggregated by the principal researcher. Aggregation was made possible by the fact that the selected heuristics were rated quantitatively. Details of the aggregation procedure are discussed in Section 4.6.4.1.

4.5.1.2. Automated testing methods

Similar to heuristic evaluations, automated usability testing methods also follow a set of predefined guidelines developed by experts. The key difference compared to heuristic evaluation is that instead of human users evaluating the interface against the guidelines, the evaluation is done by a software system.

Automated usability tools often receive input (e.g. an interface or data), perform the required analysis, and present the results. Some key advantages of using automated usability testing tools are that they are time and cost effective and can be applied consistently in testing different interfaces, making it easy to compare the usability of different interfaces (De Bruin, Malan, Eloff & Zielinski, 2014). This is particularly important for this thesis where many interfaces were evaluated and compared regarding their usability.

Many automated usability testing tools exist, however, only the tools used for the purpose of this thesis will be discussed in Section 4.6.2. These tools include Functional Accessibility Evaluator (FAE 2.0), Responsinator, Sucuri SiteCheck, TAW (Test de Accesibilidad Web), and Xenu's Link Sleuth. A three-step criteria was used to select the tools. For each evaluation aspect that required automated testing (See Appendix D) an online search was conducted to identify as many tools as possible that could be used for the evaluation. The first step, which focused on evaluating the cost of available tools, was then conducted. Due to cost constraints, this study opted for tools that were freely available and could be used for research purposes. After selecting all the free tools from the list of tools initially found, the second criteria was applied. This focused on the functionality of each tool by specifically addressing the limitations in terms of the number of interfaces that could be evaluated with the tool, the depth of evaluation, and presentation of the evaluation results. Tools with limitations on the number of interfaces were excluded, as each selected tool needed to be used to complete the evaluation of 279 e-government websites. Also, it was important to ensure that a given automated tool presented the evaluation outcomes in a way that would be easily understandable by the researcher and could be interpreted effectively.

If after this stage, there were more than one tool for a given usability aspect to be evaluated, the third criteria was subsequently applied. The third criteria involved a review of existing academic literature to determine which of the tools was most popular in terms of use in prior research. The tools that were found to be widely used, were then adopted, as it provided room for benchmarking. The details of each of the selected tools are presented in Section 4.6.2.

This triangulation of different usability methods provided the benefit of having a more comprehensive evaluation picture of the state of usability of e-government websites in SSA. As such, using automated testing methods to supplement the heuristic evaluations became a key aspect in addressing this limitation as similar e-government usability studies (Youngblood & Mackiewicz, 2012) from other parts of the world have proven the effectiveness of automated testing methods in identifying usability problems.

4.5.1.3. User-based methods

With user-based testing, a group of representative users attempt to complete a set of given representative tasks on the system being evaluated (Hoff & Preminger, 2015; Lazar *et al.*, 2010). User-based methods are very important in usability studies, as they are said to provide the most accurate representation of usability by pinpointing the important usability issues (Dillon, 2001; Viitanen & Nieminen, 2011). However, the downside to user-based methods is the fact that they are very time-consuming and costly when many users are required (Dilon, 2001). Nonetheless, since user-based methods often identify several usability issues that cannot be identified by the other two approaches (Lazar *et al.*, 2010; Thyvalikakath *et al.*, 2009), it is advisable to blend the different methods for an optimal usability evaluation. User-based usability methods can range from laboratory experiments to usability surveys. The choice of methods usually depends on the goal of the evaluation. For the purpose of this study, user-based methods were not used. As indicated above, user methods are time-consuming and costly and thus impractical for evaluating a large number of e-government websites, as was done in this study (i.e. a total of 279 e-government websites from SSA). In fact, most available e-government usability studies (Albayrak & Çaǧiltay, 2013; Alfawwaz, 2012; Darem & Suresha, 2012; Venkatesh et al., 2014) that have adopted user-based methods have focused only on about one to five e-government websites.

4.5.2. Mixed methods

As highlighted by several researchers (Agerfalk, 2013; Gacenga *et al.*, 2012), DSR can highly benefit from the incorporation of mixed methods research evaluations, especially in enhancing the research rigour with regards to the creation and evaluation of the artefact. Mixed methods research will be adopted and incorporated in this thesis both in the creation and the evaluation of the artefact.

Mixed method research brings together a combination of quantitative and qualitative research designs in the same study (Agerfalk, 2013; Venkatesh *et al.*, 2013). This implies that a researcher adopting a mixed methods design uses both quantitative and qualitative methods in a single study to gather and analyse data, integrate the findings and draw conclusions (Tashakkori & Creswell, 2007). The mixed methods research was developed in order to address some of the inherent limitations of using only one of the methods, and as a means of ensuring that more holistic results could be obtained.

Table 4.9: Purposes of mixed methods research

Purposes	Description
Complementarity	Mixed methods are used in order to gain complementary views about the same phenomena or relationships.
Completeness	Mixed methods designs are used to make sure a complete picture of a phenomenon is obtained.
Developmental	Questions for one strand emerge from the inferences of a previous one (sequential mixed methods), or one strand provides hypotheses to be tested in the next one.
Expansion	Mixed methods are used in order to explain or expand upon the understanding obtained in a previous strand of a study.
Corroboration/ Confirmation	Mixed methods are used in order to assess the credibility of inferences obtained from one approach (strand).
Compensation	Mixed methods enable compensating for the weaknesses of one approach by using the other.
Diversity	Mixed methods are used with the hope of obtaining divergent views of the same phenomenon.

Source: (Adapted from Venkatesh *et al.*, 2013)

The application of the combined qualitative and quantitative methods could either be done sequentially or concurrently. Prior IS literature (Tashakkori & Teddlie 2008; Venkatesh *et al.*, 2013) has emphasised the need for IS researchers to understand the different purposes of mixed methods research in order to guide their decision to adopt mixed methods in their research studies. Venkatesh *et al*. (2013) detailed seven purposes of mixed methods research, namely: complementarity, completeness, developmental, expansion, corroboration/confirmation, compensation, and diversity. These different purposes are described in more detail in Table 4.9 above.

In adopting mixed methods in this thesis, the key purpose was to obtain completeness. The goal of completeness entails providing a more diverse view of a phenomenon, whereby the researchers use different approaches to provide a holistic analysis of the research problem (Venkatesh *et al*., 2013). This completeness is usually achieved through the use of triangulation, as it facilitates the understanding of the problem using a combination of methods and theories (Yeasmin & Rahman, 2012). The study aimed at advancing e-government usability in SSA and a key part of the process was to examine the current state of e-government usability in SSA. This could help to determine which aspects were lacking and would need to be advanced. As such, it was important to have a complete picture of the state of e-government in SSA in order to ensure the development of an appropriate artefact for advancing e-government in SSA. The selection of this purpose of completeness guided the researcher to choose an appropriate mixed method research approach.

Table 4.10: Mixed methods research

Mixed Methods Research	**Description**
Sequential Methods	
Sequential Exploratory	Characterised by two phases whereby the first phase involves qualitative data analysis and the second phase using quantitative methods to test the relationships identified in the first phase to increase the generalisability of the findings (Venkatesh *et al*., 2013).
Sequential Explanatory	Often characterised by two phases whereby the first phase involves predominantly quantitative analysis and the second phase involving the use of qualitative data to further explain and gain useful insights from the findings from the first phase (Creswell, 2012).

Sequential Transformative	Contains two distinct phase of data gathering and analysis, where one phase is either quantitative and the other qualitative, or vice versa.
Concurrent Methods	
Concurrent Nested	This involves one phase in which quantitative and qualitative methods are used simultaneously. However, one of the methods is dominant and the other embedded or nested within the predominant method (Creswell, 2012).
Concurrent Triangulation	With this design, both qualitative and quantitative methods are used simultaneously in a single phase to produce a more comprehensive picture of the phenomena under investigation. The two methods corroborate or cross-validate the findings of each other and their point of intersection depicts the reality of the phenomena (Yeasmin & Rahman, 2012).
Concurrent Transformative	This is a combination of attributes from concurrent nested and concurrent triangulation designs. Data is collected simultaneously and both quantitative and qualitative approaches can be given the same or uneven interpretive importance.

Several mixed method approaches have been presented in prior literature. Some of the most common of these methods are described in Table 4.10 below. As previously indicated, the mixed methods can either adopt a concurrent or sequential design. This study adopted concurrent triangulation as the preferred mixed method. Triangulation in practice can always be implemented in four different ways, namely method triangulation (using different methods to gather data from different sources to address same phenomena); triangulation of sources (using the same method to collect data from different sources); analyst triangulation (using different analysis techniques to analyse the same data from different dimensions), and theory/perspective triangulation (using multiple theories/perspectives to interpret data). This thesis adopted analyst triangulation, whereby both heuristic evaluations and automated testing methods were used to analyse the same e-government websites from different dimensions.

4.6. The Research Techniques

Several tools were adopted for generating, collecting and analysing the data for this thesis. These included heuristic evaluation tools, automated testing tools, and data sources for national indicators.

4.6.1. Heuristic evaluation tools

As previously indicated, this study adopted heuristic evaluation as the primary strategy for evaluating the usability of e-government websites in SSA. Two heuristic evaluation tools were used in the process, namely the six-dimensional framework and the UsabAIPO heuristics. While the outcomes of most heuristic evaluations are qualitative in nature, this study adopted measures that produced quantitative outcomes: the six-dimensional usability framework by Baker (2009) and the UsabAIPO heuristics (González, Masip, Granollers & Oliva, 2009). This allowed for comparisons across different SSA countries. These two heuristics evaluation tools are discussed below.

4.6.1.1. Six-dimensional framework

The six-dimensional usability framework was reviewed in Chapter 3 as the fundamental theoretical framework for evaluating the usability of e-government websites (Section 3.4). One key limitation of usability heuristics that target a specific context of use has been the lack of validity evaluation of existing heuristics (Hermawati & Lawson, 2016). However, in the case of e-government website usability, the heuristics for the six-dimensional usability framework have evolved and were widely evaluated and used for over fifteen years. The initial heuristics were presented by Stowers (2002) and were further extended by other researchers (Gant *et al.*, 2002; Holzer & Kim, 2004; West 2003a, 2003b, 2006), resulting in a total of 87 variables for the six dimensions. The heuristics were further revised by Baker (2004) and evaluated and used in several studies (Baker, 2007; Raoch, 2007, Kaan, 2007).

Baker (2009) later provided a set of enhanced heuristics by using triangulation to reduce the 87 variables to 37 variables across the six usability dimensions. The 37 variables composed of both 22 dichotomous and 15 scale variables. Dichotomous variables are evaluated as dummy variables whereby the availability of a variable on a websites receives a score of one or otherwise zero. The scale variables, on the other hand, are evaluated using Guttmann-type scales.

Appendix D presents the heuristics for all the six dimensions, as well as a detailed description of the Guttmann-type scales for all the scale variables.

4.6.1.2. UsabAIPO heuristics

The six-dimensional usability heuristics were supplemented with UsabAIPO[2] heuristics to ensure that a detailed picture of the state of usability of SSA e-government websites was captured. The UsabAIPO heuristics are aimed at the evaluation of website usability, although not specifically focusing on e-government websites like the six-dimensional framework.

The UsabAIPO heuristics were developed by 15 multidisciplinary research groups from universities in Spain and Mexico that specialised in HCI research (Gonzalez *et al.*, 2008). The heuristics focus on four dimensions, namely design, navigation, content organisation, and functional diversity (Gonzalez *et al.*, 2009). The UsabAIPO heuristics comprise of 66 variables, however, after evaluation of the variables only 30 were selected for the purpose of this study. The reduction was done for two reasons. Firstly, it was important to ensure that a manageable set of heuristics was used, taking into account the time needed by evaluators to evaluate all 279 e-government websites. The time and resource constraints were important, especially as the UsabAIPO heuristics were introduced as a secondary measure to improve the scope of the usability evaluations.

Secondly, several UsabAIPO heuristics overlapped with many of the six-dimensional framework variables. As such, they were eliminated to reduce redundancy in the evaluation. The total set of UsabAIPO heuristics used in this study is presented in Appendix E, along with the rating criteria.

The USABAIPO-H function was applied to the UsabAIPO heuristics. The function processes quantitative outcomes from a heuristic evaluation (Gonzalez *et al.*, 2009). The function is given as:

[2] USABAIPO is a name of the usability project developed by the ASEAN Inter-Parliamentary Organization (AIPO). "USAB" signifies usability, while "AIPO" signifies the organisation that implemented the project.

$$USABAIPO - H(w) = D(w) * 0.28 + N(w) * 0.28 + C(w) * 0.20 + S(w) * 0.24$$

USABAIPO-H (w) represents the overall usability of a website, while D (w), N (w), C (w) and F (w) represent the weights of each of the usability heuristic dimensions.

4.6.2. Automated evaluation tools

To improve the robustness of the usability evaluation, automated evaluation was also adopted. The different usability automation testing tools used in this study are described below.

4.6.2.1. Functional accessibility evaluator (FAE) 2.0

FAE 2.0[3] is a project of the Open Accessibility Alliance and OpenAjax Accessibility Task Force. The tool is free and can be used to evaluate websites for complaints with accessibility guidelines. This study used FAE 2.0 version 0.9.9.

Table 4.11: FAE accessibility outcome classification (Source: FAE, 2016)

Message	Score	Description
Complete	100	Complete means all automated rules have passed and there are no manual checks.
Almost complete	95-99	Almost Complete means that you seem to understand the accessibility requirements of the automated rules, and are close to fully implementing their requirements on all pages within the website.
Partial implementation	50-94	Partial Implementation means that you may understand at least some of the accessibility requirements of the automated rules. The accessibility requirement should be re-read and the techniques reviewed before trying to improve the accessibility.
Incomplete	0-50	Incomplete means that you do not understand the accessibility requirements of the automated rules or did not consider accessibility in the design of the website. The accessibility requirement should be re-read and the techniques reviewed before trying to improve the accessibility.

[3] Tool available at: http://fae20.cita.illinois.edu/

The tool evaluates multiple aspects of a website in compliance with WCAG 2.0 guidelines. FAE has an interesting functionality whereby it evaluates an entire website down to third level web pages and categorises the website's accessibility compliance with a percentage score. The classification of the different scores from FAE evaluation is presented in Table 4.11 below.

FAE 2.0 also presents the results of the different rules violated by the evaluated websites, linking each rule to specific WCAG 2.0 guidelines. FAE was deemed to be better to use than other accessibility evaluation tools because it could evaluate a whole website in one click and archive the results for future recording. The presented results were also easy to understand. Most other popular accessibility tools (e.g. WebAIM, AChecker, and EvalAccess) evaluated a single page at a time, making it a cumbersome task to use them for evaluating all pages of the 279 e-government websites. Other tools, such as SortSite evaluator and Siteimprove Accessibility, could not be considered because they required a purchased license or paid subscription that funding for this thesis could not afford. However, comparable accessibility evaluation tools like the FAE 2.0 and TAW have been shown to be equally as effective as the paid versions (Adepoju et al., 2016; Akgul, 2015; Kamal, Alsmadi, Wahsheh & Al-Kabi, 2016). FAE 2.0 has been acknowledged in prior literature as a credible accessibility evaluation tool (Jabble & Sharma, 2015; Kurt, 2014) and was also used in several studies (e.g. Bakhsh & Mehmood, 2012; Kamal *et al.*, 2016). A screenshot of FAE 2.0 captured by the researcher is presented in Figure 4.6.

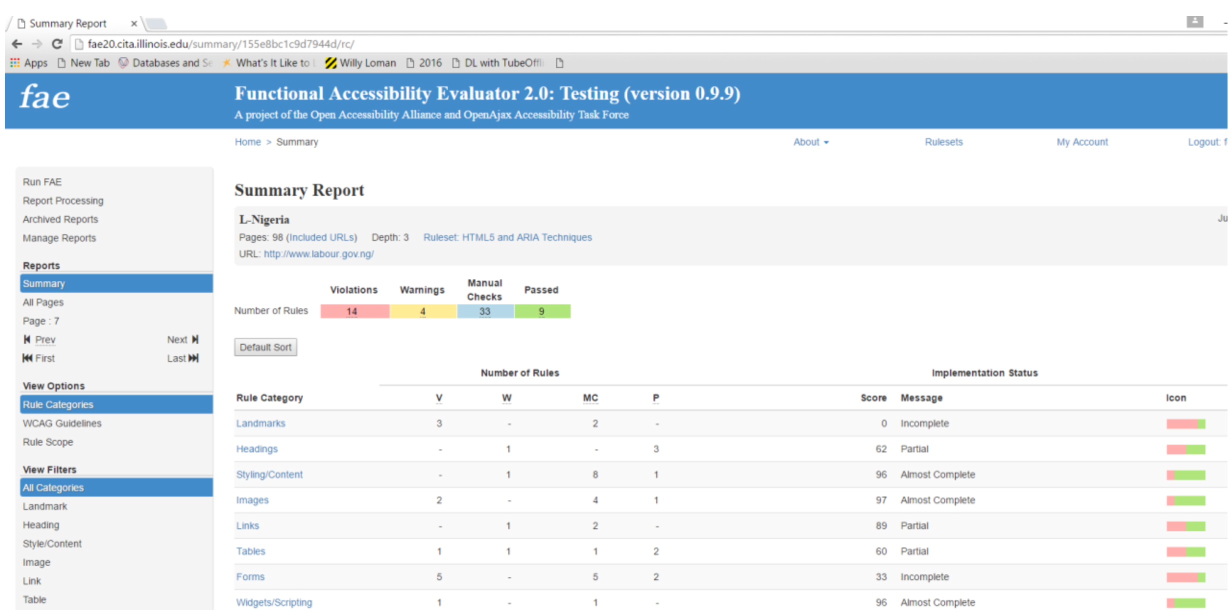


Figure 4.6: Screenshot of FAE 2.0

4.6.2.2. Responsinator

The Responsinator[4] is a website user interface testing tool that takes a website's Uniform Resource Locator (URL) and emulates the display of the website across numerous mobile device screens such as iPhones, iPads, and Android devices. Some of the device screens include iPhone 5 portrait (320px), iPhone 5 landscape (568px), iPhone 6 portrait (375px), iPhone 6 landscape (667px), iPhone 6 Plump portrait (414px), iPhone 6 Plump landscape (736px), Crappy Android portrait (240px), Crappy Android landscape (320px), Android (Nexus 4) portrait (384px), Android (Nexus 4) landscape (600px), iPad portrait (768px), and iPad landscape (1024px). A screen shot of Responsinator, captured by the researcher, is presented in Figure 4.7.

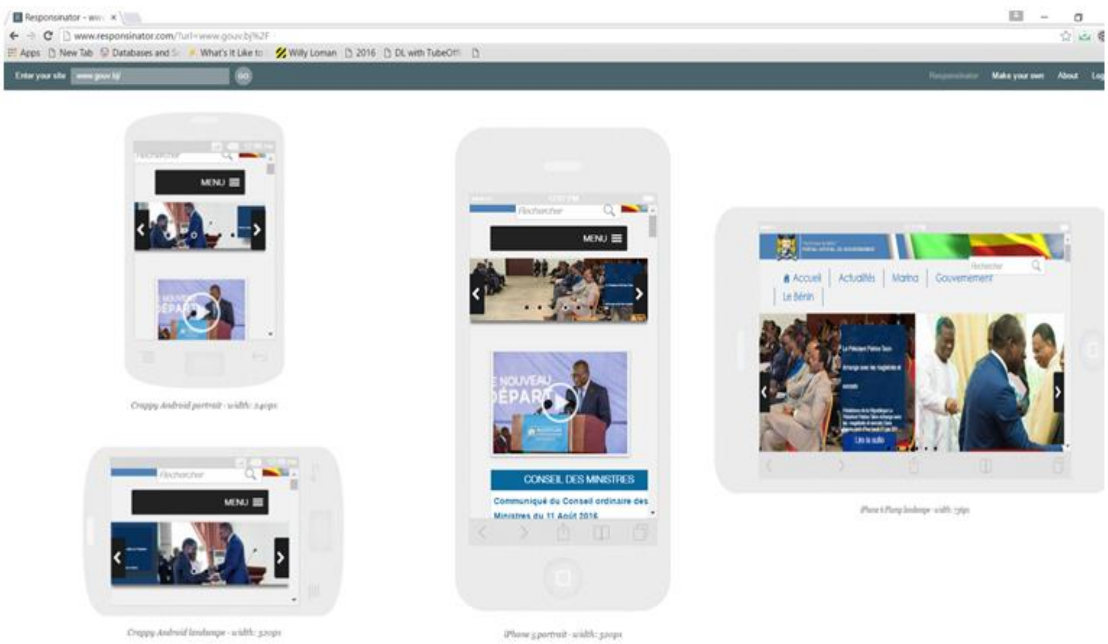


Figure 4.7: Screenshot of Responsinator

The tool was developed by Pugsley and Hovey (n.d). Kim (2013) elucidated that the Responsinator is very useful for evaluating how a website displays on different mobile devices. Similarly, Palani (2014) argued that the visibility of UX with the Responsinator was better than that for any other tool used for the evaluation of the responsiveness of websites on mobile devices. After an online review, more than 23 tools for evaluating website responsiveness were

---

[4] Tool available at: https://www.responsinator.com/

found. Kim (2013) also indicated that there were over 50 of such tools available. However, in the opinion of the researcher, the Responsinator was the easiest to use, as one simply enters the URL, clicks on go, and views the results on different display screens. Also, its user interface was not crowded with content that did not relate to the evaluation, as was the case with most other tools. Additionally, many books covering the subject of mobile websites have reviewed and recommended the use of the Responsinator (Kim, 2013; Ralins, 2016; Palani, 2014; Panhale, 2016). For these reasons, the Responsinator was selected as the suitable tool for this study.

4.6.2.3. Sucuri sitecheck

The Sucuri sitecheck[5] tool evaluates the security of a website and presents findings, such as malware detection, spam, blacklisting or use of outdated software, that open up security vulnerabilities for the website. According to Sabin-Wilson (2016), Sucuri Sitecheck was developed by Daniel Cid and Dre Armeda. The tool allows for an external security evaluation of a website in its production environment without causing any disruption of service delivery via the website. A screenshot from Sucuri Sitecheck, captured by the researcher, is presented in Figure 4.8.

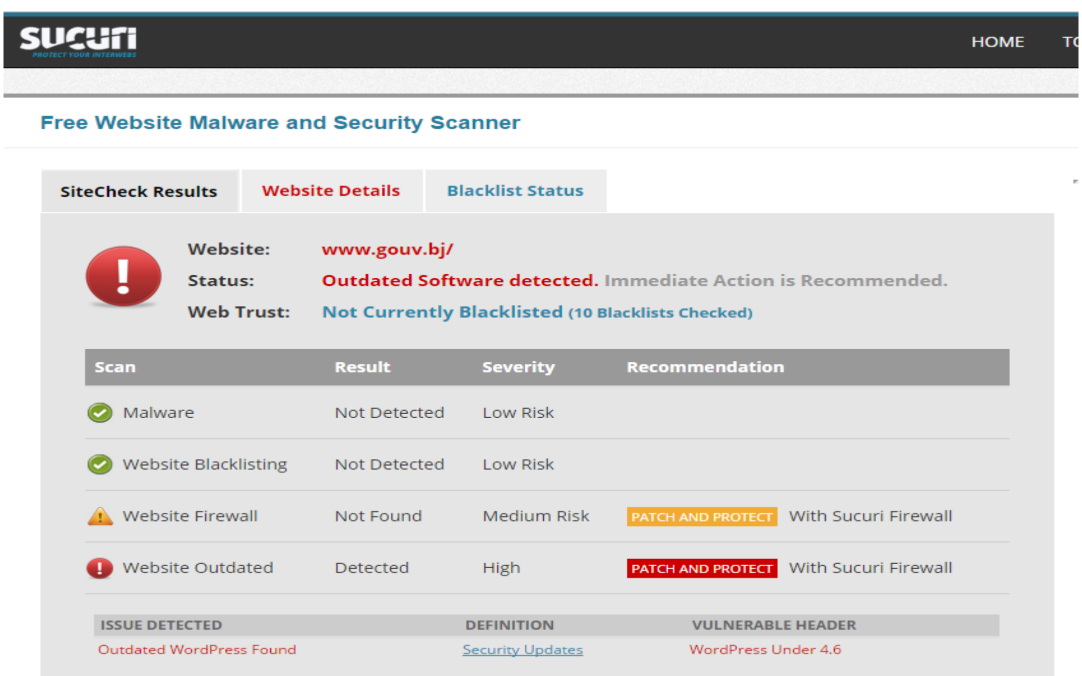


Figure 4.8: Screenshot of Sucuri Sitecheck

[5] Tool available at: https://sitecheck.sucuri.net//

After conducting a web search for website security evaluation tools, only Sucuri Sitecheck was found as a free tool for conducting website security evaluation. As such, the tool was selected for use in this study.

4.6.2.4. TAW

TAW[6] is a Java-based tool developed by the Spanish Center for the Development of Information and Communication Technologies. TAW can be used for the evaluation of websites for compliance with WCAG 1.0, WCAG 2.0 and W3C mobileOK Basic Tests 1.0 compliance.

TAW has been used to examine the accessibility of e-government websites in several prior studies (Adepoju et al., 2016; Akgul, 2015; Al Mourad & Kamoun, 2013; Butt, 2014). The validity of TAW in comparison to other accessibility tools was also presented by Al Mourad and Kamoun (2013) by showing that the accessibility evaluation results from TAW correlated with results from another widely accepted accessibility evaluation tool known as EvalAccess 2.0. Although TAW is a free tool with excellent qualities with respect to the breadth and depth of accessibility reporting, FAE 2.0 was preferred for accessibility evaluation of websites because TAW only evaluates a single web page at a time, thus making the task to evaluate whole websites cumbersomely. However, TAW provided a useful feature to be used in this study, namely the W3C mobileOK Basic Tests 1.0 that evaluates websites for compliance with W3C Mobile Web Best Practices. This determines the accessibility compliance of websites on mobile devices (Owen & Rabin, 2008).

As such, TAW was used in this study to evaluate the mobile accessibility compliance of e-government websites. The only limitation of the TAW was that only the home pages of the 279 e-government websites were evaluated. However, existing research supporting the evaluation of only home pages of e-government websites have argued that homepages of these websites are usually the first point of contact with users and, therefore, very important to be highly accessible (Akgul, 2015; Olalere & Lazar, 2011). This is because homepages shape a user’s first impression of the website (Olalere & Lazar, 2011). Additionally, Vigo, Abascal, Aizpurua and Arrue (2009)

[6] Tool available at: http://www.tawdis.net/

showed that the accessibility error profile of a homepage mirrored that of other pages in the website. A screenshot of TAW, captured by the researcher, is presented in Figure 4.9.

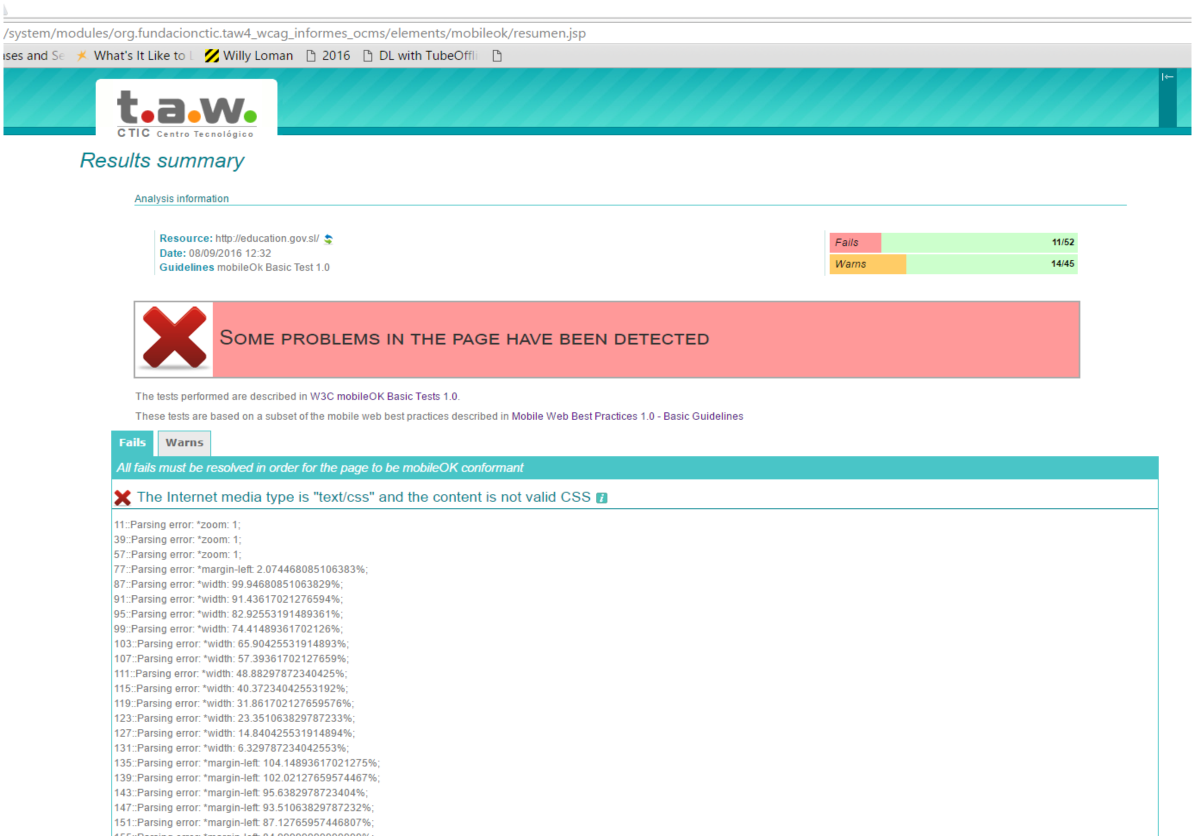


Figure 4.9: Screenshot of TAW

4.6.2.5. Xenu's link sleuth

Xenu's link sleuth is a free standalone application that evaluates a whole website to detect broken links. The tool evaluates normal links, images, frames, plug-ins, backgrounds, local image maps, style sheets, scripts and java applets (Alsmadi, 2014). Several free tools exist (e.g. Dead Link Checker, Online Broken Link Checker, W3C Link Checker, Link Checker and Dr Link Checker), however, after evaluating the functionality of these tools, Xenu's Link Sleuth was seen to be more effective with less downtime. The ability to effectively run simultaneous evaluations on more than fifty websites counted in its favour. The tool also has a reporting feature that is easy to understand and also presents detailed evaluation results.

Koopmans and Zimmermann (2010) also evaluated several website-link evaluation tools and concluded that Xenu's Link Sleuth provided the most accurate data. Similarly, many researchers (Clay, 2015; Ortega, Aguillo & Prieto, 2006; Randtke & Burrell, 2012; Schweitzer, 2009) have indicated a preference for Xenu's Link Sleuth as the best free application for evaluating website links. Based on its optimal functionality and validation, Xenu's Link Sleuth was preferred to other free tools and therefore selected as the most suitable tool for the purpose of this study. A screen shot of Xenu's Link Sleuth, captured by the researcher, is presented in Figure 4.10.

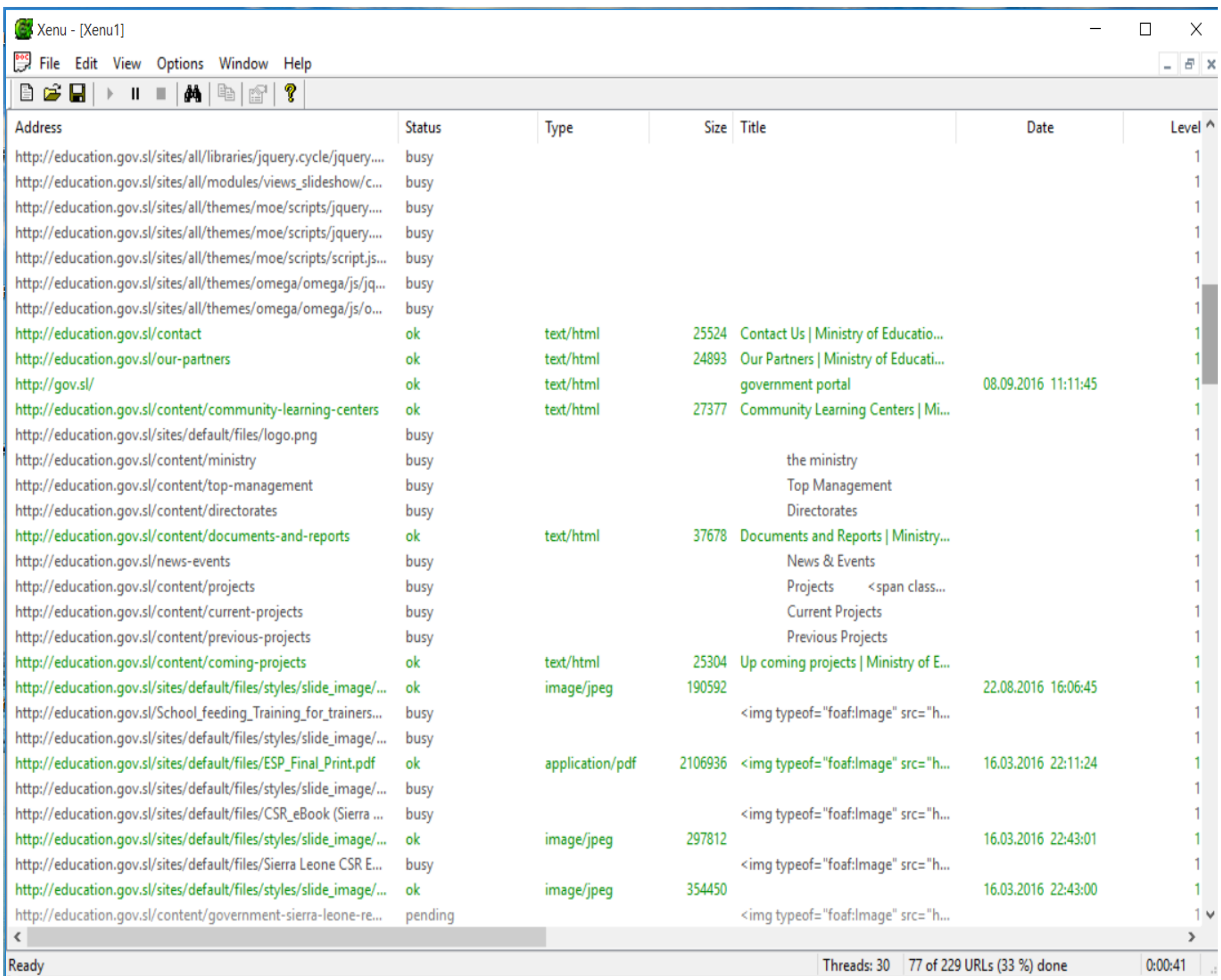


Figure 4.10: Screen shot of Xenu's ink Sleuth

4.6.3. Data sources for national indicators and the EGDI

Data for e-government development and national indicators were obtained from reputable secondary sources. Each of the data sources used in this study is discussed in Table 4.12 alongside the variable for which it was measured.

Table 4.12: Data sources of EGDI and national indicators

Variable Name	Measure	Description	Data Source*
E-Government Development	EGDI	A national level evaluation of the progress of e-government development in a given country.	UNDESA, 2016.
National Income	GNI per capita	A reflection of the average income of citizens in a given country.	World Bank, 2016.
Corruption	CPI	A percentage ranking of a countries level of corruption based on how its public sector is perceived to be corrupt with scores ranging from 0 (highly corrupt) to 100 (no trace of corruption).	Transparency International, 2015
Global competitiveness	GCI	A measure of the set of policies, institutions, and factors that account for sustainable short and medium term development in a given country.	The World Economic Forum, 2016.
Innovation	Global Innovation Index (GII)	Determines a country's capacity for, and success in, innovation.	Co-published by the World Intellectual Property Organization (WIPO), Cornell University and INSEAD, 2016.

Cybersecurity	Global Cybersecurity Index	Measurement if a country's commitment to cybersecurity based on legal measures, technical measures, organisational measures, capacity building and cooperation.	Co-published by ABI Research and the International Telecommunication Union, 2015
Cultural Diversity	Greenberg's Index of Cultural Diversity	Measures the level of cultural homogeneity among different groups within a given country.	Goren (2013).
Population age distribution	Population age distribution percentages	Describes the distribution of a country's population into three age groups namely: 0-14 years, 15-64 years, and 65 years and above.	World Bank, 2016.
Human development	HDI	A composite index measuring average achievement in three basic dimensions of human development—a long and healthy life, knowledge and a decent standard of living.	UN Development Programme (UNDP), 2016.
*Notes: Data was collected for the latest year for which data was available from a given source at the time of data analysis (i.e. August 2016).			

4.6.4. Aggregation processes

As indicated above, the mixed method research adopted in this study was concurrent triangulation. To effectively implement triangulation, researchers need to adopt relevant triangulation processes to combine the data from different sources (Leuffen, Shikano & Walter, 2013). It is imperative to note that qualitative data obtained during the evaluation of the e-government websites were first converted to quantitative data before the aggregation processes described below. The qualitative data, using the six-dimensional framework, was captured through means of Guttmann scales. The use of Guttmann scales in this framework was primarily to enhance the capturing of qualitative data about e-government websites' usability variables (Baker. 2009). Guttmann scales are a widely known approach for capturing qualitative data (Baker, 2009; Blasius & Greenacre, 2006). The numerical scores fitted into the Guttmann scales are the product of qualitative content analysis, which entails manually inspecting e-government websites and associated documents on the website for specific content (Baker, 2009; Jensen, 2010; Roach & Cayer, 2010; Rorissa & Demissie, 2010). Examples of these inspections are determining the theme and content of documents/publications on the e-government website to determine whether or not they are policy-oriented documents, or reading through the privacy policies to determine if they contain the minimum requirements of a privacy policy (see Guttmann scales in Appendix D). Similarly, the UsabAIPO heuristics transform qualitative content analysis data into a quantitative usability score following the UsabAIPO-H function described in Section 4.6.1.2. Since the testable propositions and comparison of usability across countries is based on quantitative analysis, only the quantitative outcomes of the qualitative content analysis are presented in Chapter 6. The aggregation of the obtained quantitative data is provided below.

In this study, three important aggregation processes took place. The first one included the aggregation of different usability scores from the five heuristic evaluators. The second one included the aggregation of data from heuristic evaluations and automated usability testing. The last one was the aggregation of data from the primary and supplementary heuristic evaluation scales.

4.6.4.1. Aggregation of data from different heuristic evaluators

The six-dimensional framework heuristics were made up of two kinds of ratings. The first was a binary rating for the dichotomous variables where a score of 1 was assigned for the variable's presence on an e-government website, and a 0 if not. It is imperative to note that each of the evaluators conducted the evaluation and ratings independently, as already indicated above. The aggregation of dichotomous variable scores was based on outright majority, where at least four out of the five evaluators identified or failed to identify a variable on an e-government website. Where no outright majority was obtained (i.e. 3 on one side and two on the other), the researcher further reviewed the e-government website for the presence or absence of the variable and made the final judgement. There were, however, only three cases when such an instance occurred in the process.

The second rating type for the six-dimensional framework was the Guttmann scales. An example of one of the Guttmann scales is presented in Table 4.13 below.

Table 4.13: Guttmann scale for downloadable forms

Score	Measurement attributes
0	Absence of downloadable forms
1	One to three downloadable forms
2	Four to six downloadable forms
3	Seven to nine downloadable forms
4	More than nine downloadable forms

Source: (Baker, 2009, p. 86)

All the other Guttmann scale variables were also rated on a scale from 0 to 4 (see Appendix D). In order to aggregate Guttmann scale scores, researchers (De Vet, Terwee, Mokkink & Knol, 2011; Tractenberg, Yumoto, Aisen, Kaye & Mislevy, 2012) have often taken the average ratings. A similar approach was adopted for this study. The average score for the five heuristic evaluators was taken. However, since a decimal point (e.g. 3.2) cannot be associated with an exact level of the Guttmann scale, the average score obtained for each variable was rounded to the nearest whole number. This provided the final aggregated ratings, in line with the original Guttmann scale ratings, to facilitate computation of the overall usability score, as proposed by Baker (2009).

The ratings for the UsabAIPO heuristics were similar to the Guttmann scale ratings, with possible scores for each item ranging from 0 to 4 (see Appendix E). Also, the average was computed for each of the 30 heuristic scale items and rounded. These were, however, not rounded to the nearest whole number, as the USABAIPO-(HW) function can use decimal point scores to compute the overall usability Score.

4.6.4.2. *Aggregation of heuristic evaluation data with automated testing data*

Automated usability evaluation data was incorporated into the six-dimensional usability framework. Two types of aggregations were also possible here (i.e. dichotomous variable and scale variable). For the dichotomous variable aggregation, a website had to have a perfect score on the automated evaluation. The only dichotomous variable evaluated with an automated testing tool was the PDA/wireless variable, which evaluated if an e-government website was fully responsive on a mobile device. This was achieved using Responsinator, as discussed in Section 4.6.2.2 above. An e-government website that was fully responsive on all the interfaces in the Responsinator was assigned a score of 1 and 0 otherwise.

Table 4.14: Sample Guttmann scales for automated testing

	Measurement attributes	
Score	Example Guttmann scales from Table 4.13 above	Similar Rating from automated testing for accessibility using FAE 2.0*
0	Absence of downloadable forms	Incomplete implementation status (FAE 2.0 score: < 50%)
1	One to three downloadable forms	Partial implementation Status (FAE 2.0 score: ≥ 50 % to < 75 %).
2	Four to six downloadable forms	Partial implementation Status (FAE 2.0 score: ≥ 75 % to < 95 %).
3	Seven to nine downloadable forms	Almost complete implementation status (FAE 2.0 score: ≥ 95 % to < 100%)
4	More than nine downloadable forms	Complete implementation status (FAE 2.0 score: 100%)
NB: a detailed explanation of the FAE scores and implementation status meanings are presented in Table 4.11 above.		

In evaluating the scale variables, Guttmann type scales were also used to convert the results from automated testing tools into a format coherent with the six-dimensional framework heuristics.

This was necessary to ensure calculation of overall usability scores. An example is provided in Table 4.14 above.

Table 4.14 provides an example of how accessibility scores from automated testing were converted to Guttmann type scale scores and incorporated into the six-dimensional usability framework. The details for other variables from automated testing are presented in Appendix D.

4.6.4.3. Aggregation of evaluation scores from the two usability measures

The overall usability scores from the evaluations using the six-dimensional framework and the UsabAIPO heuristics were all presented as quantitative data in the form of percentage scores using the respective computations. Consequently, the aggregation of the two measures to form an overall usability score followed a quantitative analysis based on statistical reliability. This can often be achieved using an analysis of the Cronbach's alpha (Adamson & Prion, 2013; Cho & Kim, 2015). As such, Cronbach's alpha was used to determine the suitability of combining the measures and the process is described in detail in Chapter 6 (section 6.12).

4.7. Sample of E-Government Websites for Evaluation

In order to determine how well government websites in SSA performed with respect to usability, it was important to have a representative set of websites from SSA, as well as enough websites from each SSA Country. As such, seven websites were selected from each SSA country and included in the study. Nine websites were relatively enough to depict the state of usability in a country as stated in Kuzma *et al.* (2009), while also maintaining a manageable number of total websites to be evaluated for the study.

This study intended to evaluate both national websites and local government websites. Most countries in SSA have national e-government websites for their respective ministries. However, finding local e-government websites was difficult for most countries. Consequently, a decision was made to have seven national e-government websites and two local government websites for each country, because more than two local government websites were not found for some SSA countries. After making this decision, the next step was to decide which ministry websites to choose.

Over the past fifteen years, the most prominent efforts to gauge e-government progress across countries were the UN E-Government Development Surveys (Abu-Shanab, 2016; Perry & Christensen, 2015). A total of 9 UN E-Government Development Surveys have been conducted from 2001 to 2016. These surveys included a section on online services which evaluated websites of government ministries. The ministries with websites that consistently formed part of the E-Government Development Surveys include education, labour, social services, health, finance and environment (UNDESA, 2016). From this list, four ministry websites were selected namely, education, health, finance and labour. While the ministry in charge of social services was considered to be a valuable ministry in SSA, the social services portfolio for some SSA countries fell under the Ministry of Labour and so only one combined website was provided for the Ministry of Labour and Social Services (e.g. Kenya, Ghana). There was no clear indication in the UN E-Government Development Survey about how such overlaps were managed. The Ministry of Environment was also not included because it sometimes fell under the Ministry of Tourism in SSA countries, such as Namibia and Botswana.

In this study, a preference was, therefore, made to choose the Ministry of Tourism as opposed to the Ministry of Environment as governments in Africa were increasingly using e-government websites to promote tourism (Rorissa & Demissie, 2010). The other two national websites included were International Affairs and the Office of the Presidency. The International Affairs website was selected because it was a website that bridged the communication between governments and their international counterparts and played a vital role in representing a country's image. International Affairs websites in SSA dealt with information regarding applicable visas and information regarding a country, and so are starting points for most people who intend to visit a country. The website of a country's presidency was selected, as the presidency depicts the highest office of the country and should be a vital source of key government information for citizens and other stakeholders. This, therefore, brought the total national websites to seven depicted in the following sectors of government (Education, Finance, Health, International Affairs, Labour, Presidency and Tourism).

For the local government websites, it was not possible to standardise the selection across the different countries. For some countries, only one or two local e-government websites were found, while others had more than twenty. As mentioned earlier, the decision was made to include only two so that most SSA countries could be included in the study. For countries that had more than two websites, simple random sampling was used to select two from the total found. Simple random sampling is a technique that gives each unit of a population an equal chance of being selected (Creswell, 2014). The random sample of local e-government websites for each SSA country with more than two local e-government websites was generated in Excel.

In determining which countries were eligible for the study, only countries with the above-mentioned websites presented in English and/or French were selected to allow the researchers to fully verify that the website was the official website of a given government ministry of an SSA country. These were the only two languages that could be fully understood by the researcher and heuristic evaluators. Out of the forty-nine countries in SSA, thirty-one (63.3%) fulfilled the conditions to be selected for this study. A total of eight countries (Eritrea, Somalia, Angola, Mozambique, Sao Tome and Principe, Cape Verde, Sudan and Mauritania) were eliminated because their websites were not in English or French, while ten countries (Guinea, Swaziland, South Sudan, Togo, Guinea-Bissau, Niger, Equatorial Guinea, Central African Republic, Congo and Comoros) were eliminated because e-government was still in its infancy with few or no websites to be considered. In total, 279 e-government websites from 31 countries in SSA were evaluated in this study. The list of e-government websites and countries used are presented in Appendix F.

4.8. Summary

This chapter had as primary aim to describe and explicate the suitability of the research design and methodology adopted in this thesis. The research pyramid by Jonker and Pennink (2010) was used as the fundamental framework for structuring the decisions and choices made in selecting the research paradigm, methodology, methods, and techniques.

DSR was adopted as the main research paradigm for examining the problem under investigation, which was to evaluate the state of e-government usability in SSA and provide an appropriate model for enhancing e-government usability in SSA. It is the goal of DSR to produce an artefact which could take several forms as discussed in Section 4.3.2. Since the ultimate goal of this study was to develop an artefact in the form of a model, the DSR paradigm was seen to be the most suitable approach of IS research inquiry for this thesis.

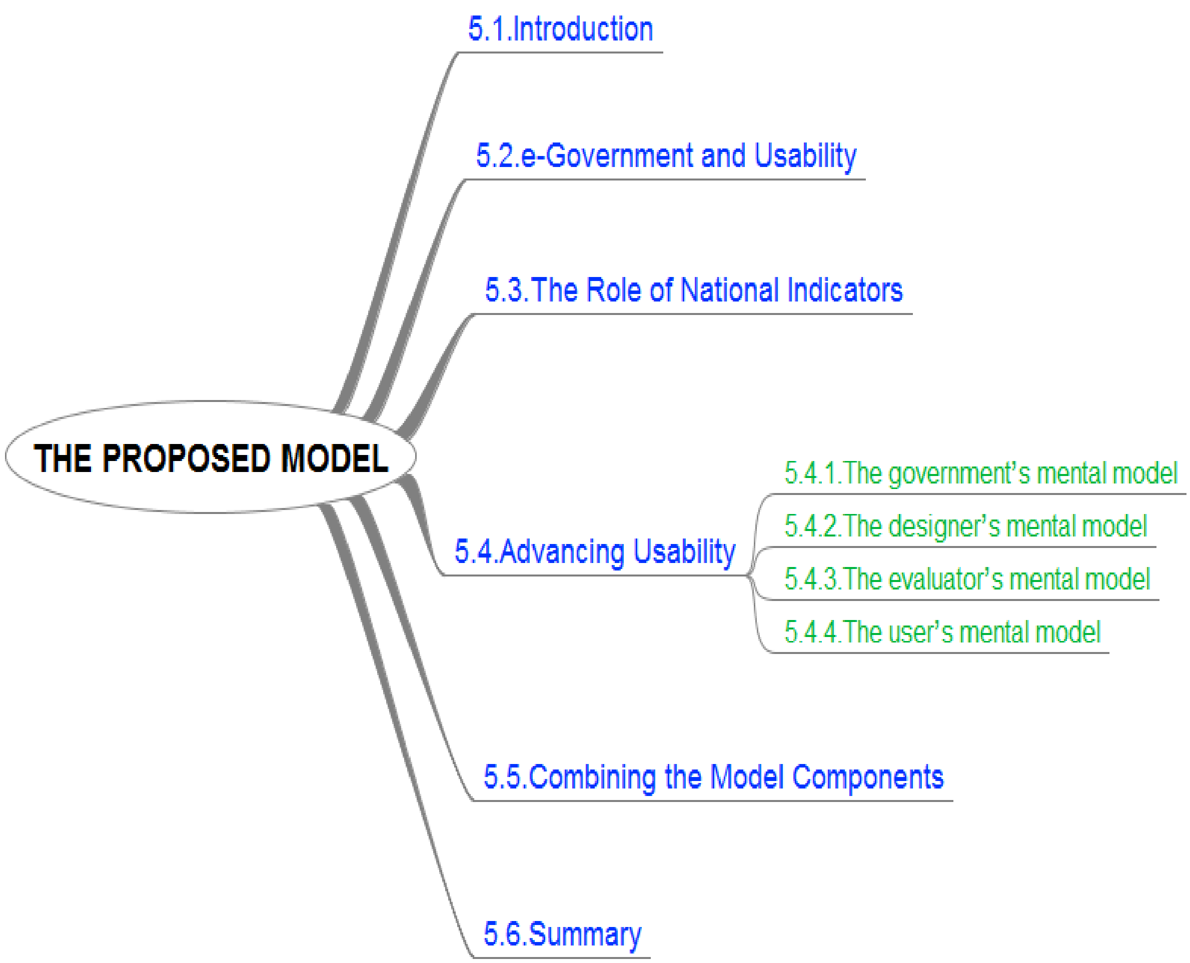
Building on the conceptualisation of DSR in IS by Hevener *et al.* (2004), the DSR methodology model by Peffers *et al*. (2008) was used to describe the six-stage research methodology adopted in this thesis (Section 4.4). Additionally, DSR methodology needs to adhere to seven guidelines, as outlined by Hevner *et al.*, (2004). This chapter fully documented how this thesis adhered to the DSR methodology guidelines to ensure rigour and relevance of the study (Section 4.5).

To enhance the DSR rigour, mixed methods research was adopted to improve the development and evaluation of the artefact. Since the study aimed at examining and enhancing the usability of e-government websites in SSA, the adopted research methods were specifically usability evaluation methods. The three groups of usability evaluation methods (expert-based methods, automated testing methods and user-based methods) that were used in this thesis were discussed with a clear indication of the choices made amidst the available bulk of usability evaluation methods. Lastly, the tools used in the thesis were discussed, along with the different e-government websites that were included in the sample.

Chapter 5 presents the initial version of the proposed model for improving the usability of e-government websites in SSA.

CHAPTER FIVE

PROPOSED MODEL



5.1. Introduction

Chapter 5 presents an initial concept of the proposed model for improving the usability of e-government websites in SSA. The chapter commences with a recap of the integral role of usability in e-government development. This is followed by a concise overview of the role of national indicators in fostering a favourable environment for e-government development and the usability of e-government websites. Afterwards, an approach addressing e-government website usability issues is discussed. This approach is based on four mental models (i.e. government, designer, evaluator and user). The chapter culminates with a discussion of the complete model after combining the different components.

5.2. E-Government and Usability

The link between e-government and usability was discussed in detail in Chapter 3. This review was important for providing the extant knowledge base for constructing the artefact, as emphasised in the rigour cycle of DSR presented in Chapter 4 (Section 4.3.3.2).

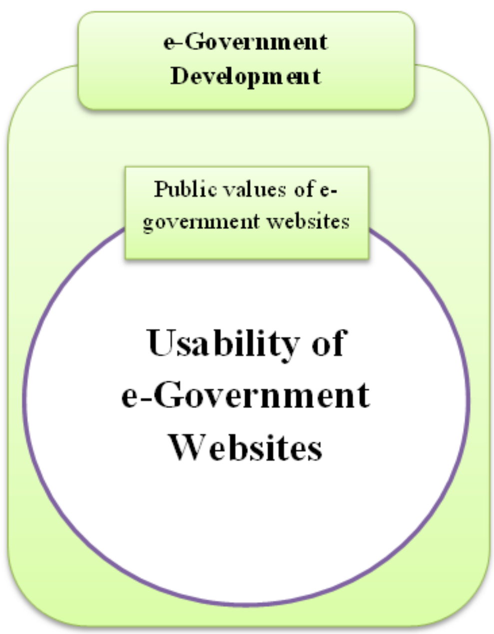


Figure 5.1: E-government development and usability of e-government websites

In linking e-government development with the usability of e-government websites, two key aspects of prior literature were considered. Firstly, the integral role of usability in e-government development was reviewed, taking into consideration the view that e-government development as a whole will stifle when usability is poor (Section 3.3). Secondly, the public value perspective of e-government development and the usability of e-government websites significantly overlap (Section 3.6). Following from the discussion in Chapter 3, a strong positive association is expected between the level of e-government development and the usability of e-government websites. This probable association is presented in Figure 5.1 below.

5.3. The Role of National Indicators

A detailed literature review of the association between national indicators and both e-government development and the usability of e-government websites was presented in Chapter 3 (Section 3.7). This review formed an important part of the knowledge base for developing the artefact. The discussed associations are graphically represented below (Figure 5.2).

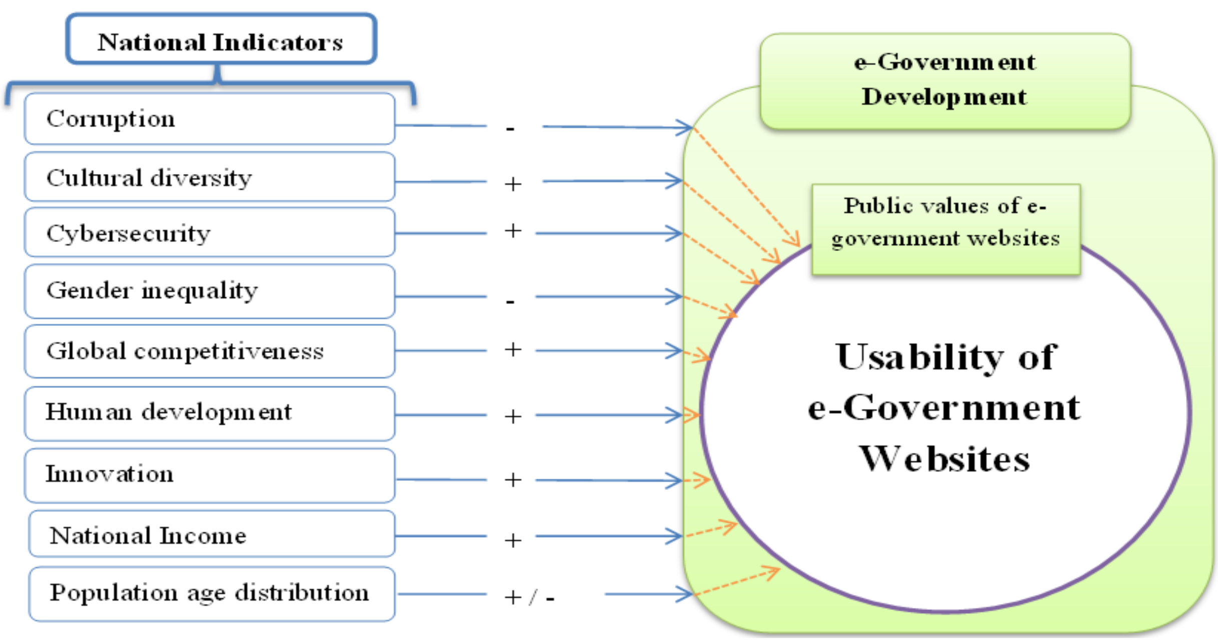


Figure 5. 2: Role of national indicators

In Figure 5.2 the expected associations are indicated with arrows carrying a positive or a negative sign, depicting the expected association between a specific national indicator and e-government development, as well as the usability of e-government websites. Corruption and gender inequality are expected to negatively influence e-government development and the usability of e-government websites. Conversely, cultural diversity, cybersecurity, global competitiveness, human development, innovation and national income are expected to positively influence e-government development and the usability of e-government websites.

For population age distribution, the relationship can either be positive of negative, depending on the distribution of the population. It is expected that a population characterised by a high percentage of the elderly (65 years and above) and children (less than 15 years) will have low e-government development and low usability of e-government websites. On the other hand, the opposite is true for a population characterised by a high percentage of active citizens (15-64 years), as they increase demand for e-government services and foster its development.

5.4. Advancing Usability

The first two sections of the proposed model preented in Section 5.2 and 5.3 above highlight the usability aspects of e-government websites that are unknown, and need to be evaluated in the context of SSA before appropriate strategies can be developed for improving the usability. These sections are based on the review of existing literature presented in Chapter 2 and 3. This section on advancing usability focuses on the last part of the model which is focused on developing solutions for addressing the identified usability issues (presented in Chapter 6). In order to advance e-government development, different e-government stakeholders need to play a key role in contributing to the development of websites with high levels of usability. These stakeholders are the government entities, the system developers, the system evaluators, and the users of the system. Generally, these different stakeholders often hold different beliefs about a given system. These different beliefs are broadly known as mental models in the context of HCI (Borsci et al., 2014; Nielsen, 2010).

According to Nielsen (2010), a mental model simply refers to what a user believes about a system, though this is only one simplistic view of mental models. The concept of mental models is quite complex and spans several definitions in the context of HCI and psychology (Elbanna & Linderoth, 2015; Johnson-Laird, 1989; Legrenzi &Girotto, 1996; Norman, 1988; Travica, 2014; Weick, 1990). However, HCI mental models differ from purely psychological mental models in that HCI mental models encompass actual interaction with the target system (Khella, 2002). For the purpose of this study the concept of mental models in HCI is aligned with Norman's perspective, initially presented in his book titled "The Design of Everyday Things" (Norman, 1988), and further expanded by other HCI researchers (Borsci et al., 2014; Payne, 2009). This approach views mental models as the psycho-technical interaction of different user groups with a system, as well as their cognitive representation of the system and its interface (Federici & Borsci, 2010). The Norman's mental models are used in three ways, namely: "to reason about a system, to anticipate a system's behaviour, and to explain why a system reacts as it does" (Borsci et al., 2014; p. 121). Following from the above, the expanded version of Norman's mental models by Borsci et al. (2014) have taken into consideration aspects of knowledge and experience related to the creation, evaluation, and interaction with a system.

This led to the development of three mental models, namely: evaluator, designer and user mental models (Borsci et al., 2014). This study adopts these three mental models and expands on it with a fourth mental model, known as the government's mental model, which is considered vital in the context of e-government systems. Even though there is a slight overlap between the government and evaluator mental models, these two are represented distinctly in the context of e-government for three important reasons. Firstly, while governments are custodians of e-government systems, they tend to depend on external private firms for the evaluation of the systems, as indicated with examples in Chapter 3 (Section 3.8). As such, the role of government in such cases tends to be more focused on putting out evaluation tenders and guiding the process of selecting evaluators, but not actually being responsible for the evaluation process itself. Secondly, e-government systems are increasingly seen as a source of public values, and as such, external entities such as civil society organizations and universities have noticeably played an important role in evaluating publicly facing e-government systems, such as e-government websites (King & Youngblood, 2016; Youngblood, 2014). These entities evaluate e-government systems on their own accord, as a service to society, with the aim of improving the e-government systems for better service delivery (Youngblood & Mackiewicz, 2012). While their findings are made publicly available, the onus to implement the requirements for improving the systems rests with the government. As such, the roles played by the government and such groups of evaluators differ significantly. Lastly, some solutions for improving the usability of e-government systems are dependent on a government's ICT policy (Goldkuhl, 2016), which is quite distinct from the technical role played by the evaluator's mental model.

Mental models are very important in usability evaluations because what someone believes about a system influences their future actions regarding the system (Albers & Still, 2011; Borsci *et al.*, 2014; Fakrudeen, Ali, Yousef & Hussein, 2013; Nielsen, 2010). This concept is in line with behavioural intention to adoption and use e-government solutions as elucidated in the literature on e-government adoption models (Alghamdi & Beloff, 2014; Boon *et al.*, 2013; Danila & Abdullah, 2014; Gosebo & Obono, 2012; Ozkan & Kanat, 2011; Shareef *et al.*, 2011; Weerakkody *et al.*, 2013). As such, how beliefs shape actions is not a new concept, both to usability and e-government researchers.

Figure 5.3 below depicts the four mental models important in advancing the usability of e-government websites. Each mental model will now be discussed.

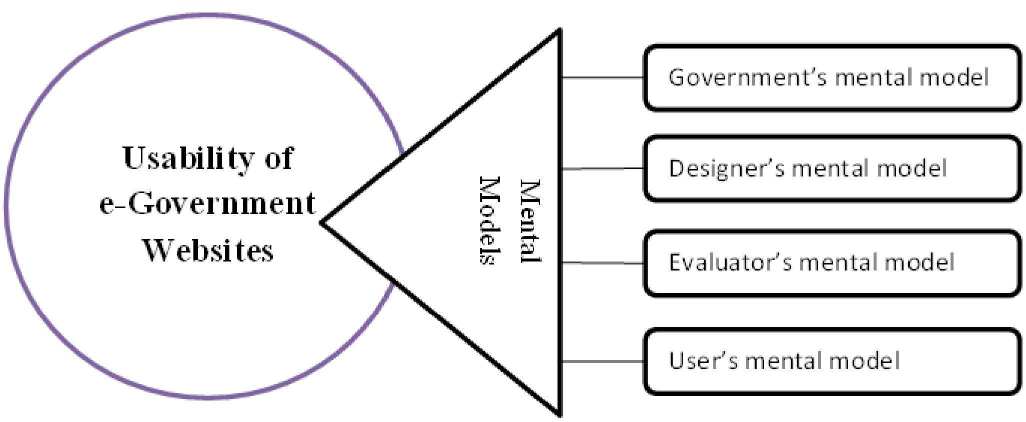


Figure 5.3: Role of mental models

5.4.1. The government's mental model

Governments play a vital role in e-government development by initiating the projects to transform existing paper-based services to e-services, as well as developing new kinds of e-service delivery (Seo & Benson, 2016). Governments are responsible for crafting the strategic roadmap for e-government development (Anthopoulos & Fitsilis, 2014) and providing or sourcing the required resources to develop e-government solutions (Abu-Shanab, 2016). Anthopoulos and Fitsilis (2014) explicated that e-government solutions are usually accomplished via top level e-strategic planning with governments increasingly investing enormous financial resources on e-government development strategies, projects and programs. Governments often take steps in advancing e-government development, such as mandating the creation of e-government websites and online service delivery (Zhao & Benyoucef, 2014).

Additionally, strategic roadmaps for e-government development often include usability strategies, policies and guidelines (Pretorius & Calitz, 2014). These usability policies guide the development of e-government websites and thus impact on the ultimate usability of e-government websites. For example, some governments in the developed world have mandated the implementation of accessibility guidelines on all e-government websites, thus enhancing the accessibility of the e-government websites (Kuzma, 2010; Olalere & Lazar, 2011; OECD, 2010; Steward, 2010). Government's role in setting standards for usability of e-government systems results in the institutionalisation of usability within governments and provide the necessary tools, resources, and best practices for enhancing usability (Butt, 2014; Schaffer, 2004; Pretorius, 2012). This role in enhancing usability also includes monitoring and evaluation of e-government websites to ensure that they meet industry standards (Galvez & Youngblood, 2016). Governments in SSA are increasingly seeing the need for continuous monitoring and evaluation of e-government websites in order to enhance the quality of the websites as the case in Kenya (Kinyanjui, 2015).

The above discussion clearly shows that governments' actions directly influence e-government development and the usability of e-government websites. As such, it is imperative for government entities to have a mental model that focuses on making decisions for the advancement of e-government development and the usability of e-government websites.

5.4.2. The designer's mental model

After governments initiate e-government projects, designers/developers are then commissioned to transform the governments' ideas into e-government solutions that can be used to achieve the intended government objectives. These designers/developers can either be internal teams within government agencies or external teams from the private sector. Irrespective of which team is commissioned, e-government website development has as primary goal to facilitate interaction between government and citizens and provide a platform for governments' service delivery to the public (Clemmensen & Katre, 2012).

Designers/developers often develop the e-government websites according to their own mental models (i.e. what they believe users will want to use). However, existing literature suggests that designers/developers of e-government websites often overlook the usability of these websites, thus making them less appealing for use by the intended users (Isa *et al.,* 2011). This is not surprising as usability studies over the years have shown that a significant gap exists between the mental models of designers/developers and users (Fakrudeen *et al.*, 2014; Nielsen, 2010). This happens when designers/developers create a system they think is what users want, but the system, however, ends up not fully meeting user requirements (Borsci *et al.*, 2014).

Some governments over the years, especially in developed countries, have been combating this issue by providing usability guidelines for designers/developers of e-government websites to follow (AlFawwaz, 2012; Baker, 2009; Venkatesh *et al.*, 2014), as well as training courses to ensure they develop websites that are highly usable (Gil-Garcia, 2012).

Another approach widely emphasised is for designers/developers of e-government websites to adopt a user-centred design approach in developing e-government websites (Asiimwe *et al.*, 2010; Tariq, 2010). User-centred design, according to the ISO 9241-210:2010(E) standard, is defined as "approach to systems design and development that aims to make interactive systems more usable by focusing on the use of the system and applying human factors/ergonomics and usability knowledge and techniques" (ISO, 2010, p.2). Designers/developers can shape their mental models to be more user-focused by understanding the usability issues of an e-government and the different approaches that can be used to address such issues. As such, in an attempt to advance usability in SSA from a designer/developer mental model, this study determined the prevalent usability issues plaguing SSA e-government websites and provides measures that can be used to address the issues.

5.4.3. The evaluator's mental model

As indicated above, there is a recognised gap between the designer's mental model and the user's mental model, which results in the existence of usability issues. This gap is often consolidated by the evaluator's mental model. Evaluators play the role of identifying usability problems and providing solutions for addressing these problems in order to bridge the gap between the mental models of designers and users (Borsci *et al.,* 2014). Evaluators often use their knowledge and expertise to evaluate if an interface complies with international usability guidelines, or use any applicable usability evaluation method to determine usability issues in an interface (Federici & Borsci, 2010).

In the context of e-government websites, governments can always commission usability professionals to conduct a usability assessment of a given e-government website, or depend on e-government usability evaluations conducted by researchers. In the first case, an example is provided in Chapter 3 (Section 3.8) of the EThekwini municipality in SA that opened up a tender for usability professionals to evaluate the usability of its website in 2013. In the latter case, there are a plethora of studies (Alfawwaz, 2012; Asiimwe & Lim, 2010; Bouazza & Chebli, 2016; Dan *et al.,* 2013; Pretorius & Calitz, 2014; Venkatesh *et al.,* 2014) that have evaluated the usability of e-government websites and provided relevant evidence-based findings that governments can adopt to advance the usability of their e-government websites.

As confirmed by Galvez and Youngblood (2016), e-government websites need to be continuously monitored and evaluated by the government to ensure that the websites remain usable. This role can be better played by evaluators with usability knowledge and expertise who could determine usability issues and guide governments on how to enhance the usability of their e-government websites.

5.4.4. The user's mental model

Users play a vital role in the success of e-government solutions because their adoption and usage of e-government solutions are critical for the sustainability of e-government (Alghamdi & Beloff, 2014; Weerakkody *et al.,* 2013; Zuiderwijk *et al.,* 2015). This explains why a lot of e-government research (Alghamdi & Beloff, 2014; Bwalya, 2011; Khanyako & Maiga, 2013; Rukiza *et al.,* 2011; Shareef *et al.,* 2011) has focused on evaluating the factors that affect user adoption and usage of e-government services.

The user mental model is very important in the context of e-government websites because these websites serve as a portal for citizens, businesses, tourist and other user groups to access and use e-government services so that governments can fulfil their purpose of delivering public values. All three other mental models (i.e. government, designers/developers and evaluators) mostly focus on ensuring that the needs of the user mental model are met, as users determine the ultimate success of an e-government project. If there are no end users (e.g. citizens and businesses) willing to adopt and use e-government websites, the progress of e-government will stifle and e-government solutions will fail (Asiimwe & Lim, 2010; Bwalya & Healy, 2010; Ray, 2011; Van Dijk *et al.,* 2007).

As earlier discussed in Chapter 3 (Section 3.3), usability is one of the key factors that influences the adoption and usage of e-government solutions. E-Government website users have been noted for refraining from interacting with e-government websites that have poor usability, thus making usability the most important issue to consider in ensuring the success of e-government websites (Donker-Kuijer *et al.,* 2010; Huang & Brook, 2011; Venkatesh *et al.,* 2014). Additionally, e-government adoption literature has emphasised the need for trust, security and privacy of e-government solutions as vital aspects that determine user adoption (Alghamdi & Beloff, 2014; Bwalya, 2011; Khanyako & Maiga, 2013; Rukiza *et al.,* 2011; Shareef *et al.,* 2011).

As discussed in Section 3.6, trust, security and privacy, as components of public values of e-government websites (Karkin & Janssen, 2014; Karunasena & Deng, 2009; Ha, 2016), are also variables of the online services and legitimacy dimensions of the six-dimensional framework of usability (Baker, 2009). This further reiterates the fact that usability as a whole plays an essential role in ensuring the success of e-government websites. While users necessitate an e-government websites to be usable before they interact with it, they can also play a fundamental role in enhancing the usability of e-governments websites. This can include taking part in e-government website usability surveys, availing themselves for a usability test of e-government websites, or even completing feedback forms on these websites. An understanding of the current usability state of SSA e-government websites can provide better insights into the role users can play in enhancing the usability of these websites.

5.5. Combining the Model Components

Prior DSR studies have emphasised the need for a DSR artefact to be ingrained in existing theory, thus following the rigour cycle of DSR (Sein *et al.*, 2011). In this light, the artefact components in Figure 5.1, Figure 5.2 and Figure 5.3 were all formed with a fundamental background of existing literature, as discussed above and in the previous chapters (i.e. Chapter 1 to Chapter 4). In addition to being theory-ingrained, Goldkuhl (2016) emphasised that DSR artefacts that focus on e-government should also be policy-ingrained. This is because the design of e-government systems is often influenced by legislations and other governing values guiding a given public agency or general public policy and laws (Goldkuhl, 2016). Thus, it becomes necessary to ensure that an e-government artefact is a policy carrier (Cordella & Iannacci, 2010; Sein *et al.*, 2011).

Not all SSA governments have publicly available policy documents on the usability of their websites, however, for countries like Kenya, Mauritius and SA, the usability of e-government websites have been emphasised as a key priority that has to be followed. Additionally, these policy documents include monitoring and evaluation of e-government websites, highlighting the need for regular evaluations using usability experts, as well as evaluating feedback from users. These internal guidelines for government agencies are in line with the different mental models presented in Figure 5.3. The government's mental model is responsible for forming these policies, while designers' mental models and evaluators' mental models enforce the usability guidelines and the monitoring and evaluation of e-government websites. Additionally, the need to evaluate user feedback provides insight into the user's mental model and how best e-government websites can be developed to better serve user needs. Additionally, some governments (like the government of Mauritius) recently commissioned a study to evaluate factors influencing user adoption of e-government in the country (Lallmahomed, 2016). Such studies provide the government with a better view of the user's mental model in the country. Designing an e-government artefact that encompasses all these mental models, therefore, represents a good policy carrier for guiding internal government agency policies for improving the usability of e-government websites.

As indicated above, e-government systems can also be influenced by outside policy not directly linked to the specific government agencies deploying the e-government system. This is because e-government systems rest within the broader socio-technological context of a country and are influenced by many factors (Khan *et al.*, 2011; Pereira *et al.*, 2016). As previously discussed, e-government development has been shown to be associated with some national indicators (i.e. national income, corruption and global competitiveness). Additionally, it is expected that other national indicators such as cybersecurity, innovation, population age distribution, gender inequality, human development, and cultural diversity are likewise associated with e-government development. Furthermore, it is noted that usability as a whole is an integral part of e-government development and that e-government websites are the primary platform for e-government information and service delivery (Karkin & Janssen, 2014).

Consequently, this study postulates a possible association between national indicators influencing e-government development and the usability of e-government websites. An understanding of this association provides a foundation for determining how national policies as a whole could contribute to the development of e-government and the usability of e-government websites. Thus, in developing a policy-ingrained e-government usability artefact, this study has looked at both information associated with government agency policies for enhancing website usability, and broader national level policies that are not directly aimed at e-government but can provide a conducive environment for advancing usability of e-government websites. This is in line with the arguments for a policy-ingrained e-government artefact that carries policies from within government agencies as well as broader public policy and legislations (Goldkuhl, 2016).

The combined model and initial artefact for this study is presented in Figure 5.4.

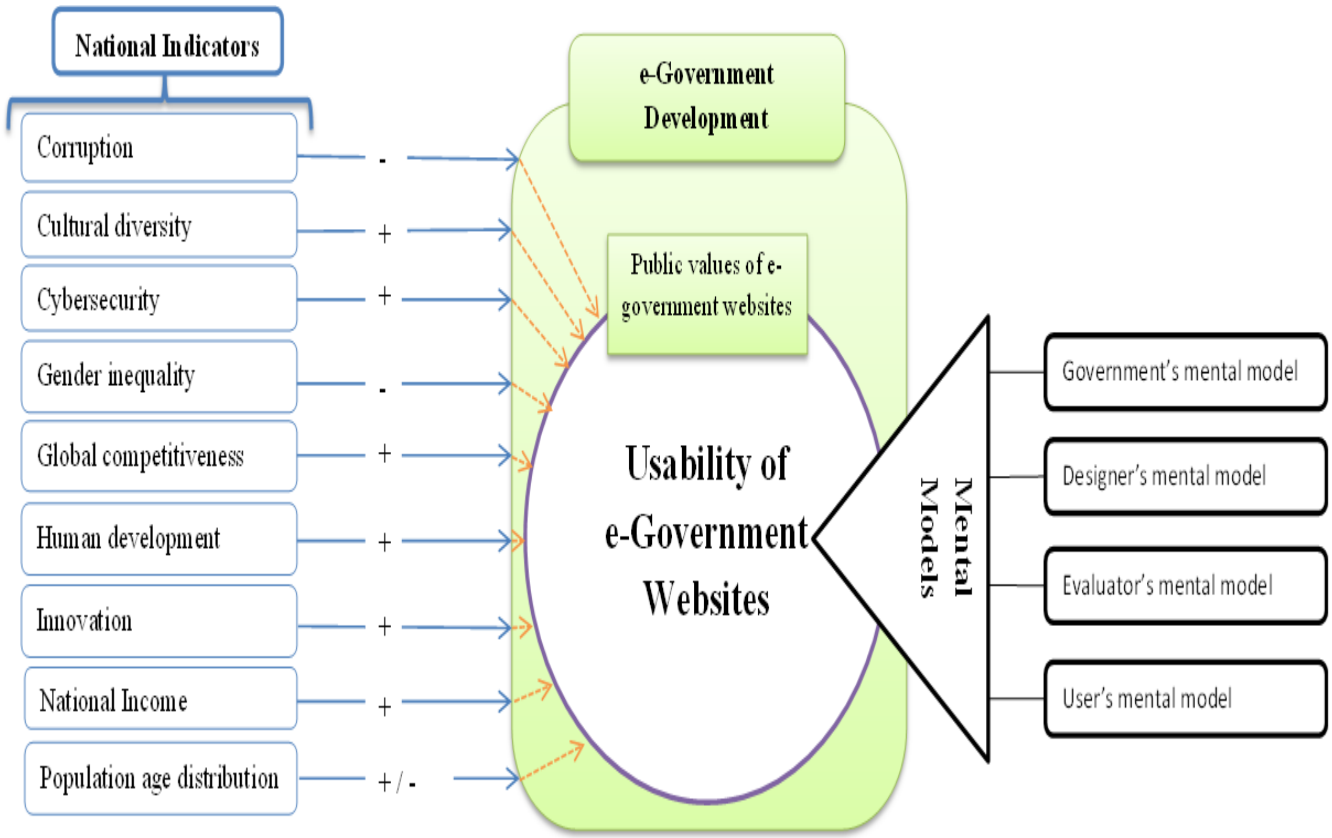


Figure 5.4: Policy-ingrained model for advancing e-government website usability in SSA

The above model (Figure 5.4) is a policy carrier that depicts both policies that can be internally implemented by specific government agencies (as in mental models) to improve e-government websites' usability, or implemented at a national level (as in national indicators) to provide a conducive environment for advancing the usability of e-government websites. The goal of this model is to provide a blueprint that governments and other stakeholders in SSA can use to guide their efforts in advancing e-government website usability in the region.

5.6. Summary

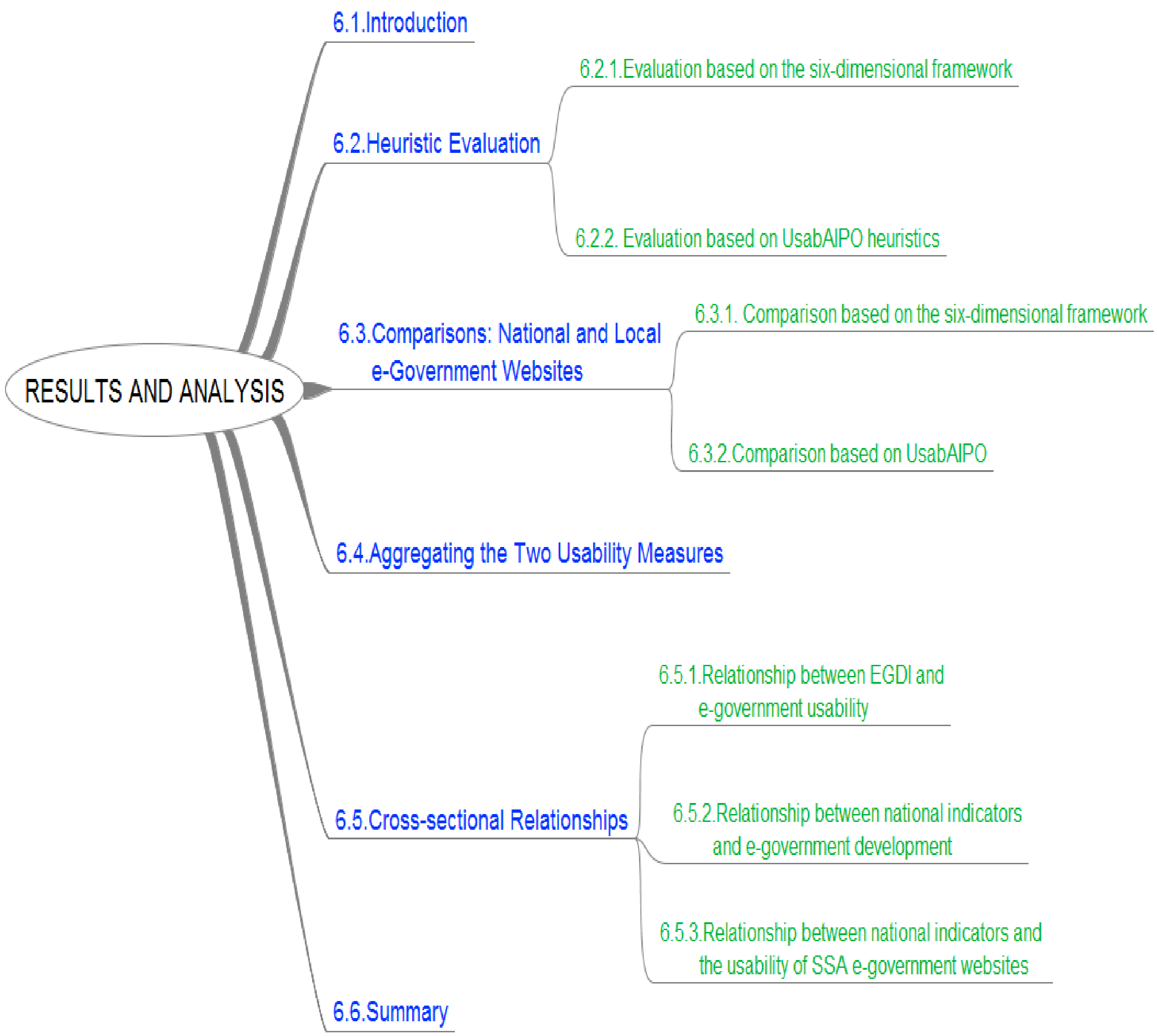
This chapter aimed at introducing the initial model (DSR artefact) for this study. In designing the model, prior literature was used, as suggested in the DSR cycle (presented in Chapter 4). The summary of the link between usability and e-government development was provided as this has been widely discussed in the previous chapters (chapters one, two and three).

Usability has been shown to be an integral part of e-government development (Section 5.2). Hence, national indicators of e-government development are also likely associated with the usability of e-government websites (Section 5.3). These factors provided an understanding of how national policies of a country can help shape the usability of e-government websites. Also discussed was the view that advancing the usability of e-government websites would necessitate an understanding of the role of four mental models, namely the government's, the designer's, the evaluator's and the user's mental model. These four mental models could help in shaping internal government agency policies that would directly influence the usability of e-government websites.

Combining both the roles of the mental models and the national indicators resulted in the development of a policy-ingrained model for advancing e-government website usability in SSA (Figure 5.5). This model - the artefact for this study - is in line with the need for ensuring that an e-government artefact is a policy carrier. However, for a DSR artefact to be complete, it needs to be rigorously evaluated. The evaluation of this proposed model is presented in the next chapter (Chapter 5). Policies aligned with national indicators are expected to create a favourable environment for e-government development and advance the usability of e-government websites while policies and procedures associated with mental models are expected to directly address the identified usability issues in SSA e-government websites.

CHAPTER SIX

RESULTS AND ANALYSIS



6.1. Introduction

This chapter presents a detailed evaluation of the usability of e-government websites in SSA. This evaluation forms an integral part of the proposed model as it determines the exact scope of usability issues pertinent to e-government websites in SSA. Additionally, the association between e-government development and the usability of e-government websites is presented. The chapter culminates by evaluating the testable propositions of the proposed model relating to the association of national indicators with e-government development and the usability of e-government websites.

6.2. Heuristic Evaluation

This section presents the heuristics evaluation results from both the six-dimensional framework and the UsabAIPO heuristics.

6.2.1. Evaluation based on the six-dimensional framework

The results are presented here for each of the six dimensions (online services, user-help & feedback, navigation, legitimacy, information architecture, and accessibility accommodation), as well as the aggregate usability score for all dimensions. The discussion entails comparing the usability of e-government websites in SSA with evidence from other countries, with some studies dating as far back as 2007(especially USA and Trinidad and Tobago). However, the comparison is vital to situate the extent of e-government website usability in SSA compared to other regions, given that SSA e-government websites today, are yet to attain the usability state that some e-government websites from developed world countries had over 9 years ago. This might further highlight why the region still lags behind the rest of the world in e-government diffusion.

6.2.1.1. Online services dimension

The online services dimension was characterised by six dichotomous variables and five scale variables (Chapter 2). The evaluation results are presented below.

6.2.1.1.1. Dichotomous variables for online services

The evaluated dichotomous variables included basic information, interactive forms, and interactive databases, multimedia applications, chat areas/message boards, and email updates. The findings from the evaluation of these variables for the selected e-government websites are presented in Figure 6.1.

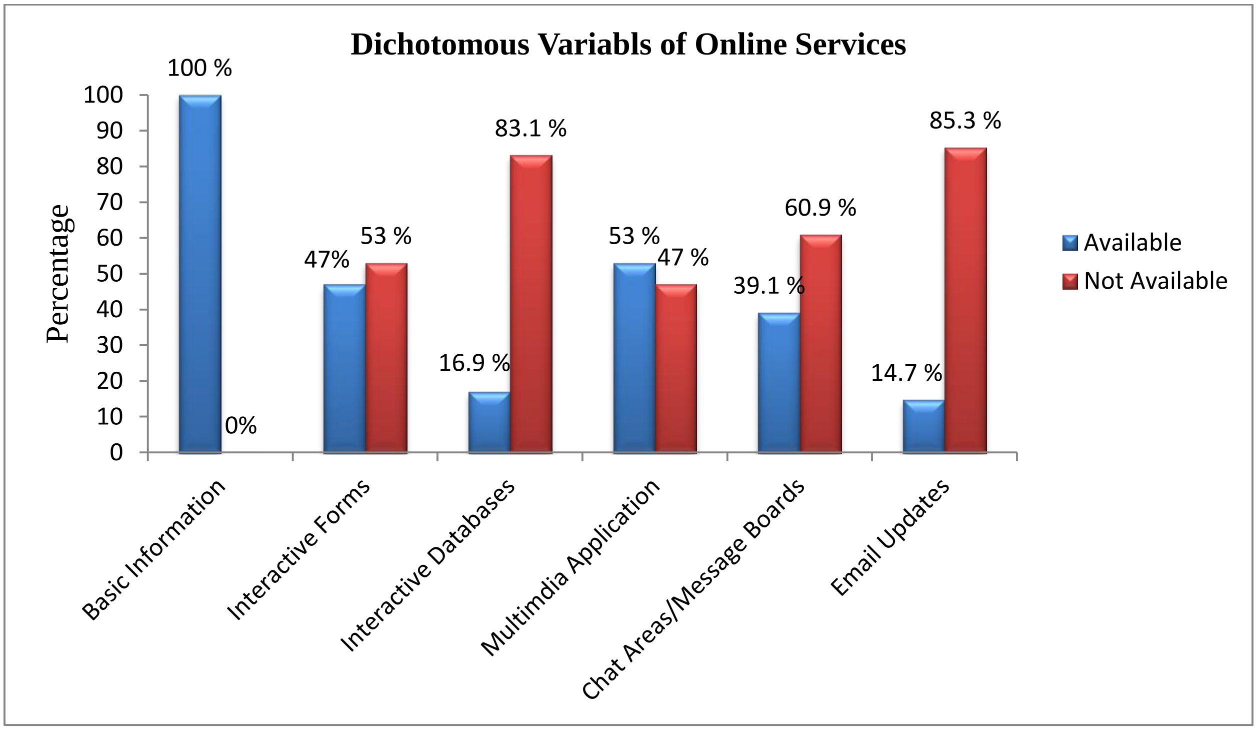


Figure 6.1: Dichotomous variables of online services

Figure 6.1 depicts the presentence of six online services variables. It was observed that all the e–government websites had basic information. This was the only online services variable present in all the websites. This is not surprising as it is common practice for e–government websites to have basic information. Prior usability evaluations (Baker, 2007; Dan *et al*., 2013; Kaan, 2007; Roach, 2007) from other parts of the world (Israel, Trinidad and Tobago and the USA) also indicated that all the websites had basic information as it is considered the most rudimentary feature of an e-government website.

The second well-performing factor was multimedia applications where more than half (53 %) of the websites had some form of multimedia applications. This is similar to findings from the evaluation of e–government websites in Oman, where it was found that 52% had multimedia applications (Bouazza & Chebli, 2016).

The other factors (interactive forms, interactive databases, chat areas/message boards, and mail updates) were not common among the e-government websites in SSA as less than 50% had these features. The two worst dichotomous variables for online services were interactive databases and email updates, as only 16.9% and 14.7% of the websites respectively contained the features. This is comparatively lower than other parts of the world. For example, 43% of evaluated websites in Oman (Bouazza & Chebli, 2016) and 100% of those in the USA (Baker, 2007) had interactive databases. Regarding subscription to email updates, Baker found that 43.3% of his sampled websites in the USA had the feature, while an evaluation of Arizona county websites by Kaan (2007) found that 55% had the option for mail update subscription. Next, the scale variables for online services are examined.

6.2.1.1.2. Scale variables for online services

The scale variables for online services (Appendix D) include documents/publications, communications with officials, downloadable forms, e-commerce applications, and employment information. The evaluation of these variables is presented here.

- *Documents/publications*

One of the common functions of e-government websites is to disseminate publications and governance oriented documents to the public. Figure 6.2 shows how e-government websites in SSA fared with regards to availability of documents/publications. Basically, only 7.2% of the websites did not have any documents or publications.

While most of the websites provided some form of documents or publications, less than half of the e-government websites (49.8%) provided governance oriented documents. One of the key benefits of e-government is its contribution to democratic governance (Elbahnasawy, 2014; Jun *et al.,* 2014; Rorissa & Demissie, 2010). As such, Roach (2007) elucidated that a usable e-government website should be able to promote civic engagement and governance, with governance being the top priority.

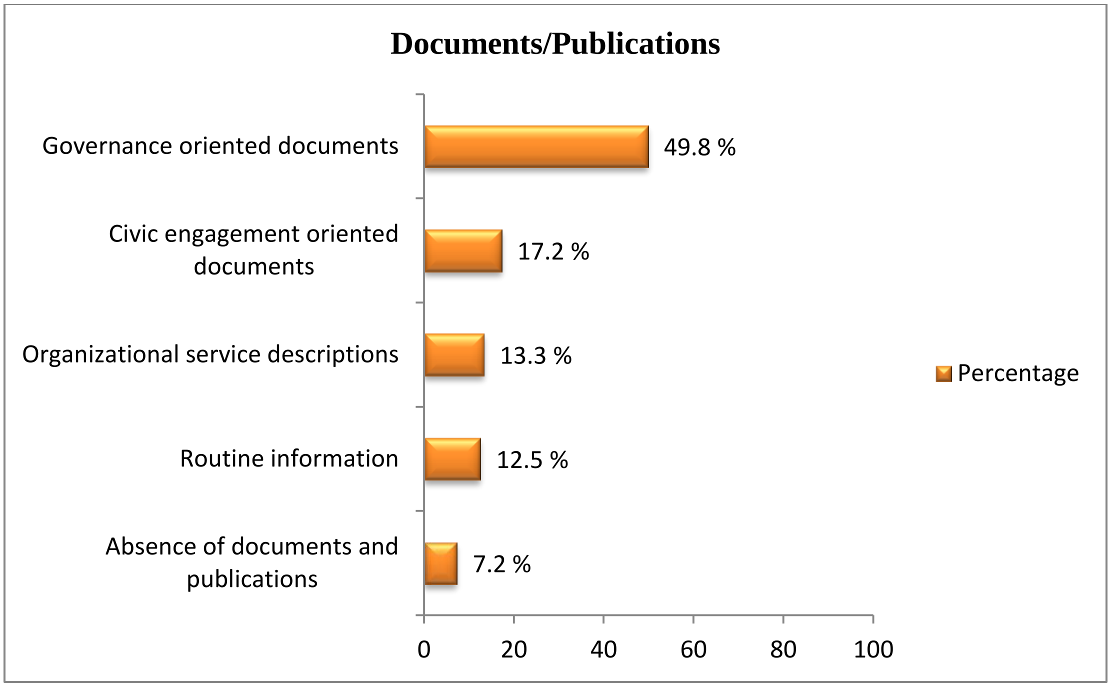


Figure 6.2: Documents/publications variable of online services

Compared to other non-SSA e-government websites SSA e-government websites performed poorly with respect to the provision of governance oriented information to the public. For example, 96.7% of websites evaluated by Baker (2007) in the US disseminated governance oriented publications and documents on the websites, while 78% of those evaluated by Roach (2007) in Trinidad and Tobago had governance oriented documents and publications.

SSA has been widely characterised as having poor governance (Domatob, 2011; Owoye & Bissessar, 2013) and this is clearly evident from the lack of governance oriented documents/publications on e-government websites in the region. If SSA countries are to use e-government to enhance governance as postulated by Rorissa and Demissie (2010), then it is important to encourage the inclusion of governance-oriented documents/publications on the e-government websites. The 49.8% of SSA e-government websites with governance-oriented information in place are an example for others to emulate, as it shows that it is possible to distribute governance-oriented information via e-government websites. Some good examples to imitate are e-government websites in SA, where Mphidi (2008) evaluated 31 of them and found that all provided governance-oriented documents to the public. Next, the evaluation of downloadable forms is presented in Figure 6.3.

❖ *Downloadable forms*

Many interactions between governments and citizens often involve the completion of forms. E-Government websites have become increasingly valuable in serving the public with forms so that they can download and complete them seamlessness before visiting the brick and mortar offices. Downloadable forms have been noted to be a valuable means of interaction between governments and citizens (Sarosa & Lestari, 2009). Figure 6.3 depicts how SSA e-government websites fared with regards to downloadable forms.

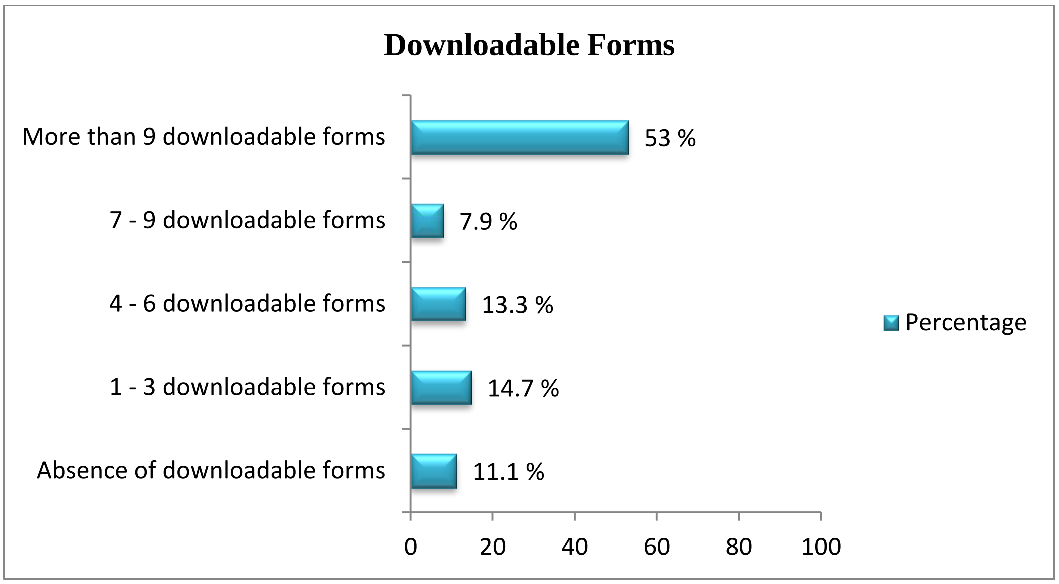


Figure 6.3: Downloadable forms for online services

Only 11.1% of the websites did not have any downloadable form, while more than half (53%) had more than 9 downloadable forms. Similarly, in Oman, only 10% of the websites evaluated by Bouazza and Chebli (2016) had no downloadable forms. However, SSA e-government websites fared worse than US websites where 100% of the evaluated websites had more than nine downloadable forms. Next, the communication with officials is presented in Figure 6.4.

❖ *Communications with officials*

E-government websites are supposed to be communication tools and should effectively facilitate communication between government officials and citizens (Jukic, Kunstelj, Decman & Vintar, 2009). Figure 6.4 shows that only 2.2% of the e-government websites lacked some form of a communication link between the government officials and the general public. This is much better than e-government websites in Oman where up to 38% had no communications link (e.g. email or phone contact) with officials (Bouazza & Chebli, 2016).

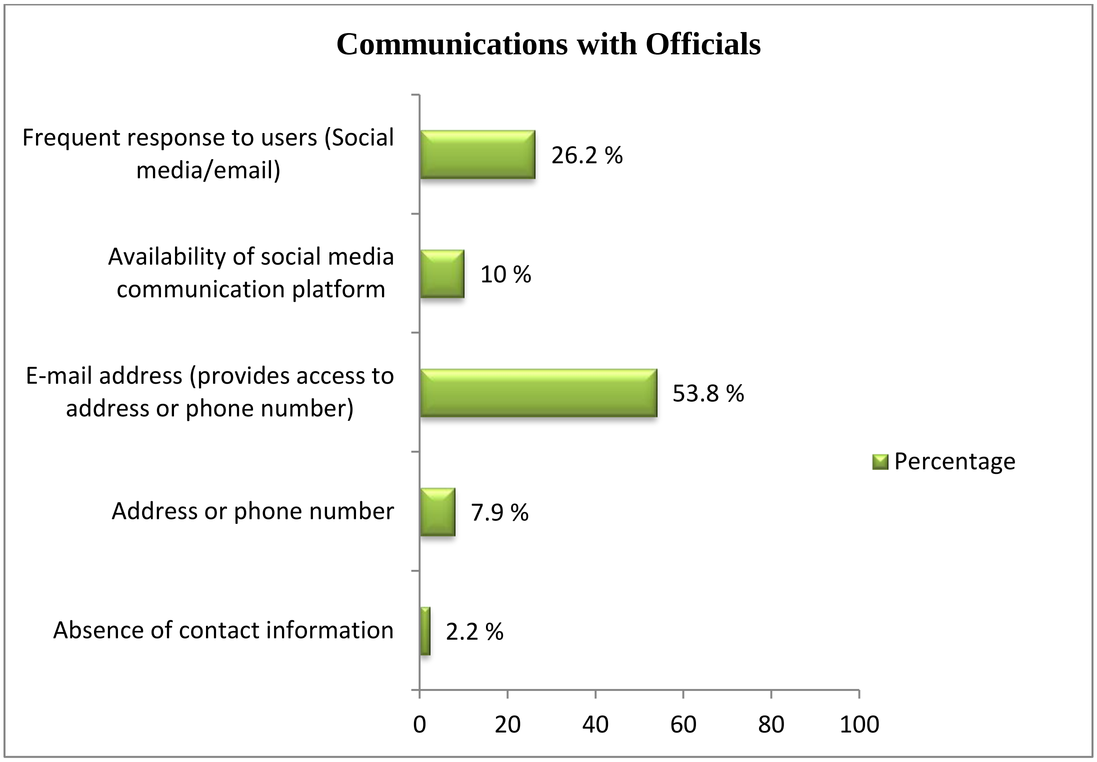


Figure 6.4: Communication with officials

A total of 7.9% provided only phone contact details, while more than half (53.8%) provided access to email contact details in addition to phone numbers. As previously indicated, governments are increasingly depending on social media as an integral part of their official mechanisms for communication, in order to increase government responsiveness (Dekker & Bekkers, 2015; Kumar et al., 2016; Lorenzi *et al*., 2014; Panagiotopoulos et al., 2013).

In the case of SSA, it was observed that a total of 36.2% (i.e. 26.2% + 10%) of the evaluated websites had an associated social media communication mechanism linked to the website. However, only 26.2% communicated frequently with citizens on the social media platforms or responded to queries within 24 hours. US e-government websites did better in communications, with 80% of the websites evaluated by Baker (2007) responding to user requests within four hours.

❖ *E-commerce applications*

The use of e-commerce applications by governments for numerous transactions has grown to become a vital segment for delivery of e-government services (Stowers, 2008). Figure 6.5 depicts the implementation of e-commerce applications within e-government websites in SSA.

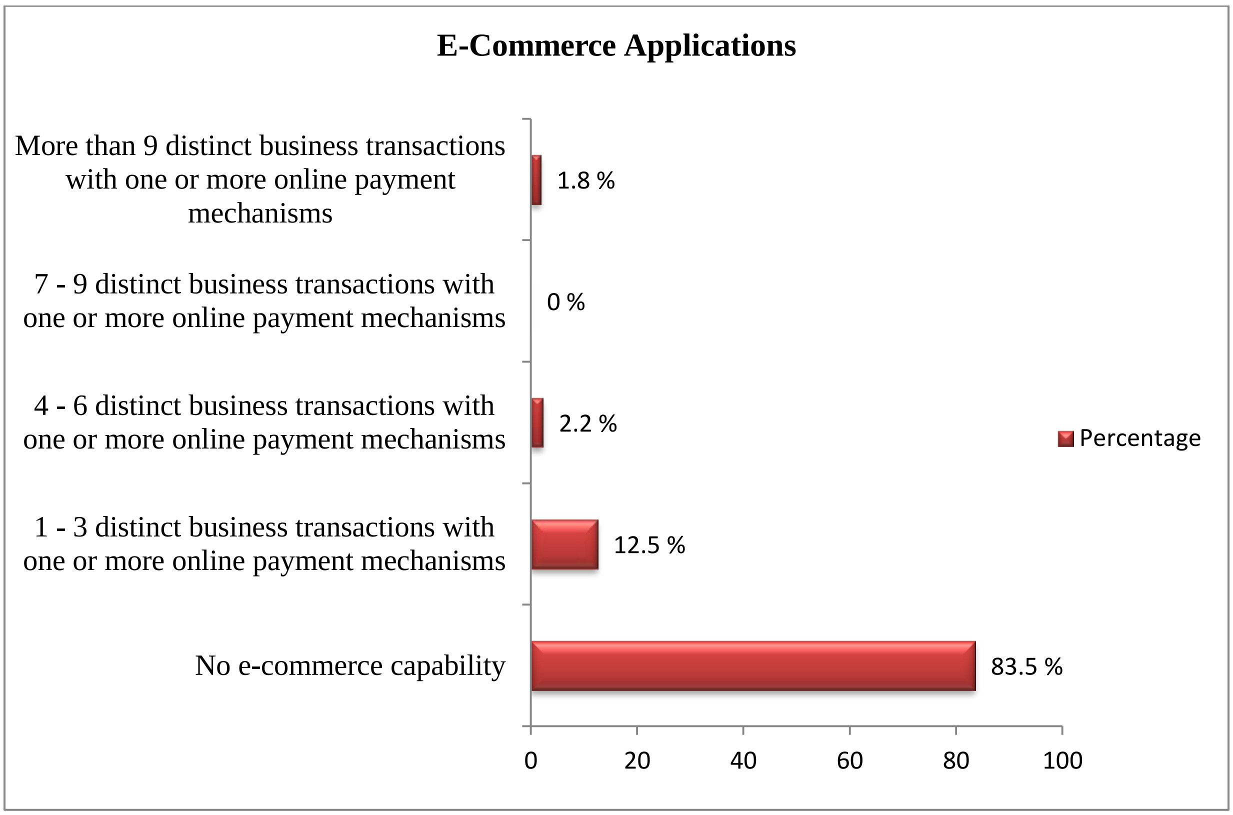


Figure 6.5: E-commerce applications

The findings show that a staggering 83.5% of the evaluated e-government websites in SSA had no e-commerce capability. SSA countries lag behind the US and Oman in e-commerce applications for e-government. In Oman, Bouazza and Chebli (2016) found that 84% of the evaluated websites had some form of an e-commerce application. Similarly, Baker (2007) found that 90% of the evaluated websites in the US had at least one e-commerce application. Nevertheless, the fact that only 16.5% of e-government websites in SSA had some form of an e-commerce application is not surprising, given that e-commerce development in SSA is still at a nascent stage (Feyi-Sobanjo, 2013; Ndonga, 2012). Lastly, the evaluation of employment information is presented in Figure 6.6.

❖ *Employment information*

Another e-government online service that has been known to be useful for citizens is access to employment information (Baker, 2009). From Figure 6.6, it is observed that only 28.7% (added together) of the evaluated websites in SSA had some form of employment information or information about tenders available to the public (i.e. 71.3% have no employment information). This outcome is worse when compared to other governments across the globe.

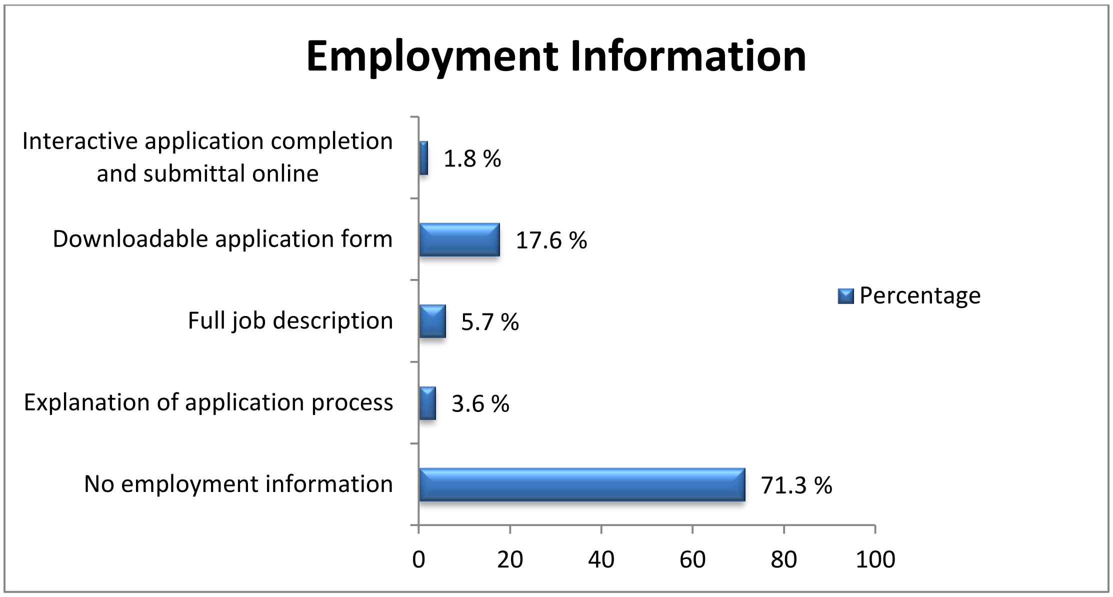


Figure 6.6: Employment/tender information

For example, in the US, 96.7% of the e-government websites evaluated by Baker (2007) had employment information, and so did 90% of those evaluated by Kaan (2007). In Oman, Bouazza and Chebli (2016) showed that 57% of the evaluated websites had information about employment and tenders. Similarly, Huang (2009) focusing on local e-government websites in the US, showed that 60% of evaluated portals had employment information. Interactive online job applications have been known to blend perfectly well with e-government with the potential to significantly benefit government recruitment processes (Mareschal & Rudin, 2009). However, for the evaluated SSA e-government websites, only five (1.8%) had the capability for online application completion and submittal. This is far lower than the US, where Baker (2007) found that 46.7% of the evaluated websites provided the functionality for completing and submitting job applications online. Since online recruitment has enormous benefits for governments and citizens (Mareschal & Rudin, 2009; Selden & Orenstein, 2011), it is imperative for governments in SSA to incorporate more online recruitment functionalities in their e-government websites to enhance their overall usefulness.

6.2.1.1.3. Overall online services dimension score

Table 6.1 depicts the weighted average score for the online services dimension for each of the 31 SSA countries, as well as the composite score for the whole sample. The maximum attainable weighted score for the online services dimension is 16.67.

Table 6.1: Online Services across the different SSA Countries

SSA Country	Min	Max	Mean*	Median	ST. Dev^{+}	Skewness	Kurtosis
South Africa	10.26	16.67	13.04	12.82	2.03	0.55	-0.03
Uganda	2.13	15.39	10.97	11.54	3.15	-0.8	0.4
Rwanda	6.41	13.46	10.61	10.26	2.25	-0.55	-0.12
Mauritius	5.13	13.46	9.4	9.62	2.27	-0.17	1.72
Kenya	2.56	14.75	9.19	10.25	4.22	-0.21	-1.36
United Republic of Tanzania	5.77	11.54	9.05	8.97	2.39	-0.13	-2.01
Senegal	5.77	11.54	8.97	9.62	1.98	-0.53	-0.86
Lesotho	7.05	10.26	8.41	8.98	1.22	0.08	-1.59
Botswana	3.21	12.18	8.05	7.69	3.22	-0.32	-130
Côte d'Ivoire	2.56	12.82	8.05	8.34	3.3	-0.26	-0.74
Ethiopia	3.85	11.54	7.98	7.69	2.67	0.02	-1.01
Liberia	2.56	11.54	7.69	9.62	3.54	-0.41	-1.86
Burkina Faso	5.77	11.54	7.62	7.05	1.77	1.43	2.62
Mali	1.92	11.54	7.34	7.69	2.85	-0.57	0.74
Zimbabwe	1.92	13.46	7.34	5.77	3.71	0.29	-0.9
Madagascar	0.64	11.54	7.27	8.34	3.47	-0.97	0.26
Democratic Republic of the Congo	1.92	10.26	7.2	7.7	2.86	-1.04	0.14

Malawi	4.49	8.98	6.98	7.05	1.74	-0.43	-1.22
Namibia	1.28	14.11	6.98	6.41	4.37	0.23	-0.98
Seychelles	2.56	12.18	6.84	6.41	3.38	0.4	-1.3
Djibouti	3.21	9.62	6.7	6.41	2.53	-0.11	-1.82
Zambia	2.56	10.9	6.63	5.77	3.06	0.19	-1.45
Sierra Leone	2.56	12.18	6.63	5.13	3.61	0.36	-1.79
Ghana	3.21	9.62	6.55	7.05	2.41	-0.17	-1.86
Nigeria	1.92	12.82	6.41	6.41	3.39	0.48	0.26
Cameroon	2.56	8.98	6.27	6.41	2.31	-0.53	-1.05
Burundi	1.92	11.54	6.2	7.05	3.36	0.02	-1.11
Benin	1.92	8.98	5.7	5.77	2.25	-0.19	-0.33
Chad	2.56	7.69	5.63	5.77	2.05	-0.36	-1.65
Gambia	1.92	10.26	5.13	5.13	3.07	0.6	-0.99
Gabon	2.56	7.69	5.06	5.13	1.58	-0.03	-0.21
All countries	**0.64**	**16.67**	**7.61**	**7.69**	**3.21**	**0.08**	**-0.59**

**The results in this table are sorted in descending order based on the mean values.*

+ST. Dev represented the standard deviation and will be denoted as such, henceforth.

The above results (Table 6.1) for each country depict the data computed from the nine websites evaluated per country. The results are ordered based on the mean values, as the mean is considered the most suitable measure of central tendency in this case (i.e. data has no outliers and median scores are almost synonymous with the mean scores).

The best performing website for the online services dimension came from SA, scoring the maximum attainable score of 16.67, while the worst website came from Madagascar with a score of only 0.64 out of 16.67. None of the websites evaluated in prior studies (Baker, 2007; Dan et al., 2013; Roach, 2007) scored the maximum score of 16.67. This outstanding SSA website is the local government website for the city of Cape Town (www.capetown.gov.za). This is, however, not surprising given the efforts put in place by the city of Cape Town over the years to advance the usability of its e-government systems. For example, as mentioned before, the Western Cape Government is the first of its kind in Africa to have created a dedicated full-fledged usability laboratory responsible for advancing the usability of e-government systems in the Western Cape, of which the city of Cape Town website is part (Western Cape Government, 2014). Moreover, as one of the most developed cities in Africa, Cape Town also leads in e-government implementation, as the city has invested heavily in e-government systems in order to improve service delivery and modernise the government services (Bagui & Bytheway, 2013; Matatu & Magoqwana, 2015). The Smart City initiative of the city of Cape Town has significantly improved the number of online services offered by the local government, ranging from billing and procurement systems, geographic information systems, and enterprise resources planning systems, with several user interaction plugins such as the C3 complaints systems, just to name a few (Bagui & Bytheway, 2013).

While a total of 12 evaluated websites (4.3%) in SSA scored above 13 points in the online services dimension, the general state of most of the websites is gloomy. To score at least 50% of the allocated points for online services, a website needed to have a minimum of 8.34 out of 16.67. However, looking at Table 6.1, only 8 out of the 31 countries had a mean online services score of at least 8.34. This clearly indicates that most of the e-government websites in SSA have poor usability with respect to the dimension of online services. The top 8 countries in order of performance (mean scores) from top to bottom are SA (13.04), Uganda (10.97), Rwanda (10.61), Mauritius (9.4), Kenya (9.19), United Republic of Tanzania (9.05), Senegal (8.97) and Lesotho (8.41).

Comparing these scores with those from e-government websites in other regions clearly place most SSA countries worse off in the dimension of online services. For example in Israel, Dan *et al*. (2013) found that the average online services score for the evaluated websites was 11.0, placing it only second to SA in SSA. Likewise, the mean online services score for websites in the US evaluated by Baker (2007) was 13.7 placing the US at the top of all SSA countries in the sample.

The overall mean score for all the 279 evaluated websites was 7.61 with a median score of 7.69, depicting that at least 50% of all the websites scored far less than half of the possible scores for online services. This is a critical concern as online services are a vital component of e-government development. Baker (2009) argued that the online services dimension was one of the most critical dimensions of e-government usability as it defined the relative value of an e-government website. This is because e-government websites will have no utility to users if they cannot perform the services that are required on the websites (Baker, 2009). It is, therefore, not surprising that online services are one of the three dimensions for measuring the level of e-government developed by the UN. Figure 6.7 below compares the online services ratings computed in this study with the most recent e-government development data (i.e. data from the 2016 UN E-Government Development Survey) for the OSI (UNDESA, 2016).

The findings in Figure 6.7 depict a strong positive correlation (r=0.738) between the OSI of the SSA countries and the online services dimension computed in this study. Correlations in this study are based on Pearson's correlation and the values are represented by "r". Pearson's correlation represents a quantitative value between -1 and 1 which depicts the strength of a relationship between two variables (Creswell, 2014). Values closer to -1 represent a strong negative correlation while values closer to 1 depict a strong positive correlation.

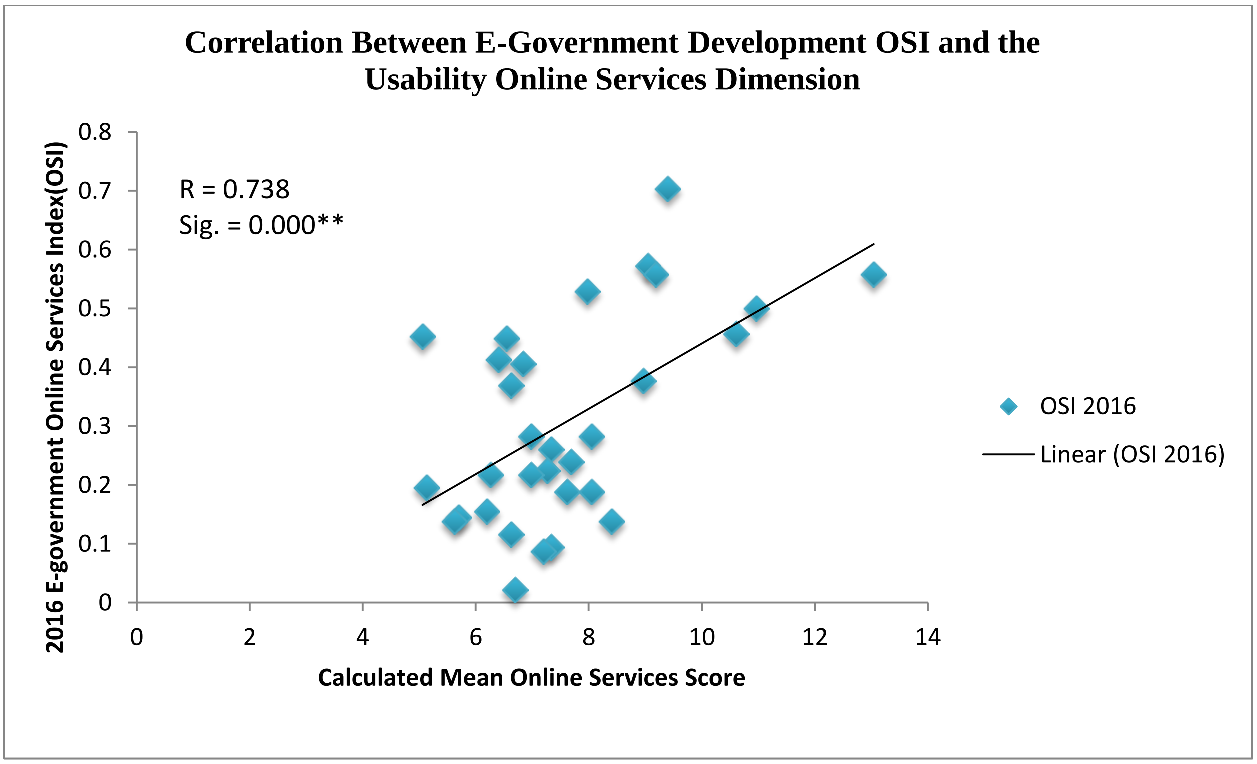


Figure 6.7: Correlation between OSI and usability online services scores (NB. **sig. at 1%)

The significant positive correlation suggests that the computed online services dimension in this study is similar to the OSI dimension of e-government development, which was expected. The top five countries in OSI, according to the 2016 e-government survey, were Mauritius, United Republic of Tanzania, SA, Kenya, and Ethiopia, while those for the online services dimension computed in this study were SA, Uganda, Rwanda, Mauritius, and Kenya. This clearly shows an overlap between the two measurements, even though the positions might differ.

The evaluation of the OSI in the 2016 e-government survey involved a rigorous assessment by 111 researchers covering the national portal, e-services portal, and Ministries of Labour, Education, Social Services, Health, Finance and Environment (UNDESA, 2016).There was also an overlap with this study regarding the websites evaluated such as Ministries of Education, Labour, Health and Finance. It is, therefore, possible that the correlation should have been stronger if both studies evaluated the same websites.

Additionally, the evaluation for the 2016 e-government survey occurred between May and July 2015 while the evaluation for this study occurred a year later. This time difference can explain why countries like United Republic of Tanzania and Ethiopia in the top five of the e-government survey were replaced by Uganda and Rwanda in this study. Nonetheless, the strong positive correlation between the similar dimensions (online services) supports the rigorous nature of the evaluation of this study, and is in line with the widely recognised E-Government Development Survey.

6.2.1.2. User-help and feedback dimension

The user-help and feedback dimension comprise of five dichotomous variables and two scale variables. The results of the evaluation of user-help and feedback variables for SSA e-government websites is presented below.

6.2.1.2.1. Dichotomous variables of user-help and feedback

The dichotomous variables for the user-help and feedback dimension (Appendix D) include information about the site, e-mail us, PDA/wireless, index and feedback. The evaluation of SSA e-government websites for these variables is presented in Figure 6.8.

It is observed that most of the SSA e-government websites (97.8%) had elementary information about the website that could provide new or novice users with knowledge on what the site entailed or its purpose. This outcome was expected, as information about the site is one of the most common features that prior studies have noted to be prevalent among e-government websites (Bouazza & Chebli, 2016; Dan *et al*., 2013; Roach & Cayer, 2010). Similarly, most of the SSA e-government websites (90.3%) provided customised email templates for site assistance. This is also another common feature among e-government websites, as Roach and Cayer (2010) found it available on 89% of evaluated e-government websites in Trinidad and Tobago, while Baker (2007) found it available on 90% of evaluated US e-government websites.

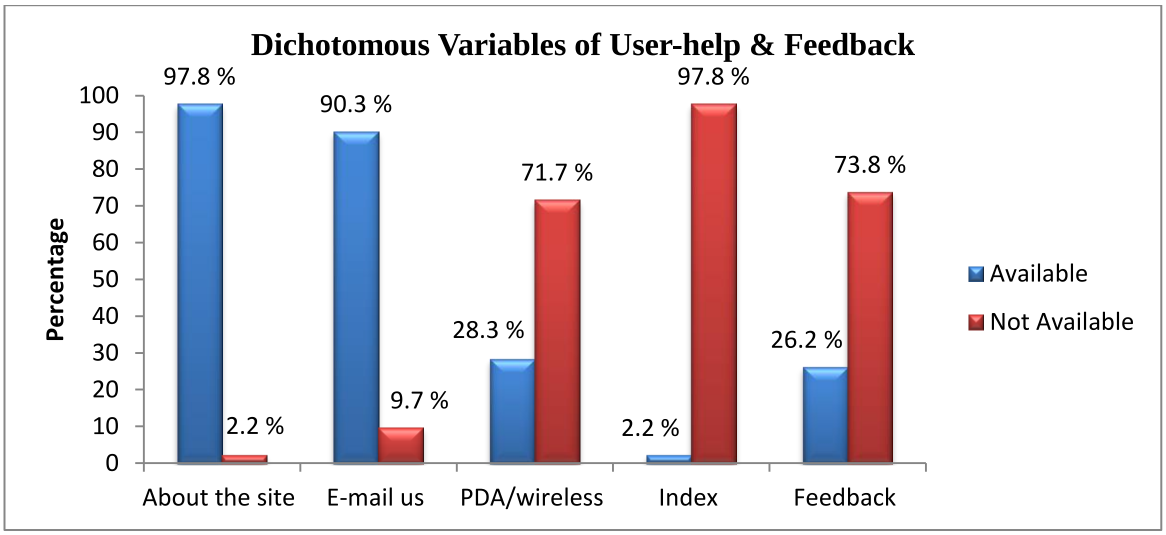


Figure 6.8: Dichotomous variables of user-help & feedback dimension

The other three features (website index, feedback mechanism, and PDA/wireless) were lacking among most of the SSA e-government websites. The website index was the worst, as only 2.2% of the websites had a website index. Dan *et al*. (2013) and Roach and Cayer (2010) also found that most of the evaluated websites in Israel and Trinidad and Tobago respectively, lacked the site index feature. However, all US e-government websites evaluated by Baker (2007) had a site index. It was also observed that only slightly above a quarter (26.2%) of the evaluated SSA e-government websites had some form of feedback mechanism. This is a cause for concern, as feedback mechanisms are needed for monitoring and effective management of e-government solutions, in order to improve its overall usefulness to the public (Alguliyev, 2015). It is, therefore, not surprising that contrary to findings from SSA, feedback mechanisms seem to be an important and highly present feature on e-government websites from other regions. For example, feedback mechanisms were available on 88.9% of e-government websites in Trinidad and Tobago (Roach, 2007), 86% of those in Oman (Bouazza & Chebli, 2016), and 93.3 % of those in the US (Baker, 2007).

Additionally, the fact that only 28.3% of the e-government websites in SSA could be accessible via portable devices, is a cause for concern, as most people in SSA access the internet via mobile devices (Ericsson, 2014, Lutu, 2015). This aspect of making websites accessible via mobile devices is known as mobile responsiveness and is a vital e-government feature, especially from a public value perspective (Karkin & Janssen, 2014).

Several years ago, making e-government websites accessible on mobile devices was uncommon (Baker, 2007; Roach, 2007). However, it has become easier to make websites accessible via mobile devices using modern technologies. As such, it is expected of e-government websites to be available via mobile devices, especially in developing countries where over 70% of internet access is via mobile devices (Ericsson, 2014).

6.2.1.2.2. Scale variables of user-help and feedback

The two evaluated scale variables for the user-help and feedback dimension were non-native language translations and search functionality. The outcome of the evaluations is presented in Figure 6.9 and Figure 6.10 below.

❖ *Non-native language translations*

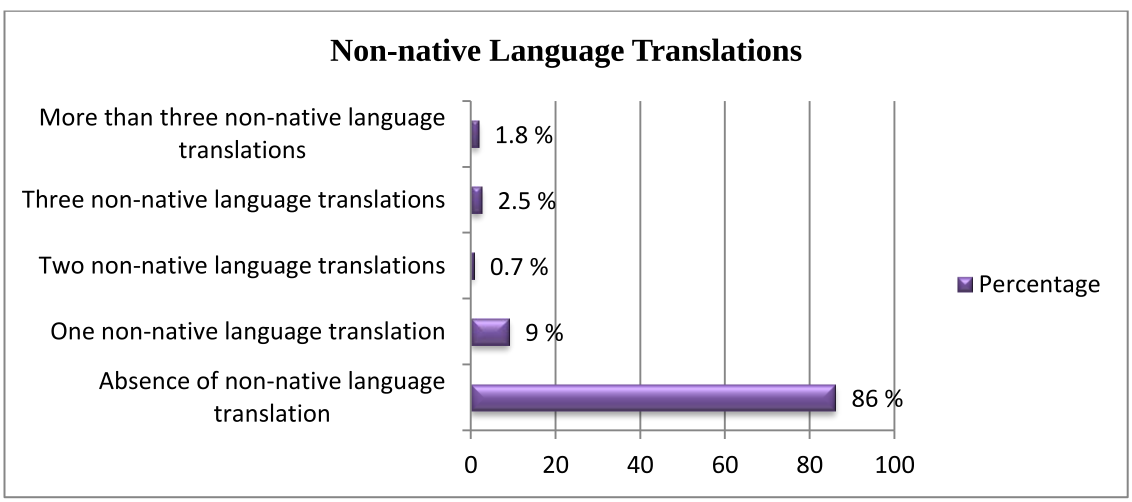


Figure 6.9: Non-native language translations

E-government services are useful not only for the natives of a country, but also for non-native users, thus increasing the need for dissemination e-government information in non-native languages (Baker, 2009; Rozis, Vasiļjevs & Skadiņš, 2016). The findings in Figure 6.9 depict the availability of non-native translations of e-government websites in SSA. The findings indicate that the majority of websites (86%) did not have any non-native translations. This trend is similar in other parts of the world, as Baker (2007) found that 80% of websites evaluated in the US had no non-native translation, while in Trinidad and Tobago, the rate was 95% (Roach & Cayer, 2010). Also, in Oman, Bouazza and Chebli (2016) decided to evaluate websites in Arabic because most of them did not have English translations for non-Arabic users. Likewise, Dan *et al*. (2013) asserted that support for foreign languages was lacking among e-government websites in Israel. This clearly suggests that, while e-government websites might serve non-native users, there is limited support for non-native users in the development of e-government websites.

❖ *Search functionality*

Search functionality is a very important dimension of e-government website usability, because it facilitates the ease of access to information within a website (Baker, 2009; González *et al*., 2009).

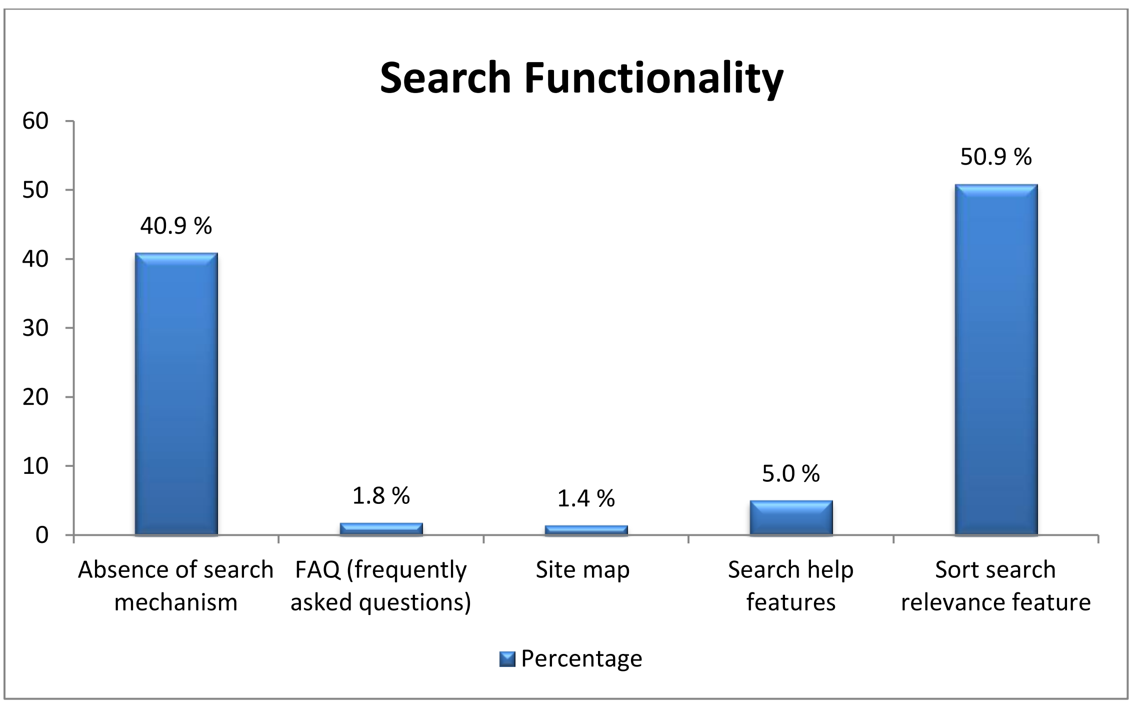


Figure 6.10: Search functionality in e-government websites

Figure 6.10 indicates the extent to which SSA e-government websites implemented search functionalities. A total of 40.9% of the websites had no search functionality. This is a cause for concern, given the importance of search functionality in enhancing the UX of a website. However, it is also encouraging to see that more than half (50.9) of the e-government websites in SSA have implemented advanced search features that sort search results according to the relevance of the searched information. When Baker (2007) examined US e-government websites, 96.7% had search functionality, however, only 26.6% had an advanced search feature that sorted information based on the relevance. Local governments' websites in the US also lacked search capabilities as Youngblood and Mackiewicz (2012) found that only 39.6% of the 129 municipal websites in Alabama had a search feature. Rauch's (2007) evaluation of e-government websites in Trinidad and Tobago indicated that even though 72% of the websites had some form of search functionality, only 39% had advanced search capabilities. In Israel, Dan *et al*. (2013) indicated that most of the websites lacked search functionality and the available search tools were inadequate. In SSA, it is important to enhance e-government website usability by developing search capabilities for the 40.9% of websites without any search functionality. This should improve the ease with which users find and access information of e-government websites, especially as most of the current e-government websites in SSA are mainly information delivery portals.

6.2.1.3. Overall user-help and feedback dimension scores

Table 6.2 indicates the overall user scores for all the evaluated websites, as well as scores per country. The minimum possible score is zero while the maximum obtainable score is 16.67 (i.e. maximum weighted score for the user-help and feedback dimension).

Unlike the online services dimension, none of the 279 evaluated websites scored the maximum possible points of 16.67. Also, 3 websites had a score of 0, which is surprising as it is inappropriate to develop an e-government website without any user-help and feedback capability. These 3 websites each come from Uganda, Zimbabwe and Zambia. The highest user-help and feedback score was 15.39, held by two websites (one from Kenya and the other from Ghana). The top five performing countries (based on the mean scores) for the user-help and feedback dimension were Ethiopia, Kenya, Gabon, Mauritius, and SA; while the bottom five were the Democratic Republic of the Congo, Côte d'Ivoire, Djibouti, Namibia and Mali.

Table 6.2: Overall user-help & feedback scores

SSA Country	Min	Max	Mean*	Median	ST. Dev	Skewness	Kurtosis
Ethiopia	3.85	14.11	10.4	10.26	2.97	-1.26	2.69
Kenya	5.13	15.39	9.26	8.98	2.7	1.27	3.99
Gabon	7.69	10.26	8.26	7.69	0.93	1.5	1.44
Mauritius	2.56	8.98	7.98	8.98	2.2	-2.35	5.39
South Africa	2.56	10.26	7.98	7.69	2.29	-1.77	4.3
Liberia	2.56	11.54	7.69	7.69	3.39	-0.57	-0.79
Rwanda	2.56	11.54	7.69	7.69	3.39	-0.57	-0.79
Senegal	2.56	8.98	7.55	8.98	2.26	-1.72	2.32
Burkina Faso	2.56	8.98	7.41	7.69	2.01	-2.05	4.86
Cameroon	2.56	10.26	6.98	7.69	2.65	-0.55	-1.04
United Republic of Tanzania	2.56	10.26	6.84	7.69	3.01	-0.66	-1.47
Malawi	2.56	14.11	6.69	7.69	3.44	1.15	2.04
Ghana	2.56	15.39	6.55	7.69	4.42	0.87	0.48
Nigeria	1.28	10.26	6.41	5.13	3.27	-0.12	-1.5
Seychelles	2.56	10.26	6.41	7.69	3.14	-0.2	-2.16
Chad	2.56	10.26	6.12	7.69	2.99	-0.19	-1.7
Uganda	0	10.26	5.84	6.41	3.69	-0.32	-1.57
Madagascar	2.56	8.89	5.7	6.41	2.8	-0.09	-2.12
Botswana	1.28	10.26	5.41	3.85	3.56	0.72	-1.81
Gambia	2.56	8.98	5.41	5.13	2.47	0.01	-1.57
Lesotho	1.28	8.98	5.41	3.85	3.19	0.11	-2.13
Sierra Leone	2.56	7.69	5.27	3.85	2.35	0.1	-2.31
Zimbabwe	0	10.26	5.27	3.85	3.48	0.04	-1.35
Burundi	2.56	12.82	5.13	2.56	3.63	1.36	1.32

Benin	1.28	11.54	4.99	3.85	3.54	0.97	-0.39
Zambia	0	10.26	4.99	3.85	3.54	0.42	-1.2
Democratic Republic of the Congo	2.56	10.26	4.84	3.85	2.78	1.03	0.11
Côte d'Ivoire	2.56	8.98	4.7	3.85	2.65	0.79	-1.4
Djibouti	1.28	8.98	4.7	3.85	2.8	0.73	-0.81
Namibia	1.28	8.98	4.42	2.56	3.22	0.7	-1.53
Mali	1.28	8.98	3.7	2.56	2.26	1.79	3.79
All countries	**0**	**15.39**	**6.32**	**7.69**	**3.21**	**0.09**	**-0.88**
The results in this table are sorted in descending order based on the mean values.							

The overall mean score for all the evaluated SSA e-government websites was 6.32 with a median of 7.69 and a standard deviation of 3.21. This is troublesome because at least half of the websites obtained less than 50% of the possible attainable scores for the user-help and feedback dimension. This clearly showed that much effort is needed to bring SSA e-government websites up to date with respect to the provision of user-help and feedback capabilities, as a means of enhancing their usability. In Israel Dan *et al*. (2013) established a mean of 8.9 and a median of 9.4 for the evaluated websites. This is similar to the e-government websites in the US evaluated by Baker (2007) and those in Trinidad and Tobago evaluated by Roach and Cayer (2010). For the USA, the mean was 10.2 and the median was 10.4, while for Trinidad and Tobago, the mean was 8.9 and the median was 11.2. This clearly suggests that in terms of user-help and feedback functionality, e-government websites in Israel, USA and Trinidad and Tobago performed better than SSA e-government websites.

This is worrying as user-help features are particularly important for e-government websites in SSA as the region is characterised by low ICT literacy (Farivar, 2011; Mukhongo, 2015). Prior literature (Asianzu *et al*., 2012; Bwalya, 2011) from SSA has shown that ICT literacy played a vital role in enhancing the adoption of e-government services. However, because of the low ICT literacy rates in SSA, many people in the region might require help to access an e-government service. For example, Mukhongo (2015) elucidated that in some SSA countries like SA, Kenya and Nigeria, where many people had access to the internet enabled phones and even free internet service during promotion hours, most of them were unable to use the internet because of low literacy rates. Nonetheless, the gap could be bridged by including user-help features as they provide a user with guidance on how to easily navigate a website. As such, because of the low ICT literacy rates in SSA, ensuring that user-help and feedback features are incorporated in the development of e-government websites should be of utmost importance, so that novice internet users could still be able to access e-government services. Furthermore, the fact that user-help features improved ease of use (Baker, 200) and that ease of use significantly influenced e-government adoption in SSA (Bwalya, 2011; Lin *et al*., 2011) emphasises the need for including user-help features in SSA e-government websites.

6.2.1.3. Navigation dimension

The navigation dimension comprises of three dichotomous variables and two scale variables (Appendix D). The evaluation of these variables for SSA e-government websites is presented below.

6.2.1.3.1. Dichotomous variables of navigation

Figure 6.11 depicts the three dichotomous variables of the navigation dimension (e-government services, link to contact information, and site map). It is observed that most of the evaluated e-government websites did not have e-government services (78.5%) and a site map (83.5%).

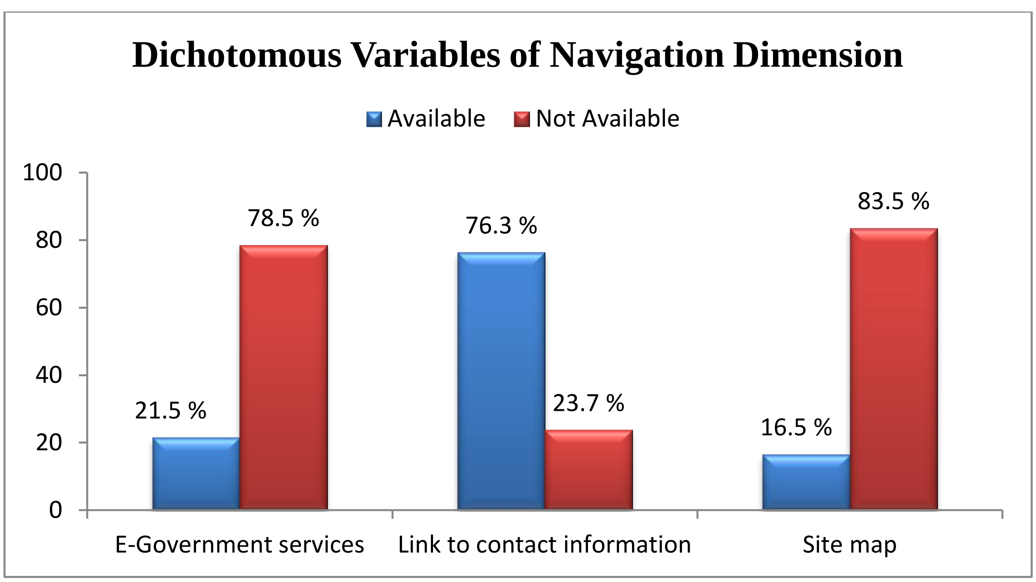


Figure 6.11: Dichotomous Variables of Navigation Dimension

The e-government services variable refers to the links that enable users to execute various online functions or transactions, depicting the provision of at least one interactive service for users. In the US, Baker (2007) found that all the evaluated websites (100%) had some form of e-government services. Raoch (2007) in Trinidad and Tobago found that 72% of the evaluated websites provided at least one service to users. It is, therefore, a cause for concern, that only 21.4% of evaluated e-governments websites in SSA offered online services to its users. This is, however, not surprising given that Rorissa and Demissie (2010) found that over 95.3% of e-government websites in Africa were still in the first (i.e. publishing or web presence) or the second phase (interacting) of development. The websites at the first phase of development are basically static web pages displaying information about the government agency, while those at the interacting phase only allow interaction levels, like downloadable documents. E-government services that allow completion of task online by users start at the transactional level. This clearly depicts that since Rorissa and Demissie's (2010) study, most e-government websites in SSA have not advanced into the transactional phase of e-government service maturity. The ideal level for e-government development is the fourth phase, known as the transformational phase, where all transactions are fully completed at an integrated online e-government portal (Macueve, 2011; Ochara, 2014; Rorissa & Demissie, 2010). This depicts that there is still a long way to go for e-government development in SSA to attain the highest maturity level.

It was also seen that only 16.5% of the evaluated websites had a site map. A site map organises the web pages of a website in a hierarchical manner, making it easy for users to navigate. While this is an important feature for enhancing the usability of e-government websites (Baker, 2009; González *et al.*, 2009), the use of sitemaps is clearly unpopular among SSA e-government websites. Given that over 40.9% of e-government websites in SSA do not have any form of search functionality (shown in Figure 6.11), incorporating sitemaps into these websites will significantly enhance the ease of finding information on these websites.

Also observed was that most e-government websites in SSA (76.3%) had a link to contact information. This link allowed for users to directly email host agencies from the website. While this is good, it is still lower than other parts of the world. For example, 100% of US e-government websites evaluated by Baker (2007) had links to contact information. Similarly, all the municipal websites evaluated by Kaan (2007) in Arizona had these links. In Trinidad and

Tobago, Roach and Cayer (2010) found that 89% of the websites had links to contact information. Contact information serves as the bridge between the government offices and e-government website users, so providing a link for users to contact the government agency should be a basic necessity. In addition to contact information links, it is also important for e-government websites to provide links to other government agencies, as government agencies often work together, thus ensuring a user centred approach to website design (Baker, 2007; Roach, 2007).

6.2.1.3.2. Scale variables of navigation

There are two scale variables for the navigation dimension. These variables are, links to other agencies and broken links.

❖ *Links to other agencies*

Figure 6.12 below depicts how SSA e-government website performed with regards to links to other agencies.

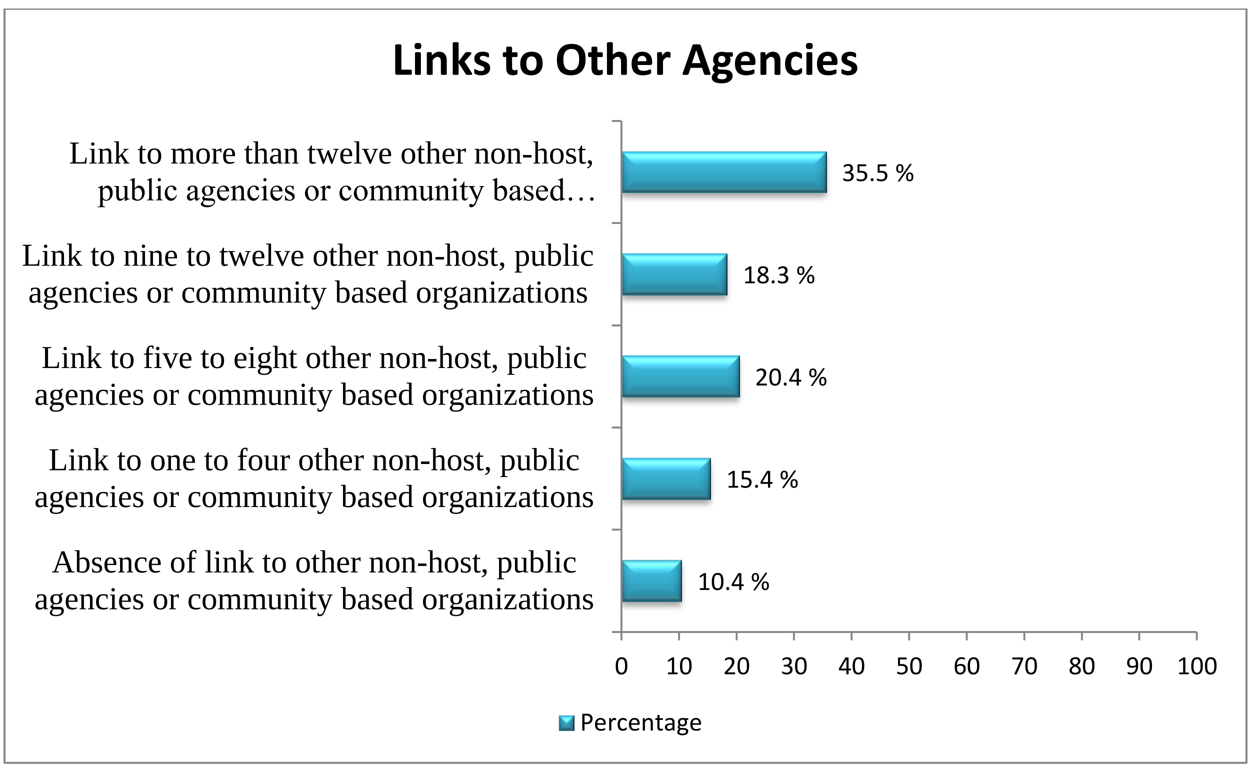


Figure 6.12: Links to other agencies

The results in Figure 6.12 shows that only 10.4% of the websites lacked a link to other agencies, while 35.5% hand links to more than twelve other agencies. In Trinidad and Tobago, Roach (2007) found that 78% of the evaluated websites had links to more than 12 agencies while only 6% had no links to other agencies. The US e-government websites also performed extremely well in this domain, with 96.7% of websites evaluated by Baker (2007) having links to more than twelve agencies.

This indicates that SSA e-government websites performed poorly compared to other regions with regards to linking with other agencies. More user interaction with SSA e-government websites will possibly be attained if more links to other host agencies are accessible to create a user-centred design as explicated by Roach (2007). Another important variable of navigation is broken links.

❖ *Broken links*

The findings regarding broken links in SSA e-government websites are presented in Figure 6.13 below.

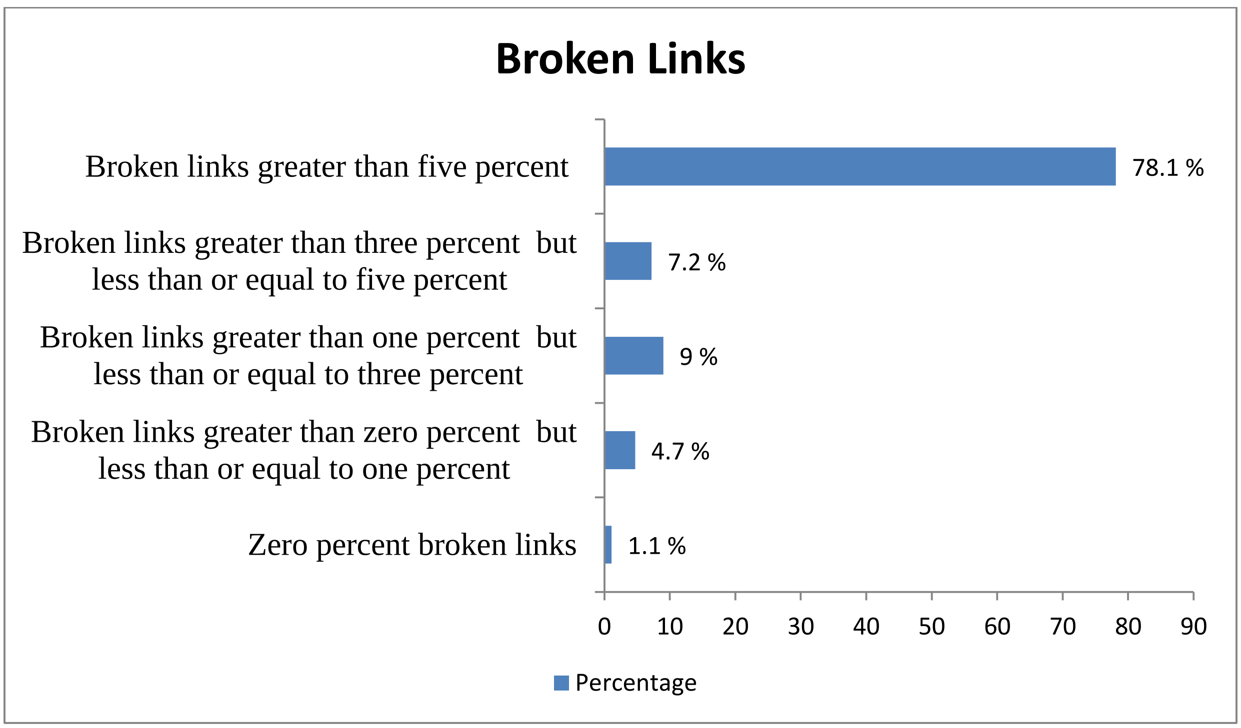


Figure 6.13: Broken links

Prior evidence suggested that broken links in e-government websites posed a serious threat to user access to information (Karkin & Janssen, 2014). Since most e-government websites in SSA simply served as information delivery portals, it was important to ensure that links to information were valid and up to date, as broken links frustrate users and discourage further website visits.

The findings from Figure 6.13 indicate that only 1.1% (5 out of 279) of the websites had no broken links. Also, 4.7% had less than 1% broken links, while up to 78.1% had more than 5% broken links. An evaluation of Turkish local government websites showed that all had at least 1 broken link; however, the worst website had less than 3% of broken links (Karkin & Janssen, 2014). This is far better than was the case in SSA where up to 85.3 % of the evaluated websites have more than 3% broken links. This is troublesome, as the likelihood of users stumbling across inaccessible pages is high for most of the SSA e-government website.

Alsaghier and Hussain (2012) showed that broken links in e-government websites resulted in a lack of trust by users regarding the website. This is important because trust plays a vital role in e-government adoption. Dolan (2015) even suggested that a fully functional e-government website is one that has no broken links. As such, it is important to fully categorise the extent of broken links among e-government websites in SSA (Table 6.3).

Table 6.3: Broken links among SSA e-government website

Statistics		Rate of Broken Links		
		Description of broken links	Number of Websites	Percentage
Mean	24.14	Less than 5 %	61	21.9 %
Median	18.34	5-25%	104	37.2 %
Standard Deviation	20.96	25-50	74	26.5 %
Min	0.0	50-75	34	12.2 %
Max	89.54	>75 %	6	2.2 %

Table 6.3 depicts further details on the state of broken links among SSA e-government websites. On average, 24.14% of the links of SSA e-government websites were broken, with half of the evaluated websites having at least 18.34% broken links. The worst website had up to 89.54%

broken links. As indicated by Dolan (2015), a functional website should have no broken links which clearly indicates that most SSA e-government websites were less than functional. A total of 40 websites (14.4%) had more than 50% broken links. This indicates that anytime a user clicked on a link on the website, there was a more than a 50% probability that the user would be taken to an inaccessible page. This is worrying because broken links frustrated users and reduced their chances of revisiting, as well as increased their lack of trust in the e-government website (Alsaghier & Hussain, 2012). It has been postulated that citizen trust in government will increase when they have 24/7 access to government information (Karkin & Janssen, 2014). However, if most links associated with e-government websites were inaccessible then this trust cannot be developed. In fact, the trust will even diminish (Alsaghier & Hussain, 2012). Thus, in the case of e-government in SSA, the governments are probably instead losing the trust of its citizens as opposed to gaining their trust, which is an intended goal of e-government. It is, therefore, imperative for governments to continuously monitor their websites for broken links and repair such links immediately to reduce user frustration rates on their websites.

6.2.1.3.3. Overall navigation dimension scores

Table 6.4 depicts weighted scores for the navigation dimension. The maximum possible weighted score is 16.67. The best e-government website in terms of navigation scored 12.12, while the worst one had a score of 0. The top countries with the highest mean navigation scores were SA, Gabon, Mauritius, Kenya and Rwanda. However, only SA, Gabon and Mauritius had good scores as they were the only countries with a mean score greater than 8.34 which was half the desirable weighted score of 16.67.

The worst five countries with respect to navigation of e-government websites were Gambia, Burundi, Namibia, Madagascar and Lesotho. The mean score for all the evaluated e-government websites was 6.22 with a median score of 6.0. This clearly indicates that most of the SSA e-government websites performed extremely poor with respect to navigation. This is not a good trend as navigation was noted to be one of the most important usability dimensions of e-government websites (Youngblood & Mackiewicz, 2012).

Table 6.4: Navigation dimension across different SSA countries

SSA Country	Min	Max	Mean*	Median	ST. Dev	Skewness	Kurtosis
South Africa	7.58	10.61	9.09	9.09	1.07	0	-0.29
Gabon	4.55	12.12	8.92	9.09	2.87	-0.64	-0.82
Mauritius	3.03	10.61	8.76	9.09	2.24	-2.48	7.01
Kenya	4.55	12.12	8.25	9.09	2.16	-0.02	0.85
Rwanda	3.03	12.12	8.08	9.09	2.73	-0.48	0.21
Senegal	4.55	10.61	7.91	7.58	2.11	-0.15	-1.06
Cameroon	3.03	10.61	7.07	7.58	2.4	-0.27	-0.51
Ethiopia	3.03	10.61	6.74	6.06	2.95	0.11	-1.44
United Republic of Tanzania	1.52	10.61	6.74	7.58	2.64	-0.7	1.1
Botswana	3.03	10.61	6.57	6.06	2.51	0.38	-0.96
Burkina Faso	3.03	9.09	6.57	6.06	2	-0.37	-0.32
Uganda	0	12.12	6.56	7.58	3.86	-0.25	-0.59
Chad	1.52	10.61	6.4	6.06	3	-0.02	-0.24
Malawi	1.52	12.12	6.4	6.06	3.62	0.09	-0.59
Ghana	1.52	9.09	6.06	7.58	3.12	-0.55	-1.4
Nigeria	1.52	12.12	6.06	6.06	3.21	0.4	0.35
Seychelles	3.03	10.61	5.89	4.55	2.56	0.62	-0.46
Sierra Leone	0	9.09	5.73	6.06	3.28	-0.49	-0.93
Zambia	1.52	9.09	5.73	6.06	2.91	-0.01	-1.57
Benin	1.52	7.58	5.56	6.06	2.27	-0.7	-0.8
Côte d'Ivoire	3.03	7.58	5.56	4.55	1.69	0.15	-1.49
Democratic Republic of the Congo	3.03	7.58	5.56	6.06	1.69	-0.54	-0.8
Liberia	1.52	9.09	5.56	7.58	2.84	-0.26	-2.04
Mali	1.52	9.09	5.56	6.06	2.51	0.05	-0.39
Djibouti	1.52	12.12	5.39	4.55	3.31	1.01	0.82
Zimbabwe	1.52	7.58	5.05	6.06	2.51	-0.47	-1.53

Gambia	1.52	7.58	4.55	4.55	2.51	-0.21	-1.67
Burundi	1.52	7.58	4.38	4.55	2.2	-0.07	-1.5
Namibia	0	9.09	4.38	3.03	3.43	0.43	-1.56
Madagascar	0	9.09	4.04	3.03	3.21	0.76	-0.43
Lesotho	0	7.58	3.87	4.55	2.53	-0.12	-1.14
All countries	**0**	**12.12**	**6.22**	**6.06**	**2.91**	**-0.1**	**-0.78**
The results in this table are sorted in descending order based on the mean values.							

For websites evaluated by Baker (2007) in the US, the mean navigation score was 13.3. Similarly, Dan *et al.* (2013) in Israel found that the mean navigation score for the evaluated e-government websites was 12.2, while Roach and Cayer (2010) in Trinidad and Tobago found the mean navigation score to be 13.3. While e-government websites from other regions seemed to provide better navigation, SSA e-government websites perform poorly with respect to navigation. Most of the e-government websites in SSA were basic information disseminating portals to the public. However, to access this information, citizens need to navigate to the pages containing the desired information. As such, navigation is crucial to accessing information and thus vital in the usefulness of SSA e-government websites.

As indicated in Figure 6.13 and Table 6.3 above, most e-government websites had broken links and this hinders navigation because such links take users to inaccessible web pages. This not only frustrates the users, but can also result in them not returning to the website again, which can significantly hamper the adoption of e-government in SSA. Consequently, it is imperative for SSA e-government website developers to address the navigation aspect of these websites, because it is clearly an area of high deficiency.

Only three countries (SA, Mauritius and Gabon) had acceptable mean navigation scores, even though in these countries there were still e-government websites that scored below 5 out of 16.67 for the weighted navigation scores.

6.2.1.4. Legitimacy dimension

The legitimacy dimension comprises of four dichotomous variables and two scale variables (Appendix D). The evaluation for legitimacy variables is presented below.

6.2.1.4.1. Dichotomous variables of legitimacy

The dichotomous variables of legitimacy are contact information, disclaimer statements, security policies and authentication password/digital sign. Figure 6.14 depicts the performance of SSA e-government websites with respect to the dichotomous variables of the legitimacy dimension.

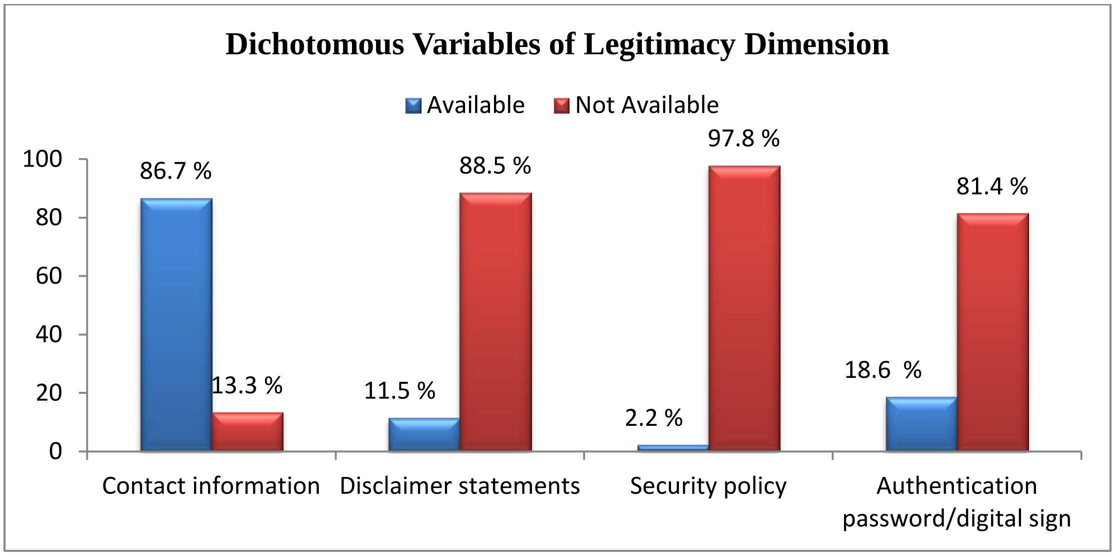


Figure 6.14: Dichotomous variables of legitimacy Dimension

The only variable common among SSA e-government websites was the availability of contact information. This included available information that assured users of the credibility of the official government agency. On the other hand, most of the websites lacked disclaimer statements, security policies and authentication mechanisms. Only 2.2% of the websites had security policies, while 11.5% had disclaimers statements. Disclaimer statements and security policies are often embedded in privacy statements on websites, however, they were highly lacking among e-government websites.

For the websites evaluated by Baker (2007) in the US, 86.7% had disclaimer statements, while 66.7% had a security policy. Bouazza and Chebli (2016) found that 33% of evaluated websites in Oman had disclaimer statements, while 29% had a security policy. In Israel, Dan *et al*. (2013) found that 95.8% of the evaluated websites had disclaimer statements. Looking at the above figures from other parts of the world, it clearly depicts that SSA e-government websites are performing worse with regards to disclaimer statements and security policies. Security is one of the factors that increase user trust in e-government and an influential factor in e-government adoption, so having security policies on e-government websites is important for assuring users of the legitimacy of the e-government website.

Also, it is seen that only 18.6% of SSA e-government websites had authentication mechanisms. This is not surprising, especially as most of the evaluated SSA e-government websites where simply information dissemination portals, with only a few of them (16.5%) having e-commerce applications. E-Government websites in SSA sparingly used authentications compared to other regions. For example, all the websites evaluated by Roach (2007) in Trinidad and Tobago utilised authentication, and so did 93.6% of the US e-government websites evaluated by Baker (2007). While authentication is inherently used in e-commerce applications, other e-government websites without e-commerce application could also utilise authentication for creating customised user content and personalisation of the UX. As such, SSA governments should consider making use of the different possibilities of authentication to enhance UX, such as providing personalised services.

6.2.1.4.2. Scale variables of legitimacy

The two evaluated scale variables of legitimacy are privacy policy and security.

❖ *Privacy policies*

Privacy concerns of e-government websites is an important aspect of legitimacy because privacy has been known to influence user trust in and adoption of e-government systems (Bwalya & Healy, 2010; Khanyako & Maiga, 2013). Figure 6.15 depicts the availability of privacy policies amongst SSA e-government websites.

The results indicate that only 14% of the websites have a privacy policy. This figure is low compared to other regions as Bouazza and Chebli (2016) showed that 29% of Omani e-government websites had privacy policies, while Baker (2007) indicated that 76.7 % of evaluated e-government website in the US had privacy policies. Additionally, Baker (2007) found 63.3% of the websites to have a clear privacy policy periodically repeated throughout the websites, as opposed to just 10% of SSA e-government websites. This is an issue that needs to be addressed in SSA as Roach and Cayer (2010) argued that users needed to see privacy statements throughout the website, in order to be assured that their privacy needs were met.

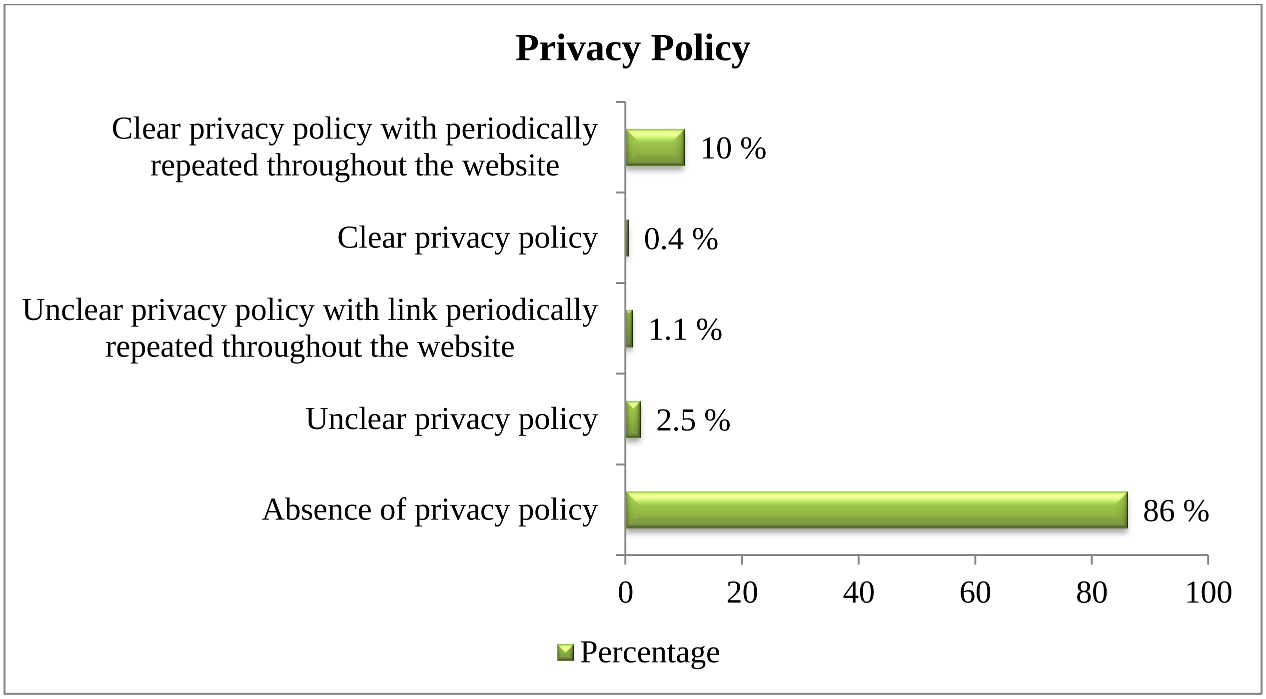


Figure 6.15: Privacy policy

The importance of addressing privacy concerns of citizens have been widely highlighted in e-government literature (Alzahrani, Al-Karaghouli &Weerakkody, 2016; Sarabdeen, Rodrigues & Balasubramanian, 2014) and, therefore, is an issue to be taken seriously. For example, as earlier indicated, 76.3% of e-government websites in SSA had a contact form which allowed users to contact the government agencies. One of the mandatory fields included in these contact forms was the email address of the user submitting the form. With only 14% of the SSA e-government websites having privacy policies, it is clear that most of the websites expected users to submit their sensitive information (email addresses) without indicating any sense of privacy regarding their information. Given the fact that privacy concerns act as a barrier to e-government users (Sarabdeen *et al*., 2014), it becomes imperative for policy makers in SSA to ensure that privacy statements become an integral part of SSA e-government websites to encourage citizens' usage of the websites. Like privacy, security of e-government websites had also been noted to be an influential factor in its adoption.

❖ *Website security*

The security of SSA e-government websites, as evaluated with the SUCURI Sitecheck tool, is presented below (Figure 6.16).

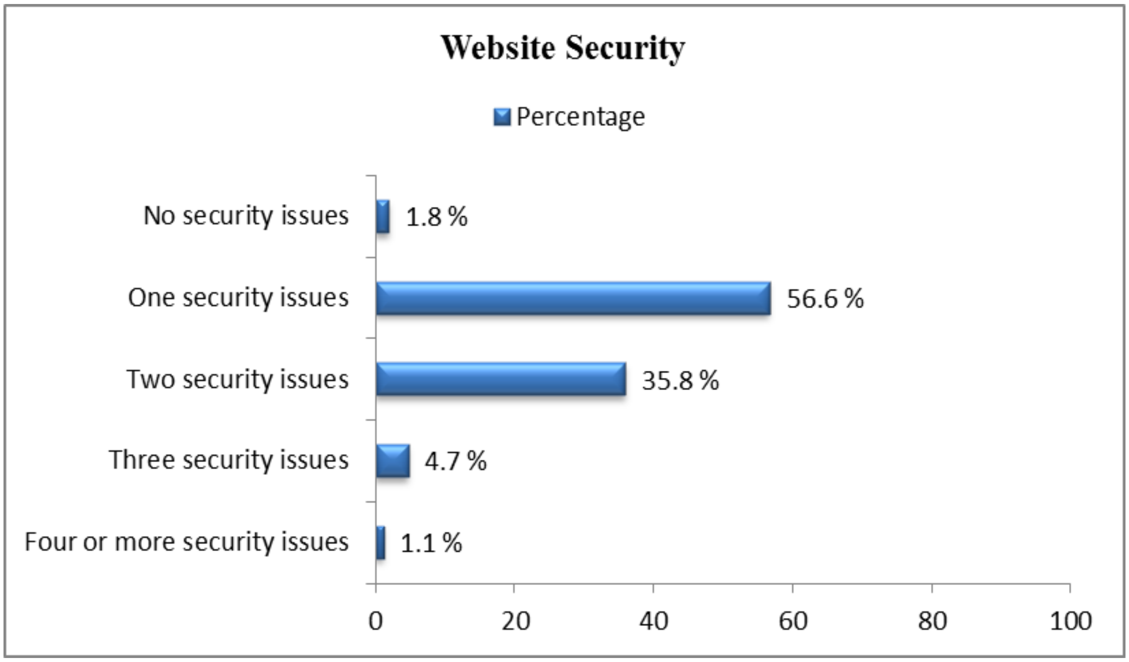


Figure 6.16: Security of SSA e-government websites

The security evaluation showed that only 1.8% of the evaluated websites had no security issues, while the majority of the website had one or two security issues. A security issue in this case basically refers to any factor that created security vulnerability for an e-government website. Security issues are a key concern because together with privacy issues they form the basis of trust in e-government systems (Alzahrani *et al.*, 2016; Karkin & Janssen, 2014). The ideal situation is, therefore, to have e-government websites that are free from any security issues. However, security efforts remain an on-going process as new security threats emerge continually, as new technologies evolve. It is important to recall here that the SUCURI security evaluation only focused on five security issues and is, therefore, not a comprehensive security evaluation of all possible security issues.

The examined security issues are presented in Table 6.5 below. From Table 6.5, it is observed that 2.87% of the websites were infected by malware, while 3.58% were recorded in the database for blacklisted websites. While the percentages are small, these are, nonetheless, very critical issues that need to be immediately addressed.

Table 6.5: Specific security issues among SSA e-government websites

Security Issue Category	Percentage having Security Issues	Percentage not having Security Issues	Severity Level
Malware	2.87 %	97.13 %	High
Blacklisting	3.58 %	96.42 %	High
Errors	21.51 %	78.49 %	High
Outdated software	21.15 %	78.85 %	High
Web application firewalls	97.13 %	2.87 %	Medium

Malware infected websites are likely to pass on malware to user devices and thus pose a security threat to user systems. It is generally advisable for users to avoid visiting malware infected websites so that their personal computers or mobile devices do not become infected by the website (Vermaat, Sebok, Freund, Campbell & Frydenberg, 2015). As such, malware infected e-government websites are already at a disadvantage because citizens are unlikely to visit the websites and thus they will not serve their intended purpose. Moreover, once users shun an e-government website, e-government adoption becomes low and can consequently result in e-government failure.

Similar to malware, blacklisting of websites also have a severe effect on the website's reputation. Websites are often blacklisted by search engines like Google and Bing, or security companies like McAfee, Norton, and SiteAdvisor. Blacklisting is often based on identified abnormalities on the website that present a security threat to users. Users might easily lose permanent trust in blacklisted websites and this can have adverse effects on the e-government efforts of a nation. The fact that up to 10 websites (3.58%) are blacklisted is, therefore, an important issue to consider, as negative perceptions of SSA e-government websites can become widespread because of a few blacklisted websites. This is because blacklisting of a website has been known to result in over 95% loss in traffic for the website (SUCURI, 2016). So, while citizens avoid the blacklisted website, they could easily become sceptical about other e-government websites and the general effect might hamper e-government progress.

It was also observed that 60 websites (21.51%) had errors that posed a security threat to the website by making the website more vulnerable to common website attacks, while 59 (21.15%) of the websites used out-dated software. Outdated software is a security threat due to its numerous vulnerabilities. One of the common outdated software systems in use by e-government websites in SSA was the outdated versions of Joomla (Joomla is an open source content management system for website publishing). Outdated software is a critical concern because it has known vulnerabilities that can easily be exploited. For example, a known Structured Query Language (SQL) injection vulnerability of an outdated Joomla version in 2015 exposed millions of websites to remote takeover attacks (Goodin, 2015). The most concerning aspect of published vulnerabilities and patches made to outdated software is the fact that even novice attackers can use the publicly available information to take down the e-government websites that still use the outdated software. As such, at least 60 e-government websites in SSA are vulnerable to attacks and this is, therefore, a cause for concern.

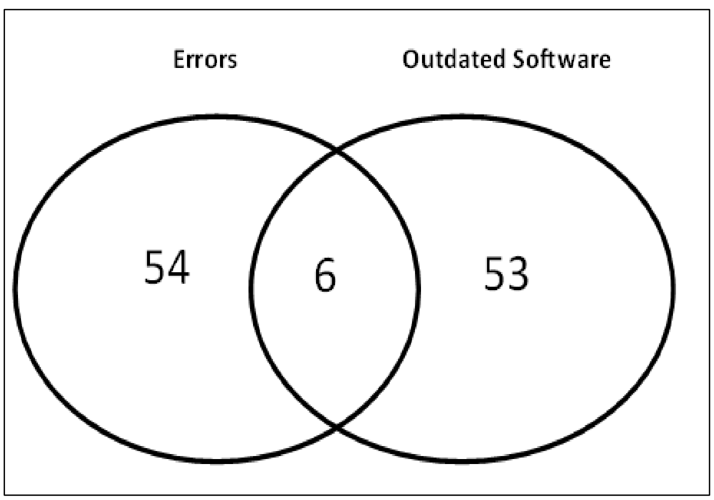


Figure 6.17: SSA websites with errors and outdated software

Lastly, most of the e-government websites in SSA (97.13%) did not use web application firewalls. Even though this is flagged as a medium security issue by SUCURI, it is still concerning, as the websites remain largely vulnerable to DOS attacks. Web application firewalls are very important because they prevent attackers from exploiting the vulnerabilities in a website with attacks such as cross-site scripting, SQL injection, and DOS. Given that these attacks are possible for all the websites with errors or outdated software, the exact number of vulnerable SSA websites is indicated above (Figure 6.17).

The Venn diagram in Figure 6.17 shows that 54 websites only had errors, 53 only had outdated software and 6 had both errors and outdated software. This shows that in total, there were 113 SSA e-government websites (40.5 %) that were vulnerable to attacks. This indicates the extent to which web application firewalls are needed in order to shield the over 113 vulnerable e-government websites which could be exploited with common website attacks.

It is, therefore, not surprising that several e-government websites in SSA have been taken down by cyber-attacks in the last few years. For example, more than 20 Angolan e-government websites were taken down by Anonymous Hackers group in March 2016. Likewise, a massive cyber-attack took down over 100 Kenyan e-government websites in 2012, while over 10 e-government websites in Ghana were hacked in January 2015.

6.2.1.4.3. Overall legitimacy dimension scores

Table 6.6 shows the overall legitimacy dimension scores for each of the SSA countries in the sample.

The worst performing website in terms of legitimacy scored 1.39, while the best-performing scored 15.28 out of a possible 16.67. Only two countries (Mauritius and Ethiopia) had mean scores that were more than 50% of the possible attainable weighted legitimacy score of 16.67. However, the median score for Ethiopia was only 5.56, depicting that at least half of the evaluated e-government websites from Ethiopia had very poor legitimacy scores.

The overall mean score for all the 279 evaluated websites was 5.68 with a median score of 5.56. These scores are lower compared to that of e-government websites from non-SSA countries. For example, the following mean scores have been obtained from e-government website evaluations in prior studies: 6.6 in Trinidad and Tobago (Roach & Cayer, 2010); 8.9 in Israel (Dan *et al.*, 2013); and 11.7 in the US (Baker, 2007).

Table 6.6: Overall Legitimacy Dimension across SSA Countries

SSA Country	Min	Max	Mean*	Median	ST. Dev	Skewness	Kurtosis
Mauritius	5.56	15.28	12.19	13.89	3.79	-1.55	0.65
Ethiopia	2.78	13.89	8.49	5.56	4.88	0.19	-2.35
South Africa	4.17	13.89	7.87	6.95	3.26	1.11	0.23
Gabon	4.17	12.5	7.41	5.56	3.87	0.77	-1.71
Uganda	4.17	12.5	7.1	5.56	3.29	1.14	-0.29
Senegal	4.17	12.5	6.79	5.56	2.98	1.35	0.56
Botswana	2.78	11.11	6.48	6.95	2.41	0.47	0.94
Benin	1.39	12.5	6.02	5.56	3.61	39	0.2
Cameroon	2.78	11.11	6.02	5.56	3.11	1.02	-0.03
Kenya	4.17	11.11	5.87	5.56	2.28	1.73	3.3
Rwanda	5.56	6.95	5.87	5.56	0.61	1.62	0.74
Sierra Leone	2.78	11.11	5.56	5.56	2.3	1.9	5.13
Mali	4.17	6.95	5.4	5.56	1.09	0.22	-1.04
Namibia	2.78	8.34	5.4	5.56	1.45	0.27	2.64
United Republic of Tanzania	4.17	11.11	5.4	4.17	2.25	2.51	6.77
Gambia	4.17	5.56	5.25	5.56	0.61	-1.62	0.74
Liberia	4.17	6.95	5.25	5.56	0.93	0.25	-0.04
Chad	2.78	5.56	4.94	5.56	1.01	-1.5	1.47
Democratic Republic of the Congo	2.78	6.95	4.94	5.56	1.41	-0.66	-0.43
Côte d'Ivoire	2.78	5.56	4.78	5.56	1.22	-1.19	-0.45
Lesotho	2.78	5.56	4.78	5.556	1.01	-1.01	0.19
Nigeria	1.39	11.11	4.78	4.17	2.7	1.68	4.27
Burkina Faso	4.17	5.56	4.63	4.17	0.69	0.56	-1.71
Burundi	2.78	5.56	4.48	4.17	0.93	-0.25	-0.04
Djibouti	2.78	5.56	4.48	4.17	0.93	-0.25	-0.04

Ghana	2.78	5.56	4.48	4.17	1.16	-0.5	-1.23
Madagascar	1.39	6.95	4.48	4.17	1.67	-0.54	0.27
Seychelles	2.78	5.56	4.48	4.17	0.93	-0.25	-0.04
Malawi	4.17	5.56	4.32	4.17	0.46	3	9
Zambia	2.78	5.56	4.32	4.17	0.83	0.02	1.13
Zimbabwe	1.39	9.72	3.86	2.78	2.38	2.16	5.6
All countries	**1.39**	**15.28**	**5.68**	**5.56**	**2.69**	**1.8**	**2.98**
The results in this table are sorted in descending order based on the mean values.							

Given that the legitimacy of e-government websites is solely based on gaining citizen trust regarding the information and services delivered via the e-government websites (Roach, 2007), it remains imperative for this dimension to be significantly improved, as citizen trust directly impacts the success of e-government initiatives (Asianzu & Maiga, 2012; Bwalya, 2011; Khanyako & Maiga, 2013). The low scores are very discouraging, as more than half of the evaluated e-government websites were basically at what can be considered a pitiable state of legitimacy. Legitimacy efforts need to be one of the aspects that take centre stage in e-government development due to its influence on citizen trust. Without trust, there will be no citizen-to-government online interaction and so e-government initiatives will be more likely to fail.

6.2.1.5. Information Architecture Dimension

The information architecture dimension comprises of four dichotomous variables and two scale variables. The evaluations for these variables are presented below.

6.2.1.5.1. Dichotomous variables of information architecture

The evaluated dichotomous variables for information architecture are agencies/departments, services, branch of government and branding (Figure 6.18).

The results in Figure 6.18 show that most of the SSA e-government websites had details about the different agencies/departments it represented (79.6%), the services it provided (76.3%), the branch of government (98.9%), as well as branding such as the logo of the represented government agency (91.8%). The websites that utilised a logo of the given government agency consistently repeated this branding across all the web pages. These findings were similar to those from other regions. For example, Bouazza and Chebli (2016) found that in Oman, 75% of the e-government websites listed the services they provided, 76% listed the agencies/departments, while 86% had appropriate branding. Also, all the websites evaluated by Baker (2007) in the US had all four dichotomous variables of information architecture.

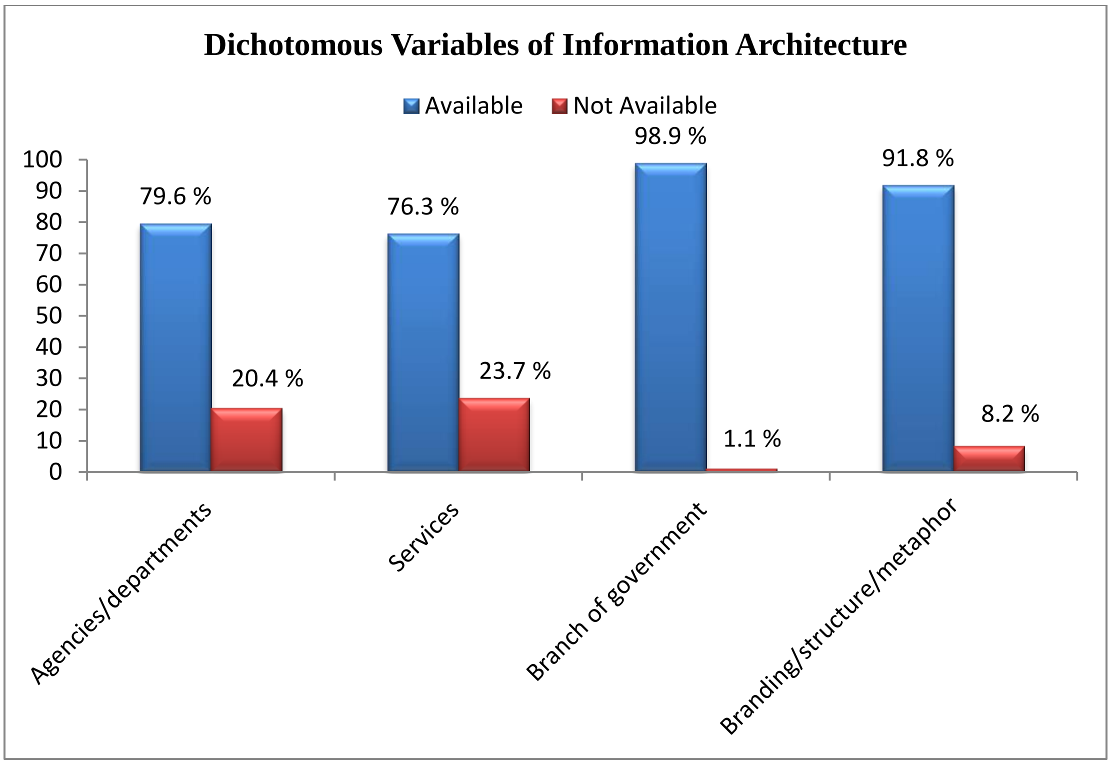


Figure 6.18: Dichotomous variables of information architecture

6.2.1.5.2. Scale variables of information architecture

The two evaluated scale variables of information architecture (Chapter 3, Section 3.4.5) are audience-focused areas and personalised/customisable features.

❖ *Audience-focused areas*

Figure 6.19 depicts the availability of audience-focused areas among e-government websites. Most of the websites (82.4%) lacked an apparent audience-focused area. Audience-focused areas are important, most particularly for novice users, in order to facilitate easy access to specific information that targets a given user group.

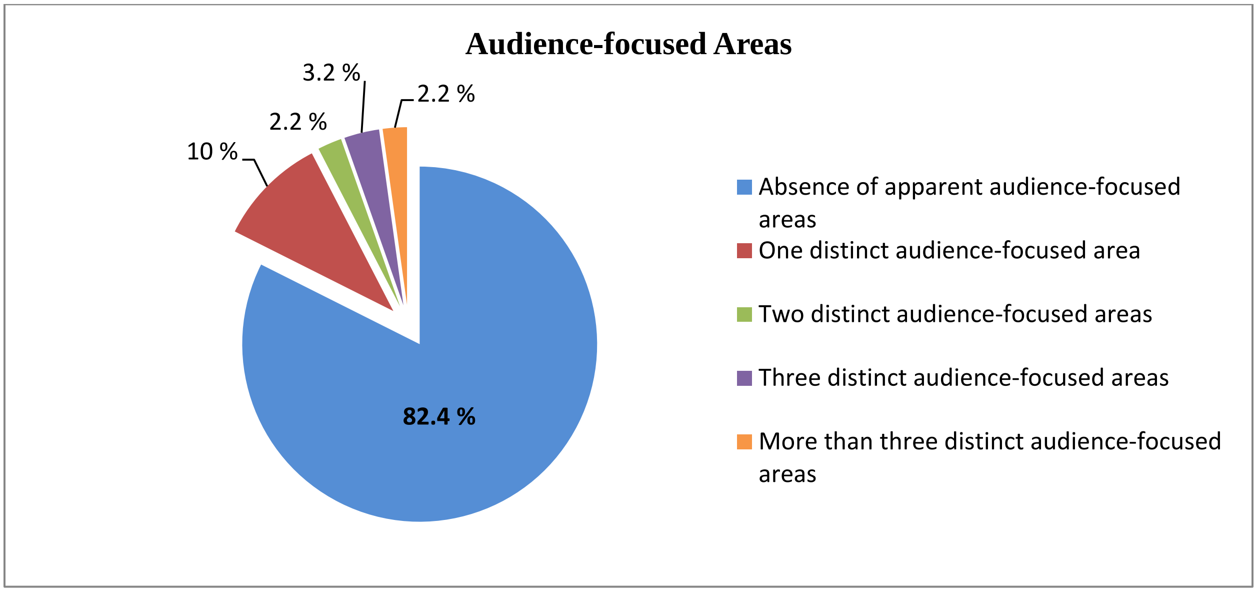


Figure 6.19: Audience-focused areas

Audience-focused areas included areas clearly labelled for the different stakeholders, such as citizens, visitors, tourists, government officials, businesses, students, etc. In Israel, Dan *et al.* (2013) found that 41.7% of the websites lacked an audience-focused area, while 37.5% had more than three distinct audience-focused areas. In the US, Baker (2007) found that 76.7% of the evaluated websites had at least one audience-focused area. Audience-focused areas could be very useful for SSA e-government websites, as most of the potential users are most probably novice users, given the low ICT literacy rate in SSA. Next, the evaluation of personalised/customisable features is presented below (Figure 6.20).

❖ *Personalised/customisable features*

Providing personalised/customisable features in an e-government website can significantly improve their usability and overall UX (Shivakumar, 2016). Figure 6.20 depicts how SSA e-government websites performed in this dimension. The results indicate that most of the websites (90.3%) had no personalised/customisable features, while the remaining 9.7% had only one of such features. This finding is not unexpected as Rorissa and Demissie (2010) evaluated 53 African websites and found that only one had customisable features. This type of feature seemed to be lacking in most e-government websites across the globe. Bouazza and Chebli (2016) found that 90% of the evaluated websites in Oman lacked personalisation/customisation capabilities. Likewise, Dan *et al.* (2013) in Israel expounded that almost all the e-government websites they evaluated lacked a customisable or personalisation feature. Similarly, in the US, Baker (2007) found that 80% of the e-government websites evaluated offered no means of customising or personalising the website. However, in Trinidad and Tobago, Roach (2007) found that only about 44.4% of the websites lacked a personalised/customisable feature.

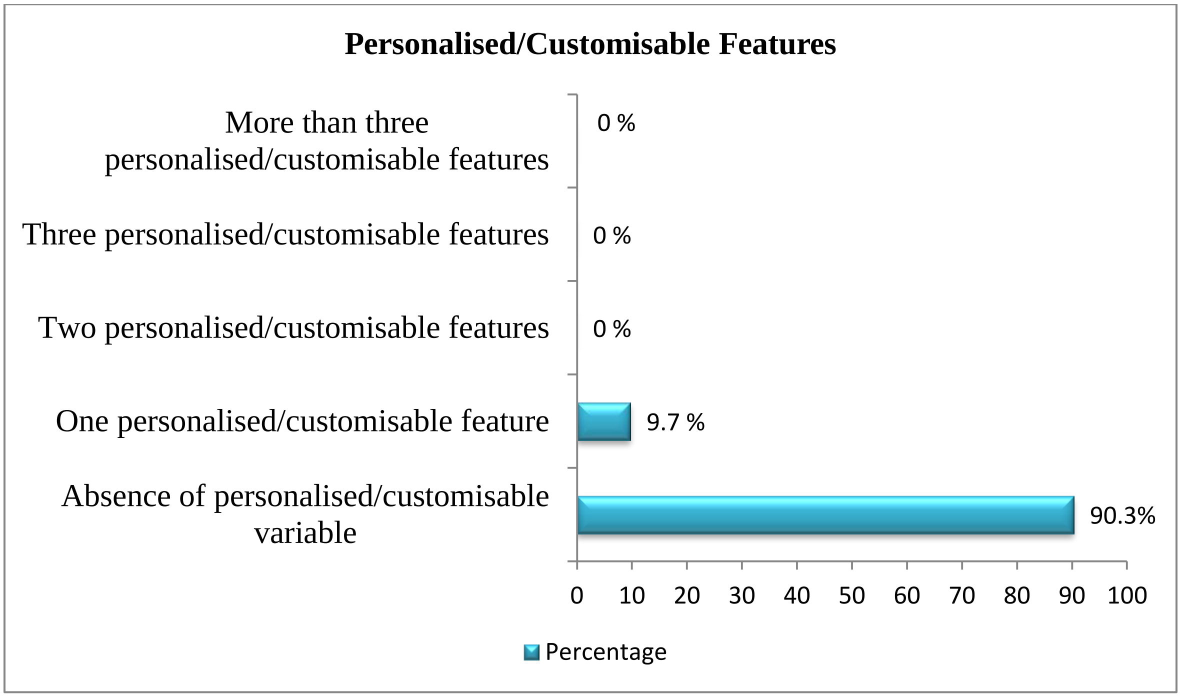


Figure 6.20: Personalised/customizable features

Personalisation/customisation has been noted to provide a truly citizen-centric approach to the delivery of e-government services (Al-Hassan, Lu & Lu, 2009; Elsheikh & Azzeh, 2014; Mpinganjira, 2014), and such a citizen-centric approach can be critical for e-government success in SSA (Mpinganjira, 2014). So, adding such features to SSA e-government websites could bridge the link between citizens and government and possibly enhance the level of trust in e-government services. Consequently, the lack thereof, could prevent SSA governments from providing a citizen-centric approach to service delivery via their websites. This, therefore, causes SSA e-government websites to fall short of maximising their possible potential in improving service delivery to citizens.

6.2.1.5.3. Overall information architecture dimension scores

Table 6.7 depicts the overall average weighted scores for the information architecture dimension for all 31 SSA countries in the study. The maximum attainable weighted score was 16.67. The results show that the best performing website in terms of legitimacy scored 12.5, while the worst performing website had a score of 1.39.

Table 6.7: Overall scores for information architecture across SSA countries

SSA Country	Min	Max	Mean*	Median	ST. Dev	Skewness	Kurtosis
Ethiopia	2.78	12.5	7.72	6.95	4.12	0.01	-2.06
Rwanda	4.17	11.11	7.1	6.95	2.24	0.69	-0.35
Mauritius	2.78	8.34	6.48	6.95	1.84	-0.88	0.74
Kenya	4.17	11.11	6.17	5.56	2.1	1.82	4.15
Lesotho	5.56	8.34	6.17	5.56	1.01	1.5	1.47
Côte d'Ivoire	4.17	9.72	6.02	5.56	1.55	1.92	4.69
South Africa	5.56	6.95	6.02	5.56	0.69	0.86	-1.71
Zimbabwe	4.17	8.34	6.02	5.56	1.39	1.07	0.43
Liberia	2.78	9.72	5.87	5.56	1.94	0.57	1.59
Uganda	2.78	6.95	5.86	5.56	1.35	-1.6	3.19
Botswana	2.78	11.11	5.71	5.56	3.06	0.81	-0.49
Seychelles	2.78	9.72	5.71	5.56	1.89	0.89	2.52
Cameroon	4.17	8.34	5.56	5.56	1.2	1.48	4
United Republic of Tanzania	4.17	6.95	5.56	5.56	0.98	0	-0.86
Namibia	1.39	11.11	5.4	5.56	2.82	0.77	1.33
Senegal	4.17	6.95	5.4	5.56	0.83	-0.02	1.13
Gabon	4.17	5.56	5.25	5.56	0.61	-1.62	0.74
Ghana	2.78	5.56	5.25	5.56	0.93	-3	9
Malawi	1.39	8.34	5.09	5.56	1.96	-0.27	1.05
Nigeria	4.17	5.56	5.09	5.56	0.69	-0.84	-1.71

Sierra Leone	4.17	8.34	5.09	4.17	1.39	1.82	3.64
Gambia	2.79	9.72	4.94	5.56	2.21	1.19	2.08
Benin	2.78	6.95	4.63	4.17	1.7	0.23	-1.56
Chad	2.78	5.56	4.63	5.56	1.2	-0.83	-1.08
Mali	1.39	8.34	4.63	4.17	1.84	0.46	2.48
Zambia	2.78	5.56	4.63	5.56	1.2	-0.83	-1.08
Burkina Faso	2.78	5.56	4.48	4.17	1.16	-0.5	-1.28
Democratic Republic of the Congo	1.39	5.56	4.48	4.17	1.35	-1.6	3.19
Burundi	1.39	5.56	4.17	4.17	1.39	-0.96	0.79
Djibouti	1.39	5.56	4.17	4.17	1.39	-0.96	0.79
Madagascar	2.78	5.56	4.17	4.17	1.2	0	-1.71
All countries	**1.39**	**12.5**	**5.4**	**5.56**	**1.85**	**0.96**	**2.42**
The results in this table are sorted in descending order based on the mean values.							

On average, all the countries performed poorly with respect to the information architecture dimension. None of them had a mean score close to half (8.34) of the possible attainable weighted score for this dimension. This could primarily be attributed to the massive lack of audience-focused areas and personalised/customisable features in the websites. The top five performing SSA countries in this dimension were Ethiopia, Rwanda, Mauritius, Kenya and Lesotho, while the least performing countries were Burkina Faso, the Democratic Republic of the Congo, Burundi, Djibouti, and Madagascar.

The overall average for all 279 evaluated websites was 5.4, with a median score of 5.56. This performance was disturbing, as half of the websites scored less than a third (5.56) of the possible attainable scores for this dimension. Comparing this with other parts of the world clearly indicates how much the findings are dismaying. In Trinidad and Tobago, Roach and Cayer (2010) found a mean of 11.2, while in Israel, Dan *et al.* (2013) found a mean of 8.1 for the evaluated websites. For the websites in the US evaluated by Baker (2007), the mean score for information architecture was 9.5.

As discussed earlier, there is an increasing need for providing citizen-centric e-government services and this could be attained through personalisation and customisation, as well as providing audience-focused areas on e-government websites. These are the key aspects of information architecture that need to be addressed in SSA, as most of the websites fully conformed to all the dichotomous variables of information architecture. The 17.6% and 9.7% of SSA websites that had audience-focused areas and customisable features respectively, were an indication that other SSA e-government websites could also do better in these domains.

6.2.1.6. Accessibility Accommodation Dimension

Accessibility of the e-government websites in SSA was evaluated using both automated and manual techniques.

6.2.1.6.1. Scale variables of accessibility accommodation

The accessibility accommodation dimension comprises of two scale variables namely, the manual accessibility evaluation of alternative text (alt-text) and automated accessibility evaluation based on FAE 2.0.

❖ *Manual Accessibility evaluation (Alt-text)*

Figure 6.21 depicts the manual accessibility evaluation of alt-text. One of the most common accessibility errors that cannot be depicted by automated accessibility evaluation tools is whether or not the content of alt-text is a reasonable representation of the non-text element it describes. As such, manual evaluations of alt-text provide a more robust evaluation of al-text accessibility compliance.

The findings from Figure 6.21 indicate that only 7.9% of the websites had no alt-text errors, while 60.6% had at least 4 alt-text accessibility errors. Alt-text errors are often the most common accessibility errors. For example, Kuzma (2009) evaluated 130 UK e-government websites and found that 63% had alt-text errors. Similarly, Latif and Masrek (2010) highlighted that alt-text errors were the most widespread and serious accessibility issues among Malaysian e-government websites, as 88.9% of those evaluated had alt-text accessibility errors.

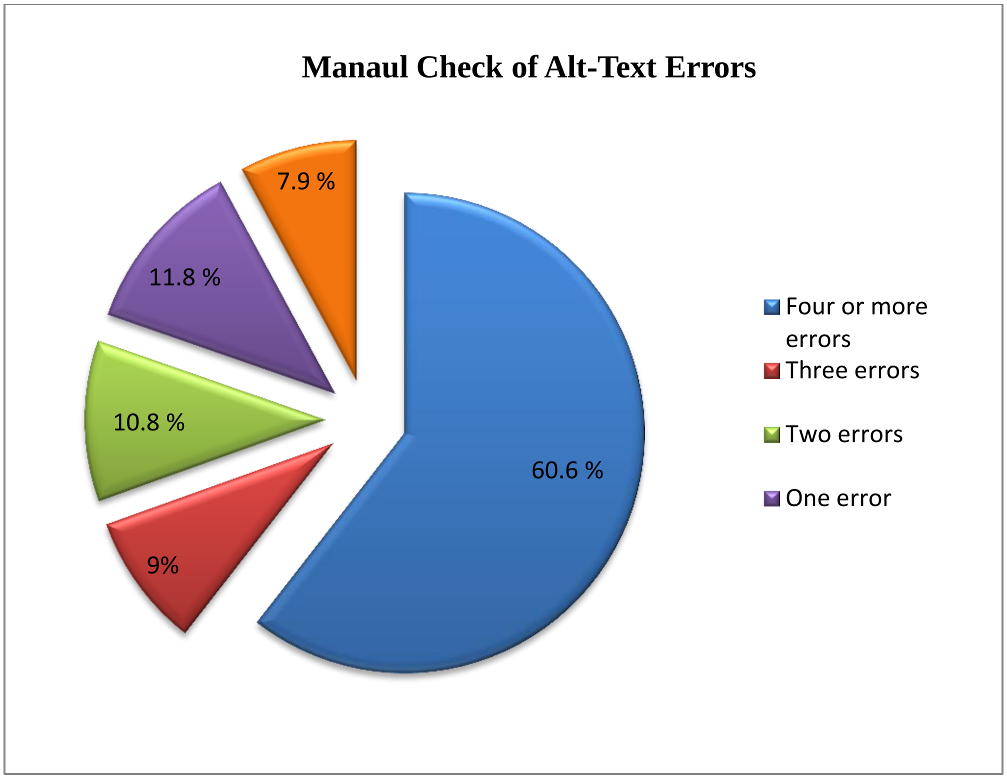


Figure 6.21: Manual accessibility evaluation

Alt-text errors are a critical concern because they negatively affect the UX of people who depend on text readers or who are visually impaired (Youngblood & Mackiewicz, 2012). There are also times when images fail to load due to slow internet connection and alt-text could serve as a valuable alternative means of accessing information originally presented in a non-text format. This could be a common problem in many SSA countries where internet connection speeds are generally slow. As such, failure to include appropriate alt-text for all non-text elements in an e-government website could negatively affect its usefulness and effective delivery of information.

❖ *Automated accessibility evaluation*

The automated accessibility evaluation was computed with FAE 2.0 and the results are summarised in Figure 6.22 below. FAE 2.0 evaluates an entire website and presents the accessibility compliance score as a percentage. From Figure 6.22, it is observed that 41.9% of the SSA e-government websites scored less than 50%, while 53.4% scored between 50% and 75%. The mean accessibility compliance score was 50.75%, with a median of 53.0%. The best performing website scored 88%, while the worst scored 8%. None of the websites had either an almost complete or a complete accessibility implementation status, indicating that all SSA e-government websites had accessibility errors.

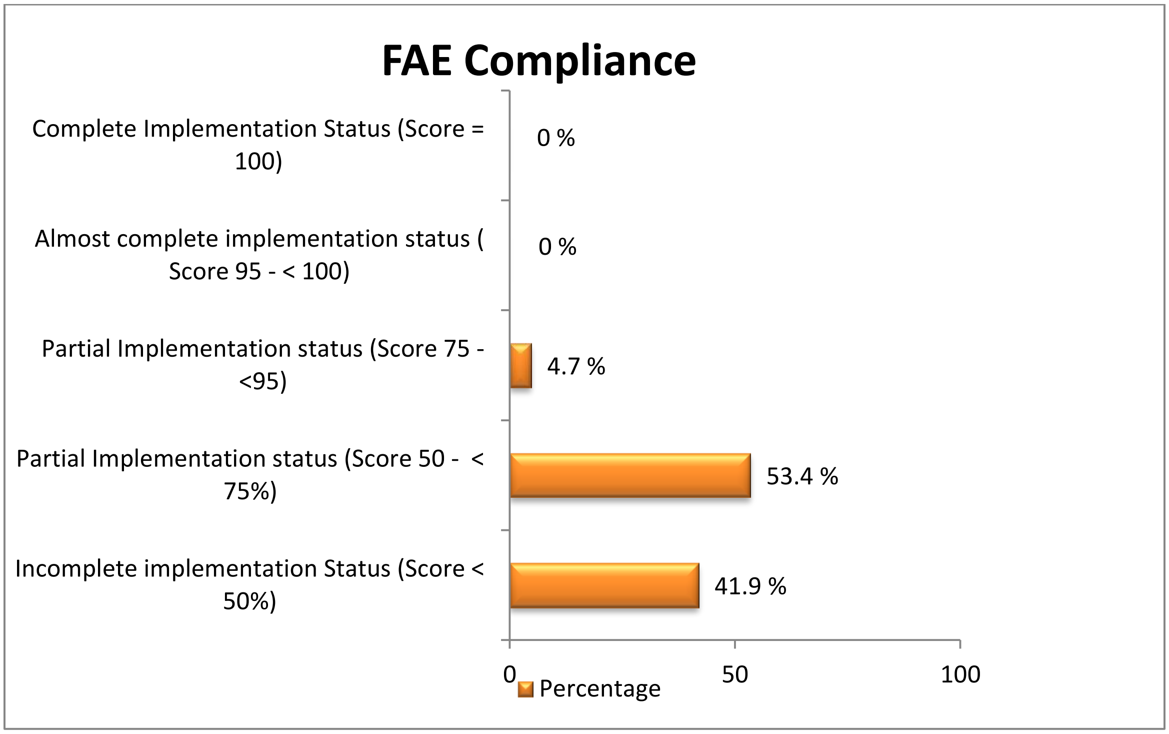


Figure 6.22: FAE accessibility evaluation

A list of the commonly violated WCAG 2.0 guidelines by SSA e-government websites is presented in Table 6.8 above.

Accessibility evaluations showed that SSA e-government websites violated, on average 14 WCAG 2.0 guidelines. The top 14 commonly violated guidelines are presented in Table 6.8 above in order of prevalence. All these violations are at level A or AA conformance. This is a call for concern, as level A and AA conformance depicts the basic WCAG guidelines that must be addressed by all websites (Lightner, 2014; W3C, 2008). Seven of the commonly violated guidelines also overlapped with five of the Nielsen's usability heuristics (i.e. consistency and standards, error prevention, flexibility and efficiency of use, recognition rather than recall, and visibility of system status), as shown in Chapter 3 (Table 3.6). This further confirms the poor state of usability of e-government websites in SSA.

Table 6.8: List of commonly violated WCAG 2.0 guidelines

Most commonly violated WCAG 2.0 guidelines		
WCAG Number	WCAG guideline	Level of conformance
1.3.1	Information, structure, and relationships conveyed through presentation can be programmatically determined or are available in text	A
2.4.4	The purpose of each link can be determined from the link text alone or from the link text together with its programmatically determined link context, except where the purpose of the link would be ambiguous to users in general.	A
1.1.1	All non-text content that is presented to the user has a text alternative that serves the equivalent purpose	A
3.1.1	The default human language of each Web page can be programmatically determined.	A
3.2.2	Changing the setting of any user interface component does not automatically cause a change of context unless the user has been advised of the behaviour before using the component.	A
2.4.1	A mechanism is available to bypass blocks of content that are repeated on multiple Web pages.	A
4.1.2	For all user interface components (including but not limited to: form elements, links and components generated by scripts), the name and role can be programmatically determined; states, properties, and values that can be set by the user can be programmatically set; and notification of changes to these items is available to user agents, including assistive technologies.	A
3.2.4	Components that have the same functionality within a set of Web pages are identified consistently.	AA
1.4.3	The visual presentation of text and images of text has a contrast ratio of at least 4.5:1	AA

3.2.3	Navigational mechanisms that are repeated on multiple Web pages within a set of Web pages occur in the same relative order each time they are repeated, unless a change is initiated by the user.	AA
1.4.1	Colour is not used as the only visual means of conveying information, indicating an action, prompting a response, or distinguishing a visual element.	A
2.1.1	All functionality of the content is operable through a keyboard interface without requiring specific timings for individual keystrokes, except where the underlying function requires input that depends on the path of the user's movement and not just the endpoints.	A
2.3.1	Web pages do not contain anything that flashes more than three times in any one second period, or the flash is below the general flash and red flash thresholds.	A
2.4.2	Web pages have titles that describe topic or purpose.	A
**Table is sorted based on the prevalence of the errors for each WCAG 2.0 guideline*		

In addition to WCAG 2.0, a MobileOK test was conducted to determine if the SSA e-government websites met the accessibility criteria for delivering content on mobile devices. The evaluation was conducted only on the homepages of the websites using TAW. The summary statistics are presented in Table 6.9.

Table 6.9: MobileOk test statistics

Statistics	**Errors**	**Warnings**
Mean	9.58	11.34
Median	12	13
Standard deviation	4.58	6.58
Minimum	1	0
Maximum	14	19

The results show that on average, the homepages of SSA e-government website do not meet 9.58

of the mobile web best practices outlined by the W3C. Also, they have on average 11.34 warnings that need to be addressed. The median score suggests that at least 50% of the evaluated websites had at least 12 errors on their homepage. This is a call for concern because these MobileOk criteria are developed to ensure that when users access a website from a mobile device, they are able to have a satisfactory level of UX. Homepages are often the first page most users access (Akgul, 2015; Olalere & Lazar, 2011; Vigo *et al.*, 2009), and so their accessibility on mobile devices is very important, especially for SSA where most users access e-government services via mobile devices (Ericsson, 2014; Katz, 2011; Keengwe, 2015; Lutu, 2015).

6.2.1.6.2. Overall accessibility accommodation dimension scores

Table 6.10 depicts the average weighted scores for accessibility accommodation across the 31 SSA countries included in this study. The maximum attainable weighted score for accessibility accommodation was 16.67. The best performing website scored 12.5, while the worst performing website scored 0 (All countries, except for Nigeria, had at least one website scoring 0 for accessibility accommodation).

Table 6.10: Overall accessibility evaluation scores

SSA Country	Min	Max	Mean*	Median	ST. Dev	Skewness	Kurtosis
Rwanda	0	10.42	6.71	8.34	3.72	-0.93	-0.48
Namibia	0	12.5	5.79	4.17	4.75	0.6	-1.39
Botswana	0	10.42	5.33	6.25	4.43	-0.25	-1.85
Lesotho	0	10.42	5.33	6.25	4.43	-0.25	-1.85
Zimbabwe	0	10.42	4.86	4.17	3.61	0.27	-1.44
Ethiopia	0	10.42	4.63	2.08	4.27	0.4	-1.76
Mauritius	0	8.34	4.63	4.17	3.26	0.04	-1.82
Zambia	0	10.42	4.4	4.17	3.82	0.42	-1.3
Burundi	0	10.42	4.17	4.17	3.29	0.98	0.4
Kenya	0	8.34	4.17	4.17	2.95	0.34	-1.09
Mali	0	10.42	4.17	4.17	3.46	0.42	-0.39
Gambia	0	6.25	3.94	4.17	2.64	-0.68	-1.25

Malawi	0	6.25	3.7	4.17	2.28	-0.19	-1.23
Nigeria	2.08	10.42	3.47	2.08	2.95	2.12	4
Cameroon	0	10.42	3.24	2.08	3.31	1.43	2.02
Chad	0	10.42	3.24	2.08	3.63	1.07	0.32
Sierra Leone	0	8.34	3.24	2.08	3.91	0.69	-1.76
Ghana	0	8.34	3.01	2.08	3.31	0.97	-0.44
Benin	0	8.34	2.55	2.08	2.71	1.23	1.68
Djibouti	0	8.34	2.55	2.08	3.42	1.29	0.15
Gabon	0	6.25	2.55	2.08	1.74	1.17	2.43
Burkina Faso	0	6.25	2.32	2.08	1.93	0.94	1.35
Madagascar	0	8.34	2.32	2.08	2.64	1.63	3.15
Democratic Republic of the Congo	0	8.34	2.31	2.08	2.64	0.72	3.15
Uganda	0	6.25	2.31	2.08	2.43	0.95	-0.23
Senegal	0	10.42	2.08	2.08	3.29	2.44	6.57
Liberia	0	10.42	1.62	0	3.42	2.63	7.24
Seychelles	0	4.17	1.39	2.08	1.47	0.61	-0.29
United Republic of Tanzania	0	2.08	1.16	2.08	1.09	-0.27	-2.57
Côte d'Ivoire	0	6.25	1.15	0	2.35	1.83	2.11
South Africa	0	4.17	1.15	0	1.51	1.01	0.19
All countries	**0**	**12.5**	**3.34**	**2.08**	**3.33**	**0.88**	**-0.36**
***The results in this table are sorted in descending order based on the mean values.**							

The average scores for all the countries were poor as no country scored an average of half (8.34) of the possible attainable score of 16.67. However, Rwanda had a median score of 8.34, suggesting that half of the e-government websites from Rwanda scored at least 8.34 out of 16.67. The best five performing countries were Rwanda, Namibia, Botswana, Lesotho and Zimbabwe, while the worst five performing websites were Liberia, Seychelles, United Republic of Tanzania, Côte d'Ivoire, and SA. While SA e-government websites have performed better in the other usability dimensions, it was surprising that they scored the lowest in terms of accessibility accommodation. However, these findings were congruent to prior evidence from Kuzma *et al.* (2009) who evaluated the accessibility of e-government websites in four African countries (SA, Liberia, Kenya, and Namibia) and found that SA e-government websites performed the worst (i.e. having the most accessibility errors).

The mean weighted score for all the 279 evaluated SSA e-government websites was 3.34, with a median score of 2.08. This is clearly a dismal situation suggesting the accessibility of SSA e-government websites is at a critically low point. Compared to other parts of the world, SSA e-government websites performed poorer with regards to accessibility. In Israel Dan *et al*. (2013) recorded an average of 10.2 for accessibility evaluation, while Baker (2007) recorded 11.0 in the US and Rauch and Cayer (2010) recorded 7.0 in Trinidad and Tobago. However, this comparison needs to be interpreted with caution, as these prior studies used WCAG 1.0 accessibility evaluation guidelines, while this study focused on WCAG 2.0 evaluation guidelines. It is important to note that WCAG 1.0 guidelines became obsolete with the implementation of WCAG 2.0 and all websites that were previously WCAG 1.0 compliant were advised to upgrade to WCAG 2.0 (Al Mourad & Kamoun, 2013; Kamoun *et al.*, 2013).

6.2.1.7. Overall Usability based on six-dimensional framework

Table 6.11 shows the average overall usability scores for each of the 31 SSA countries. The overall usability scores were computed as a percentage by summing the scores from each of the 6 usability dimensions (6 * 16.67, summing up to 100%) as each dimension had an equal weight. The best performing website had an overall usability score of 64.82%, while the worst performing website had an overall usability score of 10.79%. The top five scoring countries (based on the mean scores) were Mauritius, SA, Ethiopia, Rwanda, and Kenya, while the worst five countries are Zambia, Burundi, Gambia, Madagascar and Djibouti. Only Mauritius had a mean score above 50% indicating that the SSA e-government websites performed extremely poor in respect of the overall usability.

The overall mean for all 279 evaluated SSA e-government websites was 36.2%, with a median of 35.79%. The overall usability of SSA e-government websites was poor compared to that of other regions. Baker (2007) recorded a mean usability score of 69.4% for evaluated US e-government websites, while Dan *et al.* (2013) documented a mean usability score of 59.5% for Israeli e-government websites. Similarly, Rauch and Cayer (2010) found an overall usability score of 54% for e-government websites in Trinidad and Tobago.

Table 6.11: Overall usability scores for SSA e-government websites

SSA Country	Min	Max	Mean*	Median	ST. Dev	Skewness	Kurtosis
Mauritius	33.26	59.21	50.73	53.28	9.7	-1.2	0.08
South Africa	36.75	60.91	47.82	45.46	8	0.42	-0.56
Ethiopia	29.14	64.82	47.27	52.56	12.27	-0.18	-1.48
Rwanda	29.43	58.53	46.37	47.95	8.61	-0.73	0.86
Kenya	27.45	57.13	44.05	43.75	8.51	-0.44	1.18
Uganda	24.03	55.6	40.63	40.24	9.27	-0.35	0.47
Senegal	28.48	51.89	40.23	40.47	6.74	0.05	0.64
Gabon	29.97	56.36	39.66	39.35	8	1.02	1.52
Botswana	27.01	53.65	38.83	37.85	9.27	0.46	-0.83
United Republic of Tanzania	25.92	48.15	36.72	36.06	6.58	0.21	0.21
Cameroon	28.48	53.73	36.42	31.33	8.82	1.19	0.24
Lesotho	25.04	44.62	35.02	33.51	6.87	0.24	-1.25
Burkina Faso	24.3	42.57	35	36.34	5.02	-1.02	2.48
Liberia	16.26	44.73	34.91	38.57	9.31	-1.18	0.66
Nigeria	23.75	45.36	34.68	34.29	6.79	0.1	-0.26
Malawi	18.18	44.82	34.1	34.95	8.32	-0.85	0.45
Namibia	10.79	54.29	33.88	36.21	13.65	-0.38	-0.43
Sierra Leone	13.36	49.7	33.49	37.8	12	-0.35	-0.97
Mali	17.26	43.55	33.23	31.65	9.17	-0.43	-0.89
Ghana	16.16	43.93	33.04	37.62	10.16	-0.69	-0.93
Zimbabwe	16.26	54.11	32.76	29.63	11.67	0.65	0.15
Seychelles	23.35	43.91	32.47	33.33	6.96	0.35	-0.8
Chad	25.08	40.1	32.25	31.44	484	0.15	90.63

Côte d'Ivoire	18.95	37.71	31.55	32.4	5.7	-1.33	2.61
Democratic Republic of the Congo	20.5	38.89	31.3	29.89	6.13	-0.39	-0.61
Benin	20.47	49.79	31.12	30.37	9.1	1.05	0.98
Zambia	17.86	36.3	31.04	33.46	5.77	-1.75	3.11
Burundi	18.42	43.58	30.81	32.35	9.29	-0.18	-1.84
Gambia	18.19	39.9	30.03	32.81	8.32	-0.42	-1.66
Madagascar	15.03	45.37	29.71	32.22	933	-0.33	0.44
Djibouti	16.39	51.45	29.57	28.39	9.67	1.44	3.46
All countries	**10.79**	**64.82**	**36.2**	**35.79**	**10.08**	**0.22**	**-0.08**
***The results in this table are sorted in descending order based on the mean values.**							

The low level of usability among e-government websites in SSA is worrying, as prior evidence suggested that poor usability resulted in the failure of e-government systems (AlFawwaz, 2012; Asiimwe & Lim, 2010; Bwalya & Healy, 2010; Kirui & Kemei, 2014; Ray, 2011). This poor state of usability in SSA also supports the views of Zhao & Benyoucef (2014) that, although numerous insights have been derived from existing e-government usability studies, current e-government systems are still besieged by several usability problems. In order to provide a robust picture of the state of e-government website usability in SSA, the next section adopts a different measurement scale (UsabAIPO) to examine the state of usability of SSA e-government websites.

6.2.1.8. Summary of the evaluation for six-dimensional usability heuristics

The six-dimensional framework was used as the primary theoretical background for evaluating the usability of e-government websites in SSA. Section 6.2.1 presented the results of all six dimensions and the overall usability score. The findings clearly indicated that most SSA e-government websites were plagued by usability issues. The mean scores for all six dimensions were below the average weighted scores. Out of a weighted score of 16.67 for each dimension, online services scored the best with a mean score of 7.61, while accessibility accommodation scored the worst with a mean score of 3.34. The cumulative percentage score showed a mean score of only 36.2%, clearly supporting existing views that SSA e-government websites were characterised by poor usability. The specific usability issues that have been identified were taken into consideration in refining the initial model proposed in Chapter 5. This refined model is presented in Chapter 7, with the usability issues identified under the six dimensions outlined in Section 7.2.

6.2.2. Evaluation based on UsabAIPO heuristics

The items representing the UsabAIPO heuristics were scored on a five-point scale from 0 to 4, as earlier indicated in Chapter 4 (Section 4.6.1.2). The evaluation included a total of 30 items across the four UsabAIPO dimensions (design interface, navigation, content organisation, and functionality). The mean scores for each of these items are presented in Table 6.12.

Table 6.12: UsabAIPO evaluation scores

	Min	Max	Mean*	Median	ST. Dev	Skewness
Design Interface						
The interface includes the title of the site, the section or the page in a visible way	0	4	3.91	4	0.581	-6.633
There is a link that allows user to return to the homepage	0	4	3.85	4	0.542	-5.009
Icons related to and associated with the contents are used	0	4	3.5	4	0.734	-1.601
You know at all times where you are positioned	0	4	1.87	2	1.298	0.089
The scroll is less than two screens	0	4	3.49	4	1.049	-2.361
The information is organised according to a recognised and familiar logic for users	0	4	2.88	3	1.326	-0.852
The structure, order and logic are familiar and intuitive for users	0	4	2.78	3	0.865	-0.191
It is easy to locate information	0	4	2.74	4	1.469	-0.664

previously found						
	Min	**Max**	**Mean***	**Median**	**ST. Dev**	**Skewness**
The links are clearly differentiated	0	4	1.82	0	1.982	0.178
The interface is perfectly visualized in different resolutions	0	4	1.1	0	1.791	1.008
Navigation						
The same information (text) is expressed in the same way in the entire page	1	4	3.54	4	0.598	-1.113
It is possible to repeat an action already carried out in a simple way	1	4	3.53	4	0.723	-1.613
There is not redundancy of information on the page	0	4	3.47	4	1.359	-2.178
The information is organized and is similar in each page	1	4	3.2	3	0.785	-0.602
The information is short, concise and precise	1	4	3.13	3	0.768	-0.423
The fonts colour has sufficient contrasts with the background	0	4	2.97	3	0.954	-0.576
The text is easy to read, it is well organised and the sentences are not very long	0	4	2.81	3	0.854	-0.287
The fonts are readable and have a suitable size	1	4	2.79	3	0.806	-0.054
The same actions take to the same results	0	4	2.55	3	1.361	-0.452
The standard colours are used for visited links and for ones not visited	0	4	2.05	2	0.932	0.034
Content Organization						
The presentation of the content is	2	4	3.22	3	0.634	-0.216

familiar or understandable for the user						
	Min	**Max**	**Mean***	**Median**	**ST. Dev**	**Skewness**
The symbols and icons used are easy to understand	1	4	2.96	3	0.696	-0.463
When options exist, they are organised in the user's logical way of thinking	0	4	2.89	3	1.316	-0.871
The information is structured in titles, bold text, and frames	0	4	2.75	3	0.845	-0.47
Functionality diverse						
The news headlines contain a link to read the full story	0	4	2.65	3	1.14	-0.357
If there is help, it is visible and easy to find	0	4	2.22	3	1.912	-0.230
Homepage has a text box to introduce words to search for in the website	0	4	2.22	4	1.92	-0.240
The search's area is identified with a headline that titles the search action	0	4	2.15	4	1.998	-0.152
The page has a section of frequently asked questions	0	4	0.7	0	1.525	1.714
It shows the date of the last update	0	4	0.04	0	0.413	9.539
***The results in this table, for each of the four dimensions, are sorted in descending order based on the mean values.**						

In the design interface dimensions the worst scored item was "The interface is perfectly visualised in different resolutions" (Mean = 1.1), while the best-scored item was "The interface includes the title of the site, the section or the page in a visible way" (Mean = 3.9). Of the 10 items representing the design interface dimension, five had mean scores of at least 3, while three had a score less than 2. The remaining three had scores between 2 and 3. For each of the design interface items, there were websites that scored the lowest possible score (min = 0), as well as those that scored the maximum possible score (max = 4).

The navigation dimension also consisted of 10 items; however, most of these items generally scored better than design interface items. Half of the navigation dimensions had mean scores of at least 3, while the remaining half had mean scores between 2 and 3. Also, five of the items had a minimum score of 1 - indicating that none of the SSA websites scored the lowest possible score for these items. The best-scored navigation item was "The same information (text) is expressed in the same way in the entire page" (Mean = 3.54), while the worst scored navigation item was "The standard colours are used for visited links and for ones not visited" (mean = 2.05).

The content organisation dimension was composed of four items, with only one of them having a mean score of at least 3. The remaining items had mean scores of between 2 and 3. The best-scored content organisation item was "The presentation of the content is familiar or understandable for the user" (3.22), while the worst was "The information is structured in titles, bold text, and frames".

The functionality dimension was composed of six items. This dimension had the worst scored items. None of the items had a mean score of at least 3, while two scored close to 0. These two worst scored items were: "The page has a section of frequently asked questions" (Mean = 0.7) and "It shows the date of the last update" (Mean = 0.04). The best-scored item for the functionality dimension was "The news headlines contain a link to read the full story" (Mean = 2.65).

The focus of the UsabAIPO heuristics evaluation was to aggregate scores into an overall single usability measure that could be used to compare different websites (Gonzalez *et al.*, 2009). The weighted scores were computed using the USABAIPO-(H) function, presented in Chapter 1 (Section 1.6.2). The description of the weighted scores for each dimension and the overall UsabAIPO usability measure are presented in Table 6.13.

For the design dimension, the worst website scored 5.6, while the best scored all 28 possible points. The mean score was 19.557 with a median of 19.6. This indicates that most of the websites scored more than half (i.e. 14) of the maximum weighted score for this dimension.

For the navigation dimension, the worst performing website scored 9.8, while the best scored the maximum possible weighted score (i.e. 28). The mean for navigation was 21.035 and the median was 21.0.

Table 6.13: Overall UsabAIPO scores for SSA e-government websites

Dimensions	Weights	Weighted Scores					
		Min	Max	Mean	Median	ST. Dev	Skewness
Design	28	5.6	28	19.557	19.6	3.823	-0.368
Navigation	28	9.8	28	21.035	21.0	3.641	-0.295
Content Organisation	20	3.75	20	14.77	15.0	2.915	-0.597
Functionality	24	0	20	9.98	13.0	6.54	-0.12
Overall Usability	100	28.25	90.55	65.342	66.1	12.887	-0.249

For the content organisation, the minimum score attained by a website was 3.75, while the maximum score was 20 (i.e. the highest possible score for the dimension). The average score for all the websites was 14.77 with a median score of 15.0.

The last dimension was the functionality dimension which had a minimum score of zero and a maximum score of 20. This was the only dimension where a website had the lowest possible score (i.e. zero), and no website had the maximum possible score (i.e. 24).

As previously indicated, the goal of the UsabAIPO heuristic method was to present the overall usability score. As such, most studies that have adopted this method, presented only the overall usability thus not providing an opportunity to compare the scores obtained for the four dimensions with other studies.

Regarding the overall usability for the UsabAIPO heuristics, it is observed from Table 6.13 that the worst performing website scored 28.25 and the best scored 90.55. The mean score was 65.34% with a median score of 66.1%. The ideal usability score is 100%. However, the creators of the UsabAIPO heuristics considered a website to have a good level of usability when its usability score was above 80% (González *et al.*, 2009). Since both the mean and median scores for SSA e-government websites were far below 80%, it suggests that much is still desired to attain good usability levels for most SSA e-government websites.

After evaluating 69 university websites in Spain, based on the UsabAIPO heuristics, González *et al.* (2008) found that the worst website scored 35%, while the best scored 71%. However, González *et al.* (2009) evaluated 38 municipality websites from four Spanish provinces and concluded that, on average, the websites had a good level of usability (i.e. based on criteria that good usability is depicted by a UsabAIPO score above 80%). The average UsabAIPO heuristics usability scores for each of the SSA countries is presented in Table 6.14.

From Table 6.14, it is observed that Mauritius is the only SSA country with a mean and median scored above 80% suggesting that at least half of the evaluated e-government websites from Mauritius were considered to have good usability. SA came in second, with a mean score very close to 80 (79.16). The other three countries in the top five (based on UsabAIPO evaluation) were Kenya, Ethiopia and Senegal. The bottom five countries were Sierra Leone, Djibouti, Chad, Madagascar, and Burundi.

Table 6.14: UsabAIPO evaluation scores for each SSA country

SSA Country	Min	Max	Mean*	Median	ST. Dev	Skewness
Mauritius	65.75	89.4	81.7	85.95	8.55	-1.23
South Africa	71	85.3	79.16	77.05	5.03	-0.16
Kenya	66.85	90.55	77.16	73.15	9.64	0.49
Ethiopia	48.2	86.9	75.6	78.15	12.29	-1.58
Senegal	58.5	78.15	72.05	75.9	6.64	-1.11
Gabon	62.6	85	71.9	73.1	6.53	0.71
Uganda	53.15	88.6	71.08	71.85	10.26	-0.11
Rwanda	52.35	84.15	70.3	72.85	11.17	-0.46
Ghana	57.5	85.15	70.06	75.35	10.58	-0.04
Liberia	52.45	82.9	69.38	76.1	12.54	-0.65
United Republic of Tanzania	57.3	74.65	68.59	71.4	6.63	-1.25
Nigeria	46.85	77.05	66.67	69.75	9.92	-1.04
Burkina Faso	49.9	82.7	66.42	67.35	9.19	-0.09
Lesotho	52	81.8	66.42	63.15	11.12	0.1

Seychelles	49.9	80.4	66.03	68.6	10.88	-0.53
Botswana	40	80.9	65.21	67.8	14.54	-0.91
Cameroon	53.25	87.8	65.12	60.95	12.79	0.94
Malawi	49.2	75.1	64.4	63	7.57	-0.69
Côte d'Ivoire	49.75	71.65	63.34	65.85	940	-0.19
Namibia	48.65	87.75	62.73	60.3	12.55	1.01
Democratic Republic of the Congo	39.05	82	62.51	61.25	13.64	-0.21
Zimbabwe	48.1	89.15	61.48	51.85	15.43	0.99
Zambia	36.3	73.95	59.56	61.25	11.54	-0.88
Mali	47.25	86.15	59.04	59.4	12.35	1.35
Benin	39.85	73.55	58.6	58.3	10.75	-0.19
Gambia	38.15	71.9	58.02	59.85	10.98	-0.41
Sierra Leone	37.75	79.8	57.38	62.15	15.66	-0.02
Djibouti	40.15	78.25	56.51	52.1	12.43	0.36
Chad	41.95	73.5	55.62	50.45	11.44	0.36
Madagascar	38.45	68.6	52.51	53.5	11.42	0.19
Burundi	28.25	73.65	52.03	48.65	13.51	-0.1
All countries	**28.25**	**90.55**	**65.34**	**66.1**	**12.89**	**-0.25**
**The results in this table are sorted in descending order based on the mean values.*						

This section focused on the usability evaluation of SSA e-government websites based on the UsabAIPO heuristics. These heuristics were used as the supplementary evaluation in this study. The overall mean score for the evaluated websites was 65.34% which is far below the 80% mark that depicts websites with acceptable usability levels based on the UsabAIPO heuristics. This suggests that, like the six-dimensional framework, SSA e-government websites also underperform acceptable standards of the UsabAIPO heuristics. An association between the six-dimensional framework and the UsabAIPO heuristics is examined in Section 6.4.

6.3. Comparisons: National and Local E-Government Websites

Comparisons were made for both the six-dimensional framework and the UsabAIPO heuristics.

6.3.1. Comparison based on the six-dimensional framework

The results from Table 6.15 indicates that there are significant differences between national and local e-government websites with respect to some of the usability dimensions (i.e. online services, user help, navigation and information architecture), as well as the overall level of usability(with national e-government websites scoring better than local sites). Looking at the mean scores for national and local e-government websites across the different usability dimensions, it is evident that although both are low, the case is significantly worse for local e-government websites (except for the legitimacy and accessibility accommodation dimensions).

Table 6.15: Usability comparison between state and local e-government websites

Usability Dimension	Mean Values		T-test Parameters			95% Confidence Interval	
	National (N = 217)	Local (N = 61)	Mean Diff.	T-Value	Sig.	Lower	Upper
Online Services	7.97	6.36	1.61	3.165	**0.002**	0.59	2.61
User Help	6.55	5.52	1.03	2.244	**0.026**	0.13	1.94
Navigation	6.56	5.04	1.53	3.315	**0.001**	0.61	2.45
Legitimacy	5.64	5.83	-0.19	-0.479	0.632	-0.95	0.58
Information Architecture	5.52	4.97	0.55	2.073	**0.039**	0.03	1.07
Accessibility Accommodation	3.39	3.36	0.33	0.676	0.499	-0.62	1.28
Overall Usability	36.86	32.13	4.73	2.979	**0.004**	1.57	7.88

Most citizens and communities interact with governments at the local level where most of their fundamental services are delivered. As such, e-government development at the local level might provide more benefits to citizens. It is, therefore, not ideal to find that local e-government websites performed poorly in terms of usability (Asiimwe & Lim, 2010; Kirui & Kemei, 2014). However, the poor usability levels of local e-government websites support the existing views that local e-government in developing countries remains underdeveloped and highly constrained by technical and financial capabilities (Nabafu & Maiga, 2012).

Nonetheless, there are some outstanding local government websites, such as the Cape Town municipality website which was earlier noted for being the best performing SSA e-government website for the online services dimension. As such, while the general trend depicts that national level websites perform better than local government websites, the case might not be true for all countries in SSA. To better understand this trend, Table 6.16 compares the mean overall usability scores for national and local e-government websites for each of the 31 SSA countries.

Table 6.16: Differences in overall usability across SSA countries (national vs local e-government websites)

SSA Country	National	Local	Mean Diff	T-Value	P-Value
Mauritius	**55.92**	32.55	23.37	9.281	0.000**
Ghana	37.38	17.87	19.51	4.533	0.003**
Madagascar	32.86	16.6	16.26	4.174	0.004**
Zimbabwe	28.96	**50.21**	-21.25	-3.176	0.016*
United Republic of Tanzania	38.29	28.1	10.19	3.014	0.020*
Sierra Leone	37.04	17.95	19.09	2.582	0.036*
Seychelles	34.47	23.35	11.12	2.514	0.040*
Mali	34.85	22.43	12.42	2.506	0.041*
Democratic Republic of the Congo	32.62	23.56	9.06	2.444	0.045*
Lesotho	32.86	43.67	-10.81	-2.268	0.058
Burundi	32.67	19.09	13.58	2.168	0.067
Gambia	32.82	22.35	10.47	1.995	0.086
Senegal	42.05	32.85	9.2	1.984	0.088

Namibia	37.19	19.34	17.85	1.849	0.107
Burkina Faso	35.66	29.55	6.11	1.71	0.131
Nigeria	32.07	38.61	-6.54	-1.354	0.218
Cameroon	39.28	29.61	9.67	1.228	0.259
Uganda	38.05	46.55	-8.5	-1.137	0.293
Liberia	36.42	28.56	7.86	1.088	0.313
Kenya	42.59	49.45	-6.86	-0.952	0.373
Gabon	37.58	42.77	-5.19	-0.846	0.426
Rwanda	48.34	42.63	5.71	0.84	0.429
South Africa	45.4	**50.07**	-4.67	0.661	0.458
Chad	31.52	34.79	-3.27	-0.756	0.474
Benin	31.85	26.77	5.08	0.728	0.49
Djibouti	30.24	25.19	5.05	0.617	0.557
Côte d'Ivoire	31.1	33.13	-2.03	-0.421	0.687
Botswana	39.41	36.79	2.62	0.334	0.748
Malawi	34.71	33.02	1.69	0.282	0.786
Zambia	31.72	32.87	-1.15	-0.193	0.852
Ethiopia	47.09	45.81	1.28	0.118	0.91
Note: *the information in the table is sorted in ascending order based on the level of significance (p-values).*					

**Sig. at 1%; * at 5%

Looking at the results from Table 6.16, it is observed that there are significant differences between the overall usability of national and local e-government websites for only 9 of the 31 countries evaluated. For 8 of the countries (The Democratic Republic of the Congo, Ghana, Madagascar, Mali, Mauritius, Seychelles, Sierra Leone, and the United Republic of Tanzania) national e-government websites outperformed local e-government websites, while the remaining local e-government websites (Zimbabwe) outperformed the national sites.

Also interesting is the fact that the average overall usability for local e-government websites in SA and Zimbabwe was above 50%, which was more than the majority of the national level websites score. Nonetheless, since there were no significant differences in the overall usability for the majority of the countries, a combination of both local and national level usability levels thus presented a true picture of the state of usability in a country. This is because the average usability score was not skewed by either the national or the local level e-government website.

6.3.2. Comparison based on UsabAIPO

Independent sample t-tests were used to examine if there were any significant differences in the USABAIPO usability scores between national and local SSA e-government websites and the results are presented in Table 6.17.

From Table 6.17, it is observed that there are no significant differences between national and local SSA e-government websites with regards to the design (T=0.559, p>0.5) and navigation (T=-0.080, p>0.05) dimensions. However, the results show that for the content organisation and functionality dimension, as well as the overall UsabAIPO usability scores, national websites scored significantly better than local government websites (p<0.05). This finding is similar to that obtained for the six-dimensional usability frameworks in Table 6.15 which showed that national websites outperformed local government websites in terms of the overall usability.

Table 6.17: Differences in UsabAIPO dimension

Usability Dimension	Mean Values		T-test Parameters			95% Confidence Interval	
	National (N = 217)	Local (N = 61)	Mean Diff.	T-Value	P-Value	Lower	Upper
Design	19.626	19.318	0.308	0.559	0.577	-0.777	1.393
Navigation	21.026	21.068	-0.042	-0.080	0.936	-1.076	0.992
Content Organisation	15.063	13.075	1.313	3.180	0.002**	0.500	2.126
Functionality	10.548	8.23	2.253	2.413	0.016*	0.415	4.092
Overall Usability	66.194	62.361	3.833	2.078	0.039*	0.201	7.465

The next section compares the two different usability measures used in this study.

6.4. Aggregating the Two Usability Measures

Figure 6.23 presents the correlation between the two usability measures adopted in this study, namely the six-dimensional framework and the UsabAIPO heuristics. The results depict a correlation coefficient of 0.784 significant at the 1% level. Given the strong positive correlation between the two different measures of usability presented in Figure 6.23, it is plausible to aggregate the two variables as one combined overall usability measure for the subsequent cross-sectional analysis.

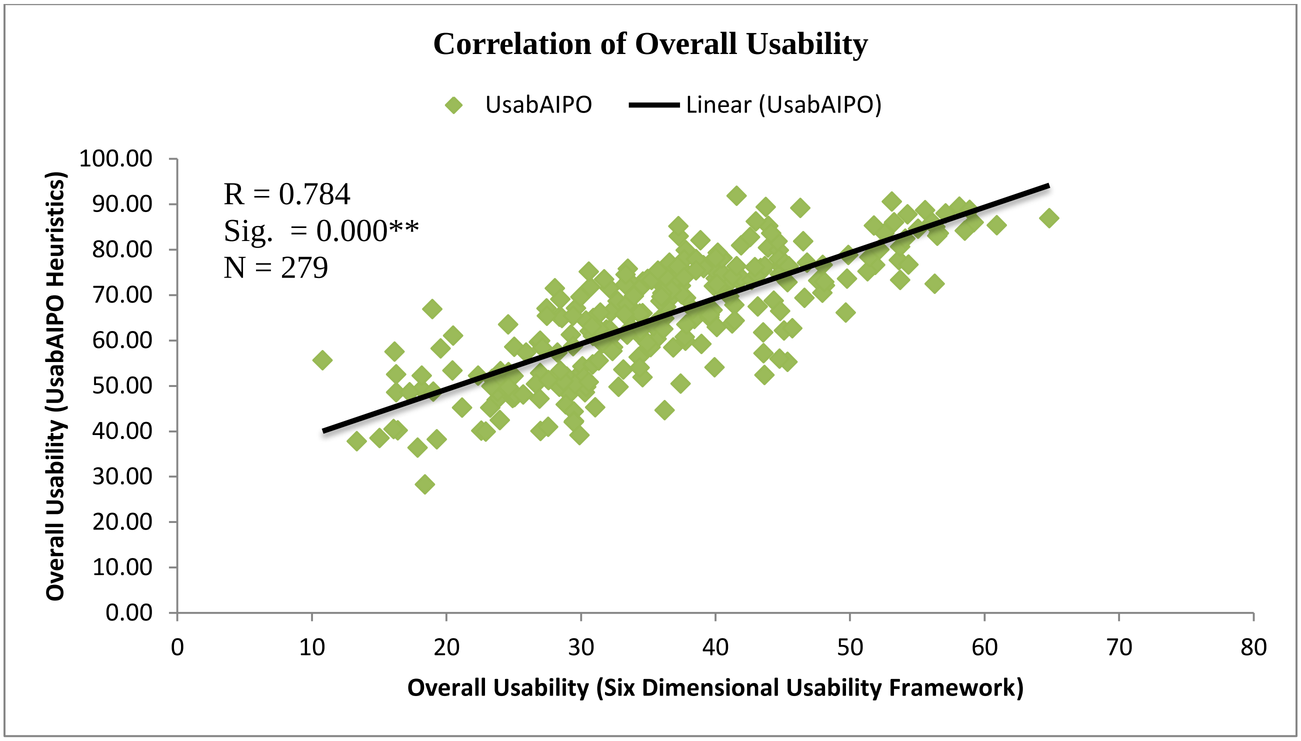


Figure 6.23: Correlation between the two usability measures

Combining the two overall usability measures as a multiple response measures of a single overall usability construct is important, as multiple response measures often have a higher level of reliability than a single response measure (Price, 2013). In order to combine the two usability measures, it is imperative to ensure that they have a high level of internal consistency, as this indicates that the items measured the same construct (Adamson & Prion, 2013; De Vet *et al.*, 2011). Consequently, items with low internal consistency need to be treated separately (Price, 2013). Cronbach's alpha is adopted here to test the internal consistency of the two overall usability measures and the results are presented in Table 6.18.

Table 6.18: Reliability statistics for overall usability dimensions

Reliability Statistics	
Cronbach's Alpha	0.863
Cronbach's Alpha Based on Standardised Items	0.878
Number of Items	2
Number of Cases	279

Cronbach's alpha values are often between 0 and 1 with values closer to 1 indicating a high level of internal consistency. Generally, alpha values greater than 0.7 are considered acceptable for use (Adamson & Prion, 2013; Cho & Kim, 2015). From Table 6.18 it is seen that the alpha value is 0.863, which is greater than 0.7 and thus suitable for combination, as the two items have a high level of internal consistency. This suggests that they measure the same construct as expected. The combined overall usability across the different SSA countries is presented in Table 6.19.

Table 6.19: Combined usability scores across the different SSA countries

SSA Country	Min	Max	Mean*	Median	ST. Dev	Skewness	Kurtosis
Mauritius	49.51	73.79	66.21	69.61	9.07	-1.25	0.15
South Africa	53.87	73.11	63.49	61.93	6.29	0.16	-0.88
Ethiopia	38.67	75.86	61.44	64.38	11.2	-1.05	1.15
Kenya	47.23	72.54	60.61	60.37	8.49	0.09	-0.72
Rwanda	44.04	71.34	58.34	59.67	9.43	-0.28	-1.22
Senegal	46.84	64.22	56.14	57.96	5.64	-0.55	-0.55
Uganda	38.59	72.1	55.86	56.53	9.59	-0.24	0.79
Gabon	49.74	70.68	55.78	53.33	6.1	2.13	5.27
United Republic of Tanzania	41.61	60.12	52.65	54.28	5.88	-0.97	0.37
Liberia	34.36	62.29	52.14	57.8	10.07	-0.91	-0.6

Botswana	33.5	65.65	52.02	54.61	11.29	-0.57	-0.79
Ghana	36.83	64.54	51.55	56.49	10.16	-0.35	-1.64
Cameroon	40.87	66.69	50.99	45.93	10.54	0.76	-1.59
Lesotho	40.48	63.21	50.73	49.27	8.68	0.23	-1.8
Burkina Faso	37.1	62.64	50.71	61.85	6.84	-0.43	2.17
Nigeria	35.3	59.05	50.67	51.85	7.77	-0.96	0.59
Malawi	33.69	56.23	49.25	50.63	7.25	-1.28	1.75
Seychelles	36.63	62.15	49.25	52.25	8.82	-0.36	-0.91
Namibia	33.17	71.02	48.31	49.21	12.27	0.44	0.01
Côte d'Ivoire	40.08	56.18	47.45	46.11	6.08	0.45	-1.35
Zimbabwe	32.41	68.23	47.12	43.22	13.08	0.89	-0.45
Democratic Republic of the Congo	34.47	60.44	46.41	45.25	9.14	0.23	-1.42
Mali	32.91	64.58	46.14	45.53	10.17	0.47	-0.43
Sierra Leone	25.55	58.8	45.44	52.46	13.19	-0.39	-1.89
Zambia	27.08	55.13	45.3	47.35	8.35	-1.34	2.37
Benin	31.39	61.67	45.01	42.72	9.51	0.53	-0.19
Gambia	28.72	55.9	44.02	48.81	8.84	-0.53	-0.78
Chad	35.71	54.24	43.93	43.94	7.32	0.13	-1.99
Djibouti	28.27	64.85	43.05	40.6	10.62	0.858	1.45
Burundi	23.33	56.85	41.42	40.42	10.75	-0.18	-0.76
Madagascar	26.74	50.67	41.11	43.33	9.43	-0.52	-1.41
All countries	**23.33**	**75.86**	**50.73**	**50.68**	**10.86**	**-0.03**	**-0.49**
***The information in the table is sorted in descending order based on the mean values.**							

After combining the two usability scores, the final scores were presented as a percentage. The overall mean score was 50.73% with a median score of 50.68%. These scores are slightly higher than the six-dimensional framework scores because of the high ratings from the UsabAIPO heuristics. However, caution should be taken in evaluating the absolute values of these scores as the websites require a usability score of 80% for UsabAIPO to be considered acceptable.

However, the combined scores in this study are used for cross-country comparisons and not as absolute values. Based on this combined measure, the top five performing countries were Mauritius, SA, Ethiopia, Kenya, and Rwanda, while the bottom five were Gambia, Chad, Djibouti, Burundi and Madagascar.

6.5. Cross-sectional Relationships

The proposed model in Chapter 5 presented several proposed associations. These included the associations between e-government development and usability, national indicators and e-government development, and national indicators and usability of e-government websites. These relationships are empirically tested and discussed here.

6.5.1. Relationship between EGDI and e-government usability

As theorised in the previous chapters, e-government development is expected to have a significant relationship with the usability of e-government websites because of the central role that usability plays in the success of e-government websites. This assumption was tested for the 31 SSA countries in this study and the results of the association are presented in Figure 6.24 below.

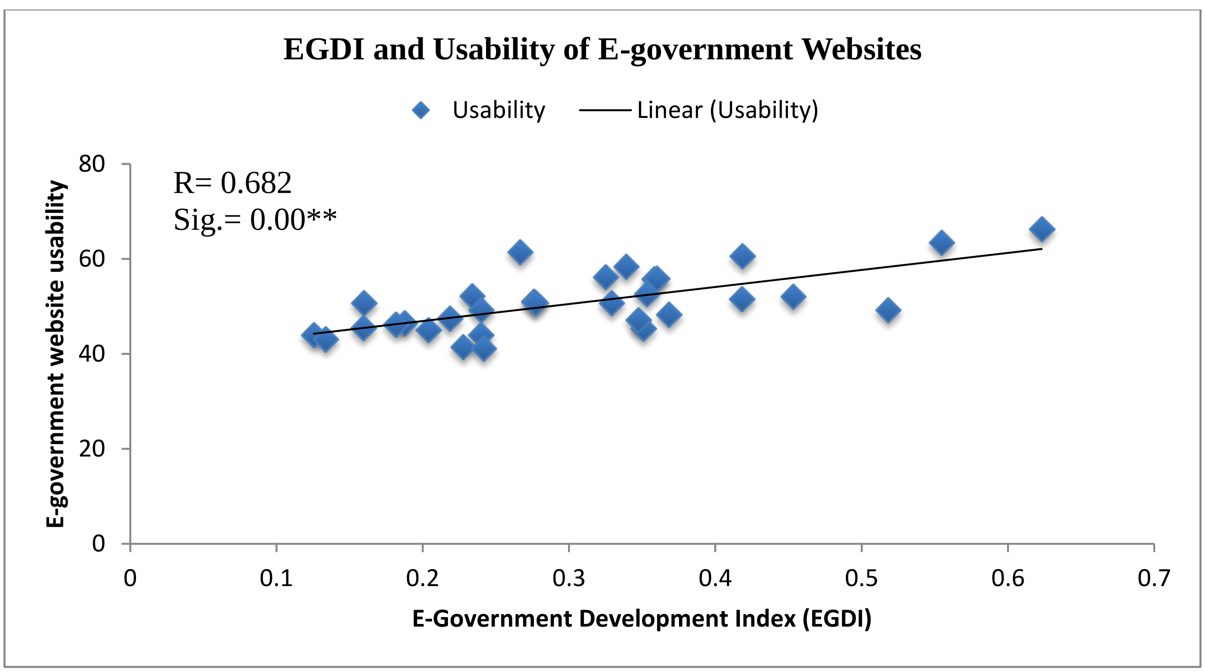


Figure 6.24: Correlation between EGDI and the overall usability scores

In Figure 6.24, it is observed that the correlation between the EGDI and the usability of e-government websites across the 31 SSA countries was 0.682 (significant at 1%). The significant positive correlation supports the association between usability and e-government development postulated in prior literature (Ansari *et al.*, 2016; Baker, 2009; Venkatesh *et al.*, 2014). With e-government development now focused on delivering public values (UNDESA, 2016), this study further indicated the apparent overlap between the public values of e-government websites and the usability of these sites. This overlap helped in shaping the view of e-government website usability as an integral part of e-government development. To further investigate this association, this study used the e-participation index (EPI) as a proxy for e-government's public values.

The EPI is "a supplementary index to the UN E-Government Development Index that extends the dimension of the Survey by focusing on the use of online services to facilitate the provision of information by governments to citizens, interaction with stakeholders, and engagement in decision-making processes" (UNDESA, 2016, p. 141). E-participation has been widely noted as a key aspect of e-government initiatives that focuses primarily on the delivery of public values (Bannister & Connolly, 2014; Cordella & Bonina, 2012; Khasawneh, Abu Shamaa & Rabayah, 2014; O'brien, Scott & Golden, 2016).

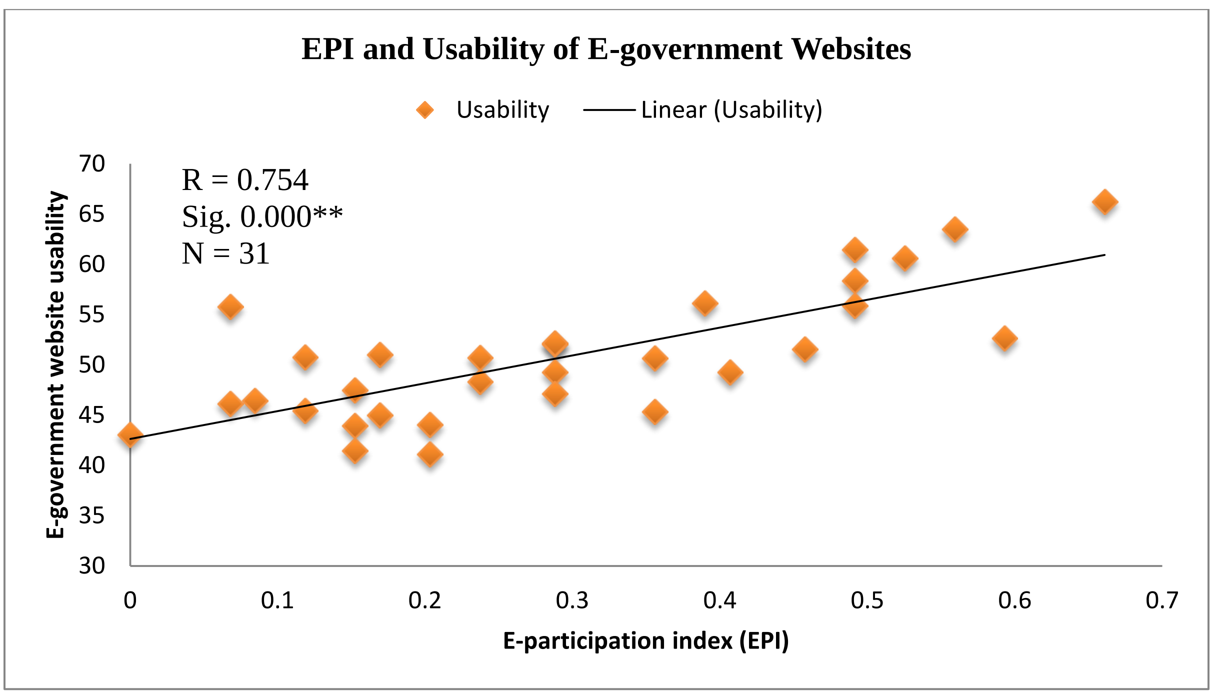


Figure 6.25: Correlation between EPI and the overall usability scores

The UN E-Government Development Survey evaluated e-participation tools on national e-government websites. As such, the EPI is a good reflection of the public values of e-government websites as it encapsulates aspects like citizen engagement, development of trust, responsiveness and quality of information and services. The association between the EPI and the usability of e-government websites in presented in Figure 6.25 above. The figure shows the correlation between the 2016 EPI and the overall usability scores for the 31 SSA countries. The strong positive correlation of 0.754 (significant at 1%) clearly supports the overlap between public values of e-government websites and the usability of e-government websites.

From Figure 6.24 and Figure 6.25, it is evident that usability is highly associated with e-government development, thus supporting the integral role of usability in e-government development. Consequently, it can be expected that national indicators associated with e-government development will also likely be associated with the usability of e-government websites, as postulated in Chapter 3 and Chapter 5. The subsequent sections present the analysis of these suggested associations that form part of the developed model.

6.5.2. Relationship between national indicators and e-government development

Chapter 3 (Section 3.7) presented nine national indicators with expected associations to e-government development. A regression analysis was computed for each of the national indicators to determine its association with EGDI. The analysis used both the 2014 and the 2016 EGDIs and the findings are presented in Table 6.20 below.

The results in Table 6.20 depict that all national indicators, except for cultural diversity, had a significant association with e-government development using both the 2014 and 2016 EGDIs. The outcome for each of the nine national indicators is discussed below. All the identified significant relationships are in line with the expectations highlighted in Chapter 3 and incorporated into the model in Chapter 5.

The positive influence of national income on e-government development ($T=6.089$ and 5.814, $p<0.01$) is in line with prior studies (Moon & Welch, 2015; Perry & Christensen, 2015; UNDESA, 2016) that have also shown that high-income countries have higher e-government development than low-income countries. This is because high-income countries can often have the necessary financial resources required for developing and implementing e-government initiatives. Thus, disparities in national income could explain the poor development of e-government in most SSA countries, as highlighted by Perry and Christensen (2015). Similarly, the negative influence of corruption on e-government is congruent with the evidence from the 2016 E-Government Development Survey (UNDESA, 2016). This supports the view that corruption significantly hampers the progress and maturity of e-government initiatives (Aladwani, 2016; Cloete, 2012; Singh *et al.*, 2007).

Table 6.20: Regression analysis for national indicators and EGDI

National Indicators	Dependent variable					
	Model A (2014 EGDI)			Model B (2016 EGDI)		
	Beta	R^2	T-value	Beta	R^2	T-value
Corruption	-0.613	0.375	-4.175 **	-0.568	0.323	-3.720**
Cultural diversity	-0.268	0.072	-1.500	-0.180	0.032	-0.984
Gender inequality	-0.786	0.618	-6.366**	-0.719	0.517	-5.169**
Cybersecurity	0.454	0.206	3.185**	0.490	0.240	3.024**
Global competitiveness	0.772	0.595	6.184**	0.779	0.607	6.341**
Human development	0.850	0.722	8.676**	0.883	0.780	10.148**
Innovation	0.821	0.674	6.896**	0.806	0.650	5.943**
National Income	0.749	0.561	6.089**	0.734	0.522	5.814**
Population Age distribution (Non-active)	-0.752	0.565	-6.141**	-0.680	0.463	-4.999**
Population Age distribution (Active)	0.752	0.565	6.141**	0.680	0.463	4.999**
In model A, the dependent variable is the 2014 EGDI. As such, the associated national indicators represent data obtained for the same period. Similarly, in model B the dependent variable is the 2016 EGDI as the associated national indicators represent data for 2016.						

**Sig. at 1%; *Sig. at 5%.

Global competitiveness and innovation (Table 6.20) are two similar national indices with a strong positive association to e-government development ($p<0.01$). UNDESA (2016) showed a positive significant association between global competitiveness and e-government development. The UNDESA researchers suggested that global competitiveness created a favourable environment for e-government development. A similar case can also be made for the level of innovation within a country, as Cheng *et al.* (2012) highlighted that innovations in government were always a reflection of innovations within a given country's private sector. The significant positive influence of innovation on e-government development ($T= 6.896$ and 5.943, $p<0.01$) also supports the views that innovation is central throughout the e-government development process (Anthopoulos *et al.*, 2015; Kim *et al.*, 2007).

The other two factors with a significant positive influence on e-government development (Table 6.20) are cybersecurity and human development. The positive influence of cybersecurity on e-government development highlights the necessary role of security in e-government adoption and development, as discussed in prior studies (Jacobi *et al.*, 2013; Khanyaako & Maiga, 2013). Several e-government websites in SSA have been hit by cyber-attacks in recent years (Cordell, 2015). As such, it is not surprising that a government in SSA committed to e-government development will also focus on enforcing strong cybersecurity measures. Human development, on the other hand, has been known to stimulate both the demand and supply of e-government (Stier, 2015). The findings in this study, therefore, support existing evidence that human development significantly promotes e-government development (Abdelsalam *et al.*, 2012; Holzer & Manoharan, 2009; Stier, 2015).

Regarding the population age distribution (Table 6.20), it is observed that the direction of the relationship depends on which side of the population distribution is considered. This is in line with the expectations highlighted in the model in Chapter 5. The results showed that having a higher non-active population (i.e. age groups 0-14 and 65+) was associated with low e-government development, while on the other hand, a higher proportion of the active population (i.e. ages between 15-64) was associated with high e-government development. This is in line with the findings by Xu and Asencio (2015) in Alabama who observed that e-government development was negatively associated with the age group of people younger than 18 years and those older than 65 years. As mentioned before, this could result from the fact that people in these age groups are less likely to engage in e-government activities. Consequently, there will be little demand for e-government services, which will negatively affect its development. On the other hand, the positive influence of the age group 15-64 can result from the high demand of e-government services by this group, as indicated by Wigand (2011).

Similar to the population age distribution, the level of gender inequality in a country also affects the demand for e-government services, thus influencing its development. The results in Table 6.20 indicate that countries with high gender inequality are associated with low e-government development, while the opposite is true for more gender balanced countries ($T=-6.366$ and -5.169, $p<0.01$). This can be explained by the fact that high demand for e-government services in gender balanced countries (Moreno *et al.*, 2013) stimulates e-government development, while countries with high gender inequality are characterised by a huge digital divide (Choi & Park, 2013) which negatively affects e-government development.

Lastly, as earlier indicated, of the nine national indicators only cultural diversity showed no significant association with e-government development ($T=-1.500$ and -0.984, $p>0.05$). According to Goren (2013), the impact of cultural diversity on a country's development is influenced by the cultural diversity of neighbouring countries. As such, failure to control for the cultural diversity of neighbouring countries in this study could account for the insignificant relationship. Additionally, since e-government development focuses on delivering public values, the negative consequences of cultural heterogeneity on delivering public values as highlighted by Alesina and Zhuravskaya (2012) could also influence the relationship. This can be more pronounced in the case of SSA as most SSA countries are characterised by high cultural diversity (Goren, 2013).

As postulated earlier in Chapter 3 and Chapter 5, e-government usability is an integral part of e-government development. As such, it is expected that national indicators associated with e-government development will also be associated with the usability of e-government websites. The empirical evaluation of the relationship between e-government development and the usability of e-government websites is presented above (Section 6.5.1).

In the subsequent sections, a detailed evaluation of the relationship between national indicators and the usability of e-government websites is presented.

6.5.3. Relationship between national indicators and the usability of SSA e-government websites

In Chapter 3 (Section 3.7) nine national indicators (national income, corruption, global competitiveness, cybersecurity, innovation, population age distribution, gender inequality, human development, and cultural diversity) were presented with hypothesised associations to the usability of e-government websites. This section presents a detailed evaluation of these hypothesised associations.

6.5.3.1. National income and e-government website usability

National income has been widely associated with e-government development in general (Hafeez & Sher, 2006; Moon & Welch, 2015; UNDESA, 2016), as well as more specifically the development of e-government websites (Gaulė & Žilinskas, 2013) and the usability of these websites (Youngblood & Youngblood, 2013). Table 6.21 depicts the relationship between national income measured in terms of the GNI and usability of e-government websites in SSA.

Table 6.21: National income and usability

	Beta	T-Value	Sig.
Coefficient		3.192	0.003**
National Income – Log(GNI)	0.422	2.505	0.018*
Parameters			
R^2	0.178		
Adjusted R^2	0.149		
F-Value	6.273		
Sig.	0.018*		

*Sig. at 5%; ** Sig. at 1%

From Table 6.21, it is observed that national income is significantly associated to the usability of e-government websites in SSA countries (Beta = 0.422, $p<0.01$). This supports the evidence from Youngblood and Youngblood (2013) who showed that per capita income was significantly correlated with the usability of local e-government (county) websites.

The finding is, however, contrary to the results of Youngblood and Mackiewicz (2012) who found no significant relationship between per capita income and the usability of municipal e-government websites in Alabama. These authors noted that the municipal e-government websites they evaluated were all characterised by basic usability problems, and not only for municipalities with limited resources. Although it is noted that richer municipalities have higher quality e-government websites than poor municipalities (Gaulė & Žilinskas, 2013), the richer municipalities actually need to invest the money in the development of these websites to attain better results. As such, being rich without investing the financial resources necessary for developing a high-quality usable website will not yield any results. On the other hand, resource-poor countries or municipalities end up with poorly developed e-government websites because they lack the financial resources to develop high-quality websites.

In the case of SSA, the results from Table 6.21 clearly suggest a significant relationship. As previously indicated (Section 3.7.1), several aspects can explain this relationship. The first one is that richer countries might invest more resources into developing better quality websites. Secondly, the increase in demand for e-government services in rich countries might result in increased supply of different kinds of quality e-government services to the citizens. The correlation results in Table 6.22 help to expand on these possible explanations.

Table 6.22: National income and usability dimensions

Usability Dimension	Correlation Coeff. (Sig.)	USABAIPO Framework	Correlation Coeff. (Sig.)
Online Services	0.071 (0.235)	Design	0.173(0.004)**
E-commerce Applications	0.163 (0.006)**	Navigation	0.285 (0.000)**
User Help	0.083 (0.166)	Content Organization	0.146(0.015)*
Navigation	0.201 (0.001)**	Functional Diversity	0.179 (0.003)**
E-government services	0.166 (0.005)**	Overall	0.255 (0.000)**
Legitimacy	0.261 (0.000)**		
Information Architecture	0.114 (0.057)		
Accessibility	0.029 (0.632)		
Overall Usability	0.207 (0.001)**		

**Sig. at 1%; *Sig. at 5%.

For the six-dimensional usability framework, it is seen that there is a significant relationship between national income and two of the six dimensions (i.e. navigation and legitimacy). The correlation coefficients for both navigation ($r=0.201$) and legitimacy ($r=0.261$) are significant at the 1% level ($p<0.01$).This contends the view that increase in financial resources might significantly translate to a high-quality usable website across all dimensions.

Nonetheless, looking at the UsabAIPO heuristics, it is observed that all four dimensions have a significant relationship with national income. Additionally, both the overall six-dimensional framework usability and the overall scores for USABAIPO dimensions have significant relationships with national income. The Six-dimensional usability framework is more robust and difficult to compute compared to the USABAIPO dimensions. This could possibly explain why the availability of financial resources might result in better adherence to UsabAIPO usability dimensions than the six-dimensional framework as far more technical efforts are required for its compliance.

The fact that national income does not have a significant relationship with accessibility ($r=0.029$, $p>0.05$) is contrary to the findings from Youngblood and Youngblood (2013) who found a significant relationship between per capita income and accessibility. This lack of significant differences can be explained by the fact that almost all the websites performed poorly in terms of accessibility, as it was the worst of the six dimensions as indicated above (Section 6.2.1.6). This suggests that financial resources alone might not directly translate to improved usability for all e-government usability dimensions. However, if the resources are effectively used in combination with technical resources, it will be possible to enhance e-government usability in SSA. Additionally, rich nations might not have quality e-government websites if resources are mismanaged, as existing evidence (Elkadi, 2013; Oreku & Menzi, 2012) suggest that several e-government projects failed because of mismanagement of funds and corruption.

The second possible explanation for national income’s influence on usability is based on the view that since citizens of richer countries have a higher adoption rate for e-government services (Alghamdi & Beloff, 2014; Komba & Ngulube, 2014; Susanto, 2014), governments are likely to supply more e-government services than for countries with little demand for such services. Looking at Table 6.22, it is observed that there is a significant correlation between national income and e-commerce applications and e-government services ($r=0.166$, $p<0.05$). The positive significant correlation suggests that e-government websites in richer SSA countries offer more e-commerce applications and e-government services than those in poorer countries. This supports the view that high national income results in high demand for e-government services, which in turn results in a subsequent increase in the supply of quality e-government services.

6.5.3.2. Corruption and e-government websites usability

Corruption is another factor that influences e-government development and likely to affect the usability of e-government websites (Chapter 3, Section 3.7.2). This is because corruption often leads to e-government projects remaining incomplete or being completed with low quality (Oreku & Menzi, 2012). Table 6.23 depicts the relationship between corruption (operationalised in terms of CPI) and usability of e-government websites.

Table 6.23: Corruption and usability

	Beta	T-Value	Sig.
Coefficient		11.680	0.000**
Corruption (CPI)	0.383	3.838	0.033*
Parameters			
R^2	0.147		
Adjusted R^2	0.117		
F-Value	4.983		
Sig.	0.033*		

**Sig. at 1%; *Sig. at 5%.

The results in Table 6.23 indicate that corruption is significantly associated on e-government usability ($Beta=0.383$, $p<0.05$), with countries that are less corrupt having higher quality websites in terms of usability. Table 6.24 below further shows that corruption is significantly associated with all the usability dimensions ($p<0.05$), except for user-help and navigation ($r=0.045$, $p>0.05$).

As highlighted by Aladwini (2016), e-government website projects involving corruption often result in the delivery of poor quality websites. It is, therefore, not surprising that almost all dimensions of usability showed a significant association with corruption, whereby corrupt SSA countries are associated with e-government websites characterised by poor usability. Similarly, Graycar (2016) noted that corruption negatively influences public values of e-government. As previously indicated (Chapter 3), usability dimensions such as accessibility, legitimacy, and online services overlapped with public values of e-government websites. The associations above, thus, suggest that corrupt SSA countries were less focused on delivery of public values, which is in line with Graycar's argument.

Table 6.24: Corruption and usability dimensions

Usability Dimension	Correlation Coeff. (Sig.)	USABAIPO Framework	Correlation Coeff. (Sig.)
Online Services	0.156 (0.009)**	Design	0.173(0.004)**
User Help	0.045 (0.455)	Navigation	0.209 (0.000)**
Navigation	0.111 (0.065)	Content Organization	0.178(0.003)**
Legitimacy	0.195 (0.001)**	Functional Diversity	0.135 (0.024)*
Information Architecture	0.157 (0.009)**	Overall	0.219 (0.000)**
Accessibility	0.125 (0.037)*		
Overall Usability	0.204 (0.001)**		

**Sig. at 1%; *Sig. at 5%.

6.5.3.3. Global competitiveness

Global competitiveness has been noted for providing a favourable environment for e-government development. As such, it is expected that e-government websites developed in such environments will have high usability.

Table 6.25 presents the analysis of the association between global competitiveness and the usability of e-government websites. The results showed that global competitiveness has a significant positive association with the usability of e-government websites (Beta =0.699, $p<0.01$). This supports the view of a highly favourable environment for e-government development being created in highly competitive countries. Governments also see e-government websites as a source of improving their competitiveness in the global economy (Palanisamy &

Mukerji, 2014). Consequently, competitive oriented governments possibly invest more in creating high-quality websites with good usability to ensure user adoption and usage of e-services.

Table 6.25: Global competitiveness and usability

	Beta	T-Value	Sig.
Coefficient		0.790	0.437
Global competitiveness (GCI)	0.699	4.978	0.000**
Parameters			
R^2	0.488		
Adjusted R^2	0.468		
F-Value	24.782		
Sig.	0.000**		

**Sig. at 1%; *Sig. at 5%.

The association between global competitiveness and the dimensions of usability is presented in Table 6.26.

Table 6.26: Global competitiveness and usability dimensions

Usability Dimension	Correlation Coeff. (Sig.)	USABAIPO Framework	Correlation Coeff. (Sig.)
Online Services	0.322 (0.000)**	Design	0.286(0.000)**
E-commerce Applications	0.252 (0.000)**	Navigation	0.402 (0.000)**
User Help	0.148 (0.019)*	Content Organization	0.292 (0.000)*
Navigation	0.263 (0.000)**	Functional Diversity	0.263 (0.000)**
E-government services	0.291 (0.000)**	Overall	0.397 (0.000)**
Legitimacy	0.347 (0.000)**		
Information Architecture	0.255 (0.000)**		
Accessibility	0.066(0.295)		
Overall Usability	0.394 (0.000)**		

**Sig. at 1%; *Sig. at 5%.

Table 6.26 depicts that global competitiveness is significantly associated with all the usability dimensions ($p<0.05$), except for accessibility ($r=0.066$, $p>0.05$). Accessibility is still a huge concern among SSA e-government websites, as it recorded the lowest scores of all the dimensions as presented above. Nonetheless, the results clearly suggest that global competitiveness plays a vital role in fostering a suitable environment for creating usable e-government websites.

6.5.3.4. Innovation and e-government website usability

Innovation has been noted to be instrumental in advancing e-government development, as it facilities initiation of new e-government systems and continuous improvements of existing ones (Anthopoulos *et al*., 2015; Kim *et al.,* 2007). As more competitive innovative e-government solutions are developed in a given country, it is expected that these new and improved solutions will provide better usability so that they can be adopted. This follows from extant e-government adoption literature which indicated that usability is a key factor for its adoption (Boon *et al*., 2013; Bwalya, 2011; Donker-Kuijer *et al.,* 2010; Lin *et al.,* 2011). Table 6.27 depicts the relationship between country-level innovation and the usability of e-government websites.

Table 6.27: Innovation and usability

	Beta	T-Value	Sig.
Coefficient		3.043**	0.007**
Innovation -(GII)	0.754	5.007	0.000**
Parameters			
R^2	0.569		
Adjusted R^2	0.546		
F-Value	25.066		
Sig.	0.000**		

**Sig. at 1%; *Sig. at 5%.

The results in Table 6.27 indicate that the level of innovation in a country is highly associated with the usability of e-government websites (Beta=0.754, $p<0.01$). Since usability has been touted as a most proximal metric in evaluating the success of e-government websites

(Clemmensen & Katre, 2012; Venkatesh *et al.,* 2014), innovative solutions for e-government websites possibly take usability into account during development. Table 6.28 presents correlations between innovation and specific usability dimensions.

It is observed that for both usability measures adopted, innovation has a significant relationship with all the dimensions ($p<0.05$), except for accessibility ($r=0.038$, $p>0.05$). This clearly suggests that countries with a high level of innovation take usability into consideration when developing e-government websites. Innovative countries probably have more competing private sector organisations bidding for e-government website projects, thus increasing room for developing usable websites.

Table 6.28: Innovation and usability dimensions

Usability Dimension	Correlation Coeff. (Sig.)	USABAIPO Framework	Correlation Coeff. (Sig.)
Online Services	0.411 (0.000)**	Design	0.277(0.000)**
E-commerce Applications	0.367 (0.000)**	Navigation	0.459 (0.000)**
User Help	0.190 (0.009)**	Content Organization	0.293 (0.000)*
Navigation	0.314 (0.000)**	Functional Diversity	0.316 (0.000)**
E-government services	0.390 (0.000)**	Overall	0.441 (0.000)**
Legitimacy	0.406 (0.000)**		
Information Architecture	0.264 (0.000)**		
Accessibility	0.038(0.607)		
Overall Usability	0.451 (0.001)**		

**Sig. at 1%; *Sig. at 5%.

Also, it is not surprising to observe that countries high in innovation have more e-commerce application and e-government services than those low in innovation. This is because innovation fosters the creation of a wide pool of applications that can be incorporated into e-government websites. In SSA, development of mobile money payment solutions in Kenya has facilitated the advancement of e-government in the country by providing the opportunity for numerous innovative e-commerce applications for government payments and tax collection (Maake *et al.*, 2015).

6.5.3.5. Cybersecurity and e-government website usability

As governments increasingly see the delivery of services over the internet as a viable strategy, there are also more security threats to these online services that need to be addressed. To address this, governments are developing cybersecurity strategies to ensure data privacy and security of e-government services. As earlier indicated (Chapter 3, Section 3.7.5), privacy and security are integral parts of the legitimacy dimension of e-government usability. As such, the expected relationship between cybersecurity measures and usability is presented in Table 6.29.

Table 6.29: Cybersecurity and usability

	Beta	**T-Value**	**Sig.**
Coefficient		31.863	0.000**
Cybersecurity	0.606	4.106	0.000**
Parameters			
R^2	0.368		
Adjusted R^2	0.346		
F-Value	16.860		
Sig.	0.000**		

**Sig. at 1%; *Sig. at 5%.

The results in Table 6.29 indicate that SSA countries with a high cybersecurity index have websites with a higher level of usability compared to those with a low cybersecurity index (Beta =0.606, $p<0.01$).

As indicated by Baker (2009), e-government users often require trustworthy evidence that the e-government websites they access provide privacy, security and legitimacy. Table 6.30 depicts the relationship between cybersecurity and the different usability dimensions. From Table 6.30, it is observed that there is a significant correlation between the level of cybersecurity measures in a country and all usability dimensions ($p<0.05$), except for accessibility ($r=-0.004$, $p>0.05$). As expected, the SSA countries with high cybersecurity levels scored higher in legitimacy than those with low cybersecurity levels. This indicates that the cybersecurity efforts of a country translate to its e-government websites, especially as cybersecurity policies often include guidance for e-government implementation.

Table 6.30: Cybersecurity and usability dimensions

Usability Dimension	Correlation Coeff. (Sig.)	USABAIPO Framework	Correlation Coeff. (Sig.)
Online Services	0.307 (0.000)**	Design	0.277 (0.000)**
E-commerce Applications	0.283 (0.000)**	Navigation	0.244 (0.000)**
User Help	0.188 (0.002)**	Content Organization	0.191 (0.001)*
Navigation	0.273 (0.000)**	Functional Diversity	0.239 (0.000)**
E-government services	0.293 (0.000)**	Overall	0.338 (0.000)**
Legitimacy	0.261 (0.000)**		
Information Architecture	0.167 (0.005)**		
Accessibility	-0.004 (0.951)		
Overall Usability	0.334 (0.000)**		

**Sig. at 1%; *Sig. at 5%.

Also, since privacy, security and trust are imperative for user adoption of e-government online services (Alghamdi & Beloff, 2014; Khanyako & Maiga, 2013), it is possible to suggest that countries with high levels of cybersecurity measures provide a more conducive environment for developing government e-commerce applications and online e-government services, thus indicating why they have more e-commerce applications and e-government services than those with lower levels of cybersecurity measures.

6.5.3.6. Cultural diversity and usability

This section examines the association between cultural diversity and usability of e-government websites. The regression results are presented in Table 6.31 below.

Based on the existing link between culture and usability (Ahmad *et al.*, 2015; Clemmensen & Katre, 2012; Van Dam *et al.*, 2005; Hseih, 2014; Sonderegger & Sauer, 2013), a significant association was expected between e-government usability and cultural diversity. This was based on the view that culturally diverse nations will pay more attention to usability, especially in ensuring inclusion of all potential stakeholders.

Table 6.31: Cultural diversity and usability

	Beta	T-Value	Sig.
Coefficient		17.605	0.000**
Cultural Diversity	0.135	0.720	0.478
Parameters			
R^2	0.018		
Adjusted R^2	0.017		
F-Value	0.518		
Sig.	0.478		

**Sig. at 1%; *Sig. at 5%.

However, the results in Table 6.31 show that no significant association exist between cultural diversity and e-government website usability in SSA (Beta =0.135, p>0.05). As was the case with e-government development, this could possibly be accounted for by the negative consequences of cultural heterogeneity on delivering of public values (Alesina & Zhuravskaya, 2012).

6.5.3.7. Gender inequality and e-government website usability

As indicated earlier (Chapter 3, Section 3.5.2.), usability preferences differ by gender and because certain e-government services might target a specific gender, it is expected that country with less gender inequality are more likely to have highly usable websites. This is because the needs of both genders are considered in delivering e-government services. Table 6.32 presents the relationship between gender inequality and the level of usability of e-government websites across SSA countries.

From Table 6.32, it is observed that there is a significant negative relationship between a country's level of gender inequality and level of usability of the country's e-government websites (Beta=-0.498, p<0.05). As postulated, the e-government websites from countries with a high level of gender inequality have lower usability scores than countries that low levels of inequality (i.e. more gender balanced countries).

Table 6.32: Gender inequality and usability

	Beta	T-Value	Sig.
Coefficient		9.575	0.000**
Gender Inequality	-0.498	-2.868	0.008**
Parameters			
R^2	0.248		
Adjusted R^2	0.217		
F-Value	8.224		
Sig.	0.008**		

**Sig. at 1%; *Sig. at 5%.

Table 6.33: Gender inequality and usability dimensions

Usability Dimension	Correlation Coeff. (Sig.)	USABAIPO Framework	Correlation Coeff. (Sig.)
Online Services	-0.208 (0.001)**	Design	-0.193 (0.003)**
E-commerce Applications	-0.197 (0.002)**	Navigation	-0.239 (0.000)**
User Help	-0.116 (0.070)	Content Organization	-0.157 (0.014)*
Navigation	-0.135 (0.036)*	Functional Diversity	-0.165 (0.010)**
E-government services	-0.310 (0.000)**	Overall	-0.243 (0.000)**
Legitimacy	-0.251 (0.000)**		
Information Architecture	-0.201 (0.002)**		
Accessibility	-0.206 (0.001)**		
Overall Usability	-0.315 (0.000)**		

**Sig. at 1%; *Sig. at 5%.

Gender has been noted to impact several aspects of e-government adoption, especially in terms of ease of use, perceived usefulness and security (Ambali, 2012), which are all components that relate to the usability of e-government websites. As such, it is expected that gender inequality, as a proxy for gender, will have a significant relationship with the different usability dimensions. Table 6.33 depicts these relationships.

The results in Table 6.35 depicts that gender inequality has a significant negative association with all the usability dimensions ($p<0.05$), except for user help ($r=-0.116$, $p>0.05$). This indicates that countries that are more gender balanced (i.e. have less gender inequality) have e-government websites with better usability than those that are less gender balanced.

Gender equality is widely regarded as a public value (Bozeman, 2007; Claringbould & Knoppers, 2013; Grossman & McClain, 2009). Thus, it is not surprising to see that SSA countries with low gender inequality perform better in the usability of e-government websites as they already understand the need for public values by thriving for gender equality.

6.5.3.8. Population age distribution and e-government website usability

As mentioned previously (Chapter 3, Section 3.5.3), age differences in usability have been widely documented (Sonderegger *et al.*, 2016; Wagner *et al.*, 2014). Since e-government development is often negatively associated with the age group of people younger than 18 years and those older than 65 years (Xu & Asencio, 2015) it is expected that countries with a higher percentage of elderly and children will have websites that score low in usability because of low levels of e-government development. Table 6.34 depicts this relationship.

Table 6.34: Population age distribution and usability

	Beta	**T-Value**	**Sig.**
Coefficient		8.113	0.000**
Population Age Distribution	-0.394	-2.311	0.028**
Parameters			
R^2	0.156		
Adjusted R^2	0.126		
F-Value	5.342		
Sig.	0.028**		

**Sig. at 1%; *Sig. at 5%.

In Table 6.34, a significant negative relationship is shown between a country's percentages of the population younger than 16 years and older than 65 years with the level of usability of the countries e-government websites (Beta = -0.394, $p<0.05$). The opposite is, therefore, true for the active population between 16 and 65 years (i.e. positive significant relationship). This suggests that the higher a country's proportion of people less likely to adopt and use e-government services (i.e. children below 16 years and the elderly above 65 years), the lower the usability scores of the country's e-government websites. This can be explained by a possible lack of commitment to e-government development, in countries with a high percentage of citizens less likely to use e-government websites. For example, the negative association highlighted by Xu and Asencio (2015) suggested that countries with a high population of non-e-government users are likely to have fewer e-government online services which, therefore, directly impacts on usability as online services are an integral part of e-government usability.

Table 6.35 below further depicts how this population group correlates with the different e-government usability dimensions.

Table 6.35: Population age distribution and usability dimensions

Usability Dimension	Correlation Coeff. (Sig.)	USABAIPO Framework	Correlation Coeff. (Sig.)
Online Services	-0.137(0.022)*	Design	-0.182 (0.002)**
E-commerce Applications	-0.188 (0.002)**	Navigation	-0.225 (0.000)**
User Help	-0.084 (0.163)	Content Organization	-0.133 (0.027)*
Navigation	-0.122(0.042)*	Functional Diversity	-0.151 (0.012)*
E-government services	-0.184 (0.002)**	Overall	-0.224 (0.000)**
Legitimacy	-0.266 (0.000)**		
Information Architecture	-0.145 (0.015)*		
Accessibility	-0.028 (0.639)		
Overall Usability	-0.212 (0.000)**		

**Sig. at 1%; *Sig. at 5%.

The results in Table 6.35 depict that the non-active population age group in SSA countries had a significant negative association with all dimensions of e-government website usability ($p<0.05$), except for accessibility (r=-0.028, p>0.05). These findings support the views of Xu and Asencio (2015) which indicated government's lack of commitment in delivering e-government services to the non-active population group. As such, efforts to create usable websites, especially for the elderly, are lacking in most SSA countries.

6.5.3.9. Human Development and E-government Website Usability

Human development has been noted to be associated with e-government development, with high HDI countries having a higher level of e-inclusion with more services for vulnerable groups (UNDESA, 2014). Given their efforts to cater for vulnerable groups such as the elderly, it is expected that e-government websites from these countries would have high levels of usability. Table 6.36 presents this association

Table 6.36: Human development and usability

	Beta	T-Value	Sig.
Coefficient		6.900	0.000**
Human Development index (HDI)	0.457	2.763	0.010**
Parameters			
R^2	0.208		
Adjusted R^2	0.181		
F-Value	7.636		
Sig.	0.010**		

**Sig. at 1%; *Sig. at 5%.

The results in Table 6.36 depict a significant positive association between a country's HDI and usability of its e-government websites, with high HDI SSA countries having better usability scores for their e-government websites (Beta = 0.457, p<0.05). This finding supports the view that successful e-inclusion requires incorporating usability guidelines into the development of e-government websites so that vulnerable groups, such as the elderly and people with low digital literacy rates, can successfully use the websites (Aleixo *et al.*, 2012).

Additionally, user-centred design approaches are often adopted when the focus in on e-inclusion (Acharya, 2015), thus increasing the chances of producing a highly usable system that meets user needs. As such, since high HDI countries tend to have a high focus on e-inclusion, it is, therefore, not surprising that the e-government websites in these countries score better in usability than low HDI countries.

The results in Table 6.37 depict that human development is associated with all the usability dimensions ($p<0.05$), except for online services ($r=0.111$, $p>0.05$) and accessibility ($r=0.014$, $p>0.05$). However, even though not significant with online services, it shows a significant association with e-commerce applications of the online services dimension. This was expected as e-commerce applications depict an important public value of e-government development (Karunasena & Deng, 2012).

Table 6.37: Human development and usability dimensions

Usability Dimension	Correlation Coeff. (Sig.)	USABAIPO Framework	Correlation Coeff. (Sig.)
Online Services	0.111(0.065)	Design	0.182 (0.002)**
E-commerce Applications	0.224 (0.000)**	Navigation	0.300 (0.000)**
User Help	0.103 (0.085)	Content Organization	0.155 (0.009)**
Navigation	0.190(0.001)**	Functional Diversity	0.198 (0.001)**
E-government services	0.235 (0.000)**	Overall	0.276 (0.000)**
Legitimacy	0.273 (0.000)**		
Information Architecture	0.130 (0.030)*		
Accessibility	0.014 (0.813)		
Overall Usability	0.224 (0.000)**		

**Sig. at 1%; *Sig. at 5%.

However, the insignificant association with accessibility was unexpected, as accessibility is a central aspect of e-inclusions that is supposedly higher for countries with high human development.

Nonetheless, the extremely low scores for accessibility across all the 31 evaluated SSA countries could explain the lack of a significant association.

6.6. Summary

This chapter focused on providing a detailed evaluation of the usability of e-government websites in SSA, as well as an analysis of the testable propositions on the association of national indicators with e-government development and the usability of e-government websites.

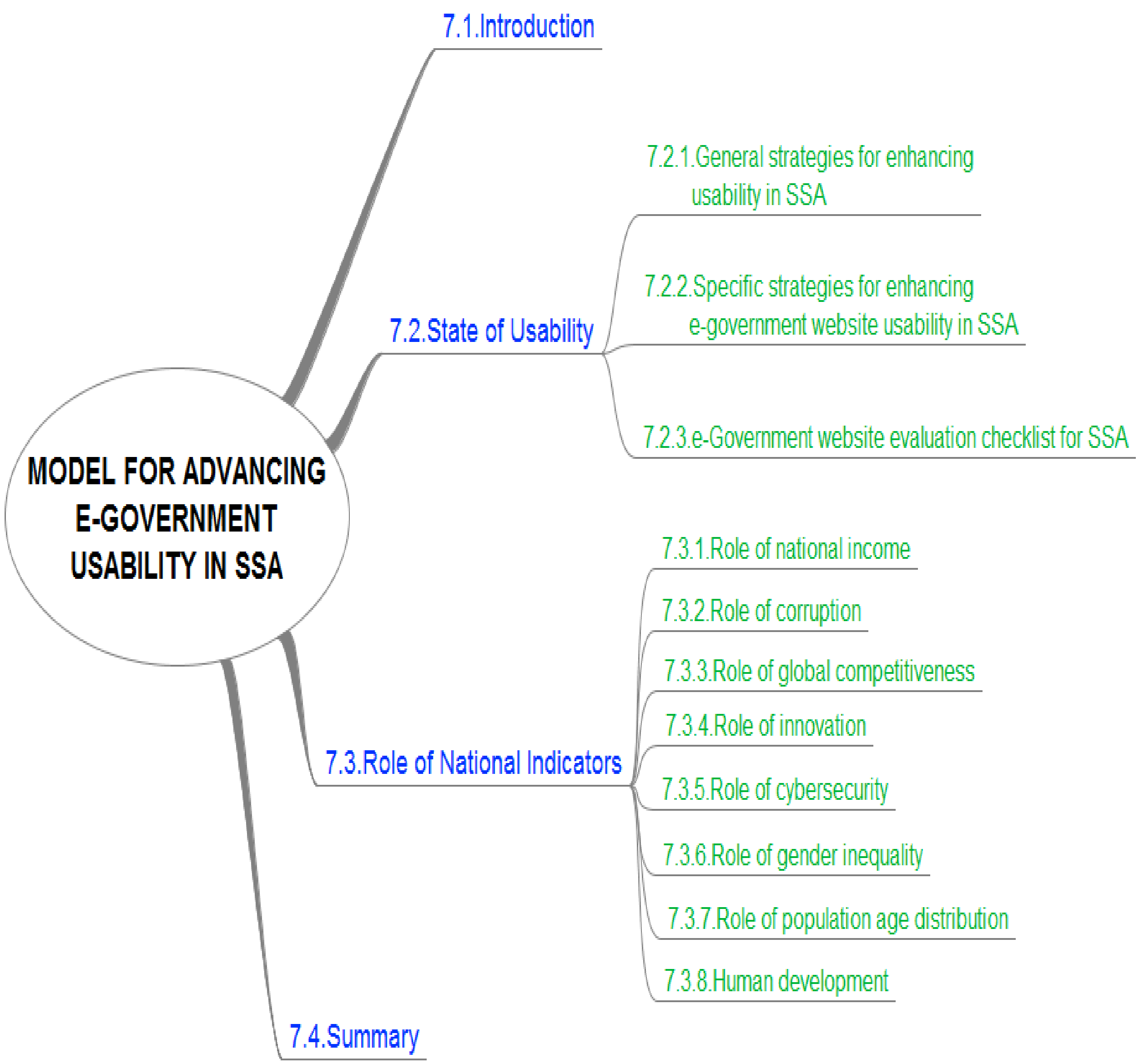
The research problem in this study centred around the poor state of usability of e-government websites around the world, and SSA in particular. However, an evaluation of the current state of usability of SSA e-government websites was highly limited. This chapter closed this gap by providing a detailed usability evaluation of 279 e-government websites from 31 SSA countries. The evaluations were primarily based on the six-dimensional framework (online services, user-help, navigation, legitimacy, information architecture and accessibility), with a supplementary evaluation based on the UsabAIPO heuristics.

The usability analysis further included a comparison between local and national e-government websites. Also, an evaluation of the association between e-government website usability and e-government development was provided. The chapter culminated with an evaluation of the testable propositions presented in the model (Chapter 5).

The usability evaluation and the evaluation of the testable propositions provided a basis for refining the initially proposed model in Chapter 5 to improve the utility of this artefact. As indicated earlier, DSR includes iterations between the build and evaluate cycles. The initial model presented three key sections. The first section focused on evaluating the usability of e-government websites and situating the integral role of usability in e-government development. The results from Section 6.2 to Section 6.5.1 helped to establish this aspect of the model. The second section focused on identifying the association of national indications with e-government development and the usability of e-government websites. The results in Section 6.5.2 and Section 6.5.3 provided further insights in understanding the testable propositions. The last section of the model focused on mental models, which are primarily integrated into the model as the main component for improving the usability of e-government websites in SSA, based on the outcomes from evaluations in the two other sections of the model. As such, the role of the mental models only sufaces after clearly establishing the usability state of e-government websites in SSA, as presented in this Chapter. The refined model clearly showing the role of mental models is presented in Chapter 7 and further evaluated in Chapter 8.

CHAPTER SEVEN

MODEL FOR ADVANCING E-GOVERNMENT USABILITY IN SSA

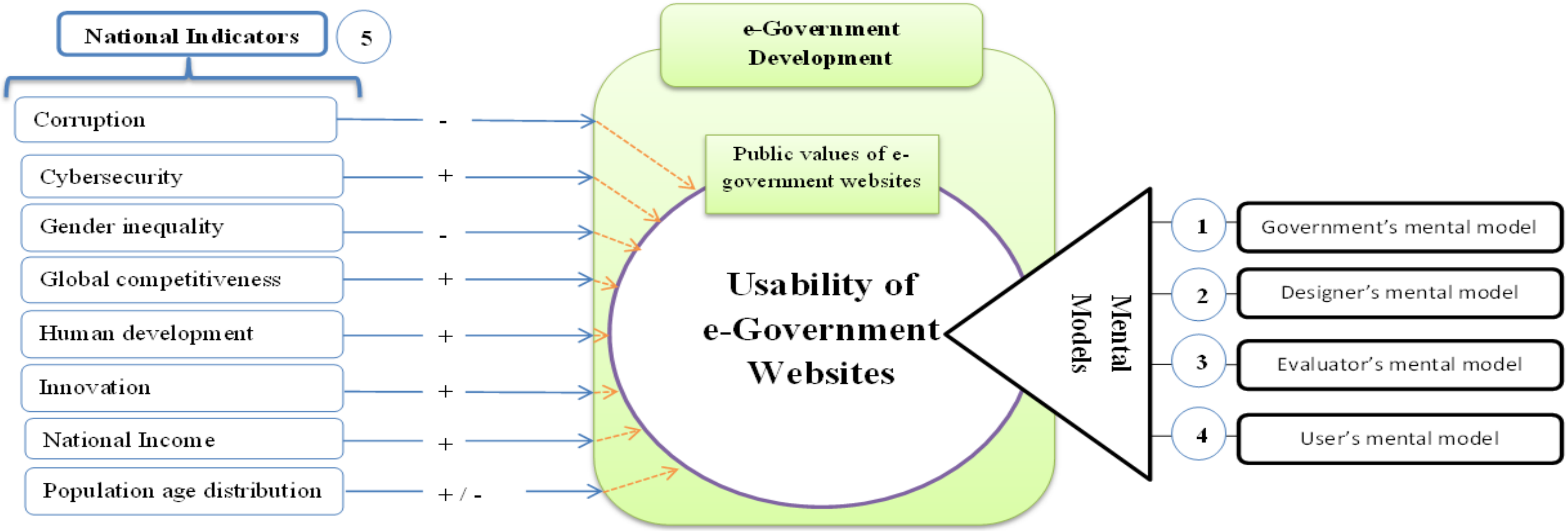


7.1. Introduction

DSR is an iterative process, thus, the building of a DSR artefact could involve several iterations. In Chapter 5, the initial policy ingrained model for advancing usability of e-government websites in SSA was presented. The initial model proposed nine national indicators (corruption, cultural diversity, cybersecurity, gender inequality, global competitiveness, human development, innovation, national income, and population age distribution) with expected associations to e-government development and the usability of e-government websites. However, after conducting statistical evaluations to determine the significance of these associations, it was observed that all, except for cultural diversity, showed a significant association. Consequently, it became important to refine the initial model and drop cultural diversity.

Additionally, the initial model as proposed in Chapter 5, introduced the need to consider the role that four key stakeholders (i.e. governments, designers, evaluators, and users) could play in advancing the usability of e-government websites in SSA. This introduced the role of the four mental models required for improving the usability of SSA e-government websites. In the creation of the initial artefact, the importance of each of the mental models was discussed. However, the artefact did not include concrete details on the role that each mental model needed to play in advancing the usability of e-government websites in SSA. At that stage, an evaluation of the initial artefact was needed to capture the current usability state of e-government websites in SSA in order to incorporate effective measures on the role that each mental model had to play in advancing e-government website usability.

After a detailed evaluation of the usability levels of 279 e-government websites from 31 SSA countries (Chapter 6), a refined artefact is proposed in this chapter, which comprehensively includes how to enhance the usability of e-government websites in SSA following from the four mental models. This revised artefact is also a policy-ingrained artefact following from the need for e-government DSR to be policy carriers (Goldkuhl, 2016). This refined artefact is presented in Figure 7.1.



Notes:

1. General and specific strategies necessary to be implemented by governments for improving the usability of e-government websites. Detailed guidelines for governments are provided in section 7.2.1.1 and section 7.2.2.1.
2. General and specific strategies to be implemented by IT staff responsible for developing e-government websites in order to improve usability of e-government websites. Detailed guidelines for IT staff are provided in section 7.2.1.2 and section 7.2.2.2.
3. General and specific strategies to be implemented by evaluators in improving usability of e-government websites in SSA. Detailed guidelines for evaluators are presented in section 7.2.1.3 and section 7.2.2.3.
4. General and specific strategies needed from users to advance usability of e-government websites in SSA. Detailed guidelines for users are presented in section 7.2.1.4 and section 7.2.2.4.
5. National indicators necessary for creating a favourable environment for e-government development and advancing the usability of e-government websites in SSA. Detailed discussion on the role of these national indicators is presented in section 7.3.

Figure 7.1: A policy-ingrained model for advancing usability of e-government websites in SSA

7.2. State of Usability

After evaluating the state of usability of e-government websites in SSA, it was deducted that SSA e-government websites generally had poor usability levels. On average, it was observed that SSA e-government websites performed poorly in all dimensions of the six-dimensional usability framework. For each of the six dimensions, the key areas of concern were determined and are presented in Table 7.1.

Table 7.1: Key usability areas of concern in SSA

Online Services (Mean = 7.61)	**User-help (Mean = 6.32)**
• Interactive forms • Interactive databases • Chat areas/message boards • Email updates • Multimedia applications • Governance oriented documentation • Communications with officials • E-commerce applications • Employment Information	• PDA/Wireless • Index • Feedback • Non-native language translations • Search Feature
Navigation (6.22)	**Legitimacy (5.68)**
• E-government services • Sitemap • Broken links	• Disclaimer statements • Security policy • Authentication password/digital sign • Privacy policy • Security issues
Information architecture (5.4)	**Accessibility Accommodations (3.34)**
• Audience-focused areas • Personalised/customisable features	• Manual check alt Accessibility errors • Accessibility compliance with WCAG 2.0 and mobile testOK.

From Table 7.1, a total of 21 usability variables were identified, depicting the extent to which SSA e-government websites failed to meet the usability criteria of the six-dimensional framework. The variables are distributed as follows: 9 for the online services dimension, 5 for user help, 3 for navigation, 5 for legitimacy, 2 for information architecture, and 2 for the accessibility accommodation dimension.

7.2.1. General strategies for enhancing usability in SSA

This section discusses the general strategies for each of the four mental models.

7.2.1.1. Government's mental model

In proposing an approach for improving the usability of e-government websites in Jordan, AlFawwaz (2011) suggested the need for the government to form a usability committee to oversee usability efforts. A usability committee would also be suitable for governments in SSA, as significant efforts are required to improve the current usability state of the region's e-government websites. Additionally, SSA governments need to develop appropriate policies, fund e-government usability research, and incorporate usability mandates for public-private partnerships.

7.2.1.1.1. Usability committee

According to Alfawwaz (2011), a government usability committee should comprise both government officials and usability experts who could either be government employees or outside specialist. The government officials should provide the necessary organisational support for e-government usability efforts, while the usability experts should provide the needed skills for enforcing usability standards. Alfawwaz (2011) emphasised the need for all members of the usability committee to be people with an interest in e-government initiatives.

Governments often comprise of many different ministries and departments with each rolling out its own e-government websites. Creating a centralised government usability committee could provide an advisory group capable of monitoring e-government websites within a country and enforcing usability standards. For several countries in SSA (e.g. Mauritius, SA, Tanzania, Kenya, and Namibia), e-government development efforts have been tasked to the ministry in charge of information and communications technologies. As such, it should be possible to easily form usability committees within the ministry to coordinate usability measures across the country’s e-government websites.

To advance e-government usability, the usability committee needs to focus on the following tasks:

- Monitoring and evaluation of website usability. This has to be a periodic activity so that websites could be kept up to date with respect to usability. As indicated by prior studies (Galvez & Youngblood, 2016; Kinyanjui, 2015; Lazar & Wentz, 2012), the usability of e-government websites could be enhanced by monitoring and evaluation of the websites.
- Develop e-government website usability guidelines and standards. Guidelines and standards are important to provide a benchmark for all e-government websites to meet minimum usability standards. In developing usability guidelines and standards for SSA e-government websites, there are some key resources that the usability committee could use as a starting point. These include the Research-Based Web Design & Usability Guidelines (U.S. Department of Health and Human Services, 2012), the ISO DIS 9241-151 usability standards (Bevan, 2005), the Joint Information Systems Committee (JISC) guidelines (Bevan, 2005), and the WCAG accessibility standards and guidelines (W3C, 2008).
- Enforcing usability standards for e-government websites. This task should align with monitoring and evaluation activities, so that e-government websites with usability issues would be given a time frame to address the issues before the next cycle for monitoring and evaluation.
- Creating awareness of usability issues across the different government ministries and departments, providing usability training to e-government website developers and designers, and setting priority areas for e-government usability based on available information and feedback from evaluations (Alfawwaz, 2012).

7.2.1.1.2. Usability policies

The government also has to play an active role in developing usability policies that could guide the development of its websites. Currently, several SSA governments have indicated usability as a precondition for the development of its e-government websites. However, specific policies on minimum usability standards to adhere to are not outlined in the website policy documents. In the developed world, many governments have set policies for minimum usability standards. A good example is the New Zealand government which has elaborated a broad policy on e-government website usability[7], clearly indicating minimum usability standards that had to be included in all the country's e-government websites. Likewise, the European commission also has established usability policies and standards[8] that have to be adhered by all government websites of European Union (EU) member states.

SSA countries should adopt such an approach and define complete policies that mandate e-government websites to meet specified minimum standards clearly outlined in the policies. This will not only ensure that developed e-government websites meet minimum usability standards, but will also facilitate the task of periodically monitoring and evaluating the state of usability of the e-government websites. The developed usability policies need to be updated regularly to ensure that a country stays up to date with the latest international usability standards, as well as to enforce novel approaches and criteria for usability evaluations and adherence.

7.2.1.1.3. Funding e-government usability research

Most of the current knowledge bases on e-government website usability have been provided by researchers around the globe. As such, it is not surprising that researchers are increasingly calling for the need for evaluation and improvement of e-government websites (Baker, 2009; Bwalya & Healy, 2010; De Roiste, 2013; Scott, 2005; Zhao & Benyoucef, 2014). Governments could make good use of researchers by funding e-government usability studies so that usability issues of e-government websites could be identified and addressed. A usability study, such as that conducted by Venkatest *et al.* (2014) on the Obamacare website, provided practical guidelines that could simply be adopted by the US government to improve the usability of the Obamacare website.

Funding e-government research is not a far-fetched idea in SSA. Mauritius, the currently top ranked country in the whole of Africa in terms of e-government development (UNDESA, 2014), recently funded a study to determine the factors influencing the adoption of e-government services in the country (Lallmahomed, 2016). This study provided the Mauritian government with insights on how to advance adoption and usage of e-government in the

[7] New Zealand Usability Standard: https://webtoolkit.govt.nz/standards/web-usability-standard-1-2/
[8] European union Policies: http://ec.europa.eu/ipg/standards/accessibility/eu_policy/index_en.htm, http://ec.europa.eu/ipg/design/usability/index_en.htm#section_6_1

country. Usability is a key factor that influences e-government adoption in SSA (Bwalya, 2011; Khanyako & Maiga, 2013; Lin *et al.*, 2011) and so SSA governments could foster user adoption and usage of e-services by supporting usability studies that could help to identify usability issues and provide guidance for addressing the identified issues.

7.2.1.1.4. Usability training

The poor usability state of most e-government websites has prompted the view that developers and designers of e-government websites clearly have little understanding of usability standards (Asiimwe & Lim, 2010). As such, training could be a means of improving the competency of developers and designers involved in the creation of e-government websites. For example, usability training was an integrally incorporated in the process of improving the usability and UX of the Western Cape government in SA (Pretorius & Calitz, 2014). In the US, there is mandatory annual training for new employees on compliance with the country's accessibility standards (Lazar & Olalere, 2011). Likewise, Gil-Garcia and Hernandez-Tella (2011) reported that over 22 states in the US actively provided usability and accessibility training for government's IT employees.

Training provides staff involved in e-government website development with the necessary skills for maintaining high usability standards and complying with the country's usability standards. As such, the governments in SSA should provide training opportunities for its staff and other external stakeholders involved in the development of e-government websites. This would ensure that they are skilled enough to ensure compliance with the usability policies and standards enforced by the government. In cases where the government lacks the capacity to provide training, they could partner with international organisations that could support in providing the training. An example of such an organisation is UNESCO, which in recent years has actively been involved in training government officials on web accessibility in some SSA countries, like Kenya, Rwanda, and Uganda (UNESCO, 2016).

7.2.1.2. Designer's mental model

Everyone involved in the process of designing and developing e-government websites needs to have a good understanding of the policies and standards for government websites in a given country. They should also have the capability to implement the standards when creating the e-government websites. As such, two things are necessary for the designer's mental model, namely skills development and compliance.

7.2.1.2.1. Skills development

As indicated above, the current poor state of e-government website usability has been attributed to the lack of usability skills by designer/developers creating the websites. As such, several governments are engaging in usability skills development to enhance the skills of the IT personnel responsible for creating the e-government websites. It is, however, important for these government IT employees to take advantage of any training programs provided by governments to improve their skills. Similarly, the staff of private companies that develop systems and e-government websites also need to develop usability skills. IT staff today could take advantage of free online resources to enhance their usability skills.

A good place to start is the Nielsen Norman Group (an evidence-based UX research, training, and consulting group) which publishes many free articles with guidance on usability issues from well-known usability professionals, like Jakob Nielsen (famously known for creating the Nielsen heuristics and for publishing many books and articles on usability).

Furthermore, it is widely suggested that most usability issues occur because of the mismatch between what the designers/developers think the users want and want the users actually want (Borsci *et al.,* 2014). As such, there is an increasing call for designers/developers to adopt a user-centred design approach to the development of e-government websites (Pribeanu, 2014; Tariq, 2010). Consequently, it is imperative for all IT employees responsible for creating e-government websites to learn about the user-centred design approach and other new approaches or guidelines that might emerge from evidence-based research.

7.2.1.2.2. Compliance with usability standards as policies

Usability standards and policies are created to ensure that all developed websites have a minimum acceptable level of usability. Bouazza and Chebli (2016) emphasised the need for e-government developers to create e-government websites that complied with specified usability standards. As such, it is important for designers and developers of e-government websites to comply with the usability standards and policies created for a given country. Consequently, IT employees involved in e-government website development need to have an understanding of the usability policies and standards mandated for a given country and to ensure that the developed e-government websites comply with these usability standards and policies.

7.2.1.3. Evaluator's mental model

Evaluators also play a vital role in advancing e-government usability. Two groups of evaluators are important here. The first group of evaluators are the usability professionals employed or contracted by governments to conduct usability evaluation of its e-government websites. The second group of evaluators are the research community who continuously evaluate and publish findings on the state of usability of e-government websites. The role each of these evaluator groups should play in advancing usability in SSA is discussed below.

7.2.1.3.1. Government employed or contracted usability professionals

In SSA, it has been noted that some governments employ or contract usability professionals for evaluating its e-government website. In the previous chapters, the case was discussed of the usability evaluation tender by the eThekwini municipality and the usability laboratory of the Western Cape government. These evaluators needed to bridge the gap between what the users required and what the developers created (Borsci *et al.*, 2014). To attain this, future evaluators of SSA e-government websites need to have a mastery of usability evaluation techniques that can unearth the core usability issues for the evaluated e-government website.

Additionally, these evaluators need to understand the policies and standards for a given country and ensure that evaluated e-government websites are benchmarked against these standards and policies to provide government and developers with insights on how to effectively address the identified usability issues.

7.2.1.3.2. E-government usability researchers

The second group of evaluators are the e-government usability evaluators, who to date have played a major role in advancing the usability of e-government websites (Baker, 2009; Bwalya & Healy, 2010; De Roiste, 2013; Scott, 2005; Zhao & Benyoucef, 2014). Usability researchers in SSA countries need to take an active interest in the usability of e-government websites, especially as e-government usability studies in the region are limited (Kirui & Kemei, 2014).

Such an active interest can be seen in the developed world. A good example is the Obamacare[9] e-government website in the U.S. After the launch of this website, several researchers (Cardello, 2013; Tannen, 2013; Tomlin, 2013; Venkatesh *et al.*, 2014) in the US took an active interest in evaluating the usability of the website, identifying usability issues and providing guidelines and recommendations for addressing the identified issues. Similarly, many researchers (King & Youngblood, 2016; Youngblood, 2014; Youngblood & Mackiewicz, 2012; Youngblood & Youngblood, 2013) in Alabama have dedicated a lot of efforts in evaluating the usability of state and local government websites in Alabama. According to these researchers, they focused on government websites in Alabama as part of Auburn University's effort to give back to the community. Auburn University is located in Auburn, Alabama in the US.

As indicated in the government's mental model, it is important for governments in SSA to fund usability research. However, it is also equally important for usability researchers in SSA to play an active role in evaluating the usability of e-government websites in the region and providing recommendations for addressing the identified issues. This should supplement government efforts of monitoring and evaluating e-government websites and thus play a vital role in enhancing the usability of e-government websites in SSA.

SSA usability researchers from academic institutions could also view the activity as giving back to the community, especially as most SSA governments are characterised by limited ICT capacity (Awotwi, 2011). This is even more important for local government websites as they tend to perform poorer in usability than national e-government websites, as shown in Chapter 6 (Section 6.3). As such, universities can see the evaluation of local e-government websites as giving back to their community, especially as improving e-government would have many benefits for all stakeholders in the community.

7.2.1.4. User's mental model

Users are the main audience for which e-government websites are created. Their acceptance and usage of these websites are imperative for e-government success. It is, therefore, important for the needs of users to be considered when creating e-government websites.

[9] Healthcare.gov : https://www.healthcare.gov/

One way of achieving this is by including users in the design process of e-government websites (Pribeanu, 2014; Tariq, 2010). Another way users can help is by participating in e-government usability studies (i.e. surveys or lab experiments). For this to be successful, users need to avail themselves for participation in e-government website development processes and research studies. This is very important, as some usability issues could only be identified from user testing methods (Addullah & Downe, 2011; Aizpurua, Arrue, Harper &Vigo, 2014).

The last and easiest way for users to contribute in advancing usability of e-government websites is by submitting feedback to government about the e-government websites and their needs (i.e. user needs). Prior literature suggested that most citizens failed to submit feedback to governments because they were not sure the feedback would be considered (Panagiotopoulos *et al.,* 2013). To encourage citizen feedback, awareness of the importance of feedback should be created among the different e-government users, as well as commitment from the government in responding to how the feedback information is used for improving the complaints made by the users.

7.2.2. Specific strategies for enhancing e-government website usability in SSA

After an evaluation of the usability of e-government websites in SSA (Chapter 5), several key usability issues were identified. These key issues are summarised above in Table 7.1. This section provides guidance on the role that each of the four mental models could play in addressing specific usability issues identified among SSA e-government websites.

7.2.2.1. Specific strategies for the government's mental model

Government, as the custodian of the e-government websites, need to play an active role in addressing all the identified usability issues. Table 7.2 below summarises specific usability issues under each of the usability dimensions and the required efforts needed for addressing the issues.

Table 7.2: Government's roles in addressing identified usability issues

Usability Issues	***Recommended Government Roles***
Online Services dimension	
• Interactive forms • Interactive databases	These online services are imperative for delivery of e-services to the different e-government stakeholders.

• E-commerce applications • Employment Information	Government policy needs to create an avenue for introducing interactive services that citizens and other e-government stakeholders require. The delivery of interactive online services and e-commerce applications for governments constitute an important set of public values (Bertot *et al*., 2010; Karkin & Janssen, 2014; Karunasena & Deng, 2012). Policy development for delivering such public values requires the participation of all policy actors and stakeholders (e.g. government officials, politicians, citizens, and businesses) in order to effectively identify and prioritise the public values to deliver (Yildiz & Saylam, 2013). As such, it becomes imperative for SSA governments to adopt a citizen-centric approach for development and delivery of online e-government services (Chen, 2010; Deka, 2013). This should ultimately lead to increased usability, utility and usefulness of the e-services for the e-government stakeholders.
• Chat areas/message boards • Email updates • Multimedia applications • Communications with officials	A detail responsiveness policy is required from SSA governments to clearly outline how governments should interact with citizens in a timely manner. The policy should incorporate integration of chat areas on e-government websites, email updates, multimedia applications and communications with officials. As previously indicated, social media is becoming an important medium for government communication with citizens (Dekker & Bekkers, 2015; Kumar *et al.*, 2016; Lorenzi *et al*., 2014; Panagiotopoulos *et al.*, 2013). Consequently, government policy on responsiveness should clearly define standards for social media integration in e-government websites for improving responsiveness.
• Governance oriented documentation	Governments in SSA need to define an e-governance policy that clearly stipulates governance oriented documents to be made public via e-government websites. Transparency and

	openness are required from governments as a key public value (Bertot *et al.*, 2010; Karkin & Janssen, 2014; Karunasena & Deng, 2012).
User-help dimension	
• PDA/wireless	Access to e-government websites on mobile devices should be considered a major policy agenda for SSA governments. Usability standards for mobile access of e-government websites should be established. This should significantly increase the reach of e-government services, especially as most people in SSA access the internet via mobile devices (Ericsson, 2014; Katz, 2011; Keengwe, 2015; Lutu, 2015). This should also enhance the responsiveness of SSA governments (OECD, 2011).
• Index • Search feature	Usability standards developed by the government should include easy and accurate access to information. A search feature and an index page should be recommended for all e-government websites. A search feature on e-government websites that returns accurate information to users will depict the efficiency of the e-government website in service delivery (Maheshwari *et al.*, 2007). A search feature should be mandatory on all e-government websites to ensure digital inclusion by allowing users unfamiliar with the e-government website to easily access the information and services they require (da Silva & da Silva, 2010).
• Feedback	Tools for capturing feedback from users should also be incorporated into the responsiveness policy described above. Feedback from users should not simply be captured, but governments need to act to respond to the citizens about feedback received. This will encourage further participation of citizens in providing feedback to governments.
• Non-native language translations	Governments in SSA should incorporate of non-native languages in e-government websites. The different languages should be incorporated online in line with the

	country's needs. Some SSA country's that have more than one national language should include standards for presenting e-government website information in all the national languages.
Navigation dimension	
• E-government services	Government policy should clearly stipulate that for each e-government website, the services delivered by the department (be it online or offline services) should be explained in detail on the e-government website. This is an important part of information delivery to ensure that citizens have a detailed understanding of services available to them by specific government ministries, departments or agencies.
• Sitemap • Broken links	Government usability guidelines for monitoring and evaluation should include an assessment of sitemaps and broken links to ensure that sitemaps remain up to date and links to inaccessible resources removed.
Legitimacy dimension	
• Disclaimer statements • Security policy • Authentication password/digital sign • Privacy policy • Security issues	At a minimum, government policy should mandate all e-government websites to have detailed security and privacy policies that clearly outline how the privacy and security of user information are ensured. For SSA countries that have laws regarding the privacy and protection of information, the considerations outlined in the legislation should be included in e-government websites. All e-government websites should have a comprehensive privacy policy which clearly stipulates the rights of citizens and outlines the fact that personal information of users is only collected and used for legitimate reasons (Alshehri & Drew, 2011). Similarly, appropriate disclaimer statements should be incorporated in the websites. Furthermore, government policy should clearly outline minimum security measures that should be incorporated into any website with e-commerce applications (e.g. tax payment websites). The Payment Card Industry

	Data Security Standard (PCI DSS)[10], e-commerce guidelines by the PCI Security Standards Council, can serve as a valuable resource for SSA governments in defining the minimum security standards. Lastly, usability standards should include periodic monitoring and evaluation of e-government websites in terms of compliance with stipulated security and privacy measures in the government policy.
Information architecture dimension	
• Audience-focused areas • Personalised/customisable features	E-government usability policies in SSA should instruct government ministries/departments and agencies to determine e-services that could be personalised/customised and extend delivery of more specialised services to its users. Additionally, usability standards established by the usability committee should clearly define minimum audience-focused areas that should be present in e-government websites based on the potential users of a given website (e.g. businesses, citizens, tourist, non-citizens, non-governmental organisations, etc.).
Accessibility Accommodations dimension	
• Manual evaluation of alternative text accessibility errors • Accessibility compliance with WCAG 2.0 and mobileOK.	Governments create policies that mandate compliance with WCAG 2.0 accessibility standards. With WCAG 2.0 guidelines, governments should mandate complete compliance with all level A and level AA success criteria. It is not possible for a website to satisfy all level AAA success criteria (Lightner, 2014; W3C, 2008). As such, government policies need to stipulate the minimum level AAA criteria that e-government websites must comply with. Similarly, the government policy should also stipulate the minimum success criteria for conformance to mobileOk accessibility standards. Some governments around the world that have

[10] For more details on these guidelines, consult the following resource. PCI Security Standards Council (2013). Information Supplement: PCI DSS E-commerce Guidelines. Retrieved from: https://www.pcisecuritystandards.org/pdfs/PCI_DSS_v2_eCommerce_Guidelines.pdf

	mandated WCAG 2.0 compliance for all e-government websites include Australia, Canada, France, Germany, Hong Kong, India, Italy, Ireland, Israel, Japan, Netherlands, New Zealand, Norway, Spain and the United Kingdom (Rogers, 2016).

In Table 7.2, recommendations were provided on the strategies and policy measures that governments in SSA could use to address the identified e-government website usability issues in the region. Government's role in enhancing the usability of e-government websites includes the implementation of sufficient policies for addressing usability issues and determining minimum usability standards.

7.2.2.2. Specific strategies for the designer's mental model

As indicated earlier (Chapter 5, Section 5.4.2), the designer's mental model encompasses the software designers, developers and IT personnel involved in the creation of e-government websites. This group of people play a central role in implementing the standards established by the government, as well as ensuring the compliance of e-government websites with national and international usability standards. Recommended solutions on the role that IT staff could play to address the identified usability issues in SSA are presented in Table 7.3.

Table 7.3: Designer's roles in addressing identified usability issues

Usability Issues	***Recommended Designer Roles***
Online Services dimension	
• Interactive forms • Interactive databases • E-commerce applications • Employment Information	These interactive and transactional e-government services require a user-centred approach in the design process. Where e-commerce applications are involved, the development team should ensure that international e-commerce application standards are strictly followed, especially the PCI DSS e-commerce guidelines. E-recruitment portals for governments should be easy to use, as evidence indicates that e-government websites with easy to use e-recruitment services receive significantly more applications for

	advertised positions than those with poor usability (Selden & Orenstein, 2011).
• Chat areas/message boards • Email updates • Multimedia applications • Communications with officials	E-government website development teams in SSA need to adhere to the responsiveness policies by governments and ensure that websites have enough tools for citizen engagement. Where social media plugins are integrated into the e-government websites, developers should learn how to effectively implement the Application Programmable Interfaces (APIs) of the selected social media (Spiliotopoulou & Charalabidis, 2016).
User-help dimension	
• PDA/wireless	It is imperative for staff involved in the development of e-government websites to have a good understanding of the different responsive web design frameworks that could be used to display websites correctly on mobile devices. The most appropriate framework for a development team should be selected based on the website requirements and competencies of the development team. Some of the popular and robust frameworks that have been widely tested include Bootstrap and Zurb Foundation (Rawlins, 2016).
• Index • Search feature	The e-government website development teams in SSA should include an index on the websites. Regarding the search feature, the focus should be on detail and accuracy. The websites should be developed in such a way that a search feature could be included for easy access to information located anywhere on the website.
• Feedback	IT staff developing e-government websites in SSA should incorporate appropriate feedback tools for each website. The feedback tools should be secure (especially when personal information is included) to ensure the privacy of information submitted by citizens and other stakeholders.
• Non-native language translations	When professionally translated versions of an e-government websites are available, IT staff should ensure that multi-

	language features are incorporated into the designs. On the other hand, when professional translations are not possible, the designers and developers of e-government websites in SSA could implement automated translation tools to provide multi-language options for the website content (Rozis *et al.*, 2016). It is, however, important to note that many existing automated translation tools often produce erroneous translations. Nonetheless, trends have been changing over the past few years, especially with the development of hybrid machine translation systems that incorporate the most optimal aspects of data-driven and knowledge driven translation systems (Costa-jussà & Fonollosa, 2015; Mohameda & Sadat, 2015). Additionally, neural machine translation systems that have emerged recently are also increasingly proving to produce high levels of translation accuracy (Firat, Cho, Sankaran, Vural & Bengio, 2016; Peris, Domingo & Casacuberta, 2016).
Navigation dimension	
• E-government services	Services provided by an associated government ministry or department should also be reflected on e-government websites.
• Sitemap • Broken links	E-government website developers in SSA could consider including as many navigation aids as possible. These could include sitemaps, breadcrumb trails, and site indexes (Baker, 2009; Ding & Lin, 2010). Also, all links to resources on the e-government websites should be checked and validated to ensure that links point to available resources (e.g. web pages, images, forms, news articles, etc.).
Legitimacy dimension	
• Disclaimer statements • Security policy	Security and privacy of e-government websites require both technical and non-technical measures (Alshehri & Drew,

• Authentication password/digital sign • Privacy policy • Security issues	2011). The e-government website development teams in SSA should adhere to privacy and security standards mandated by their governments. Additionally, application security measures should be taken into consideration in the design and development of the e-government websites.
Information architecture dimension	
• Audience-focused areas	During the user-centred design process, IT personnel responsible for elicitation of user requirements for e-government websites should clearly determine user needs that could be grouped into different categories of audience-focused areas.
• Personalised/customisable features	Developers of e-government websites need to understand the different approaches of service personalisation and how to implement them. These approaches include the top-down, data-driven service personalisation, bottom-up service personalisation, and location-driven service personalisation (Millard, 2011). Personalisation encompasses a lot of backend development efforts by designers and developers. It is important for developers of e-government websites in SSA to understand the development of recommender systems that can automatically filter information and deliver e-government services according to user preferences (Shambour & Lu, 2011; Al-Hassan, 2014).
Accessibility Accommodations dimension	
• Manual evaluation of alternative text accessibility errors • Accessibility compliance with WCAG 2.0 and mobileOK standards.	Designers and developers of e-government websites should have a good understanding of WCAG guidelines and how to implement them. W3C (2016) provides a comprehensive guide that describes all WCAG 2.0 guidelines in detail along with directions on how to implement these guidelines. This can serve as an important resource for IT personnel developing SSA e-government websites.

7.2.2.3. Specific strategies for the evaluator's mental model

Evaluators increasingly play an important role in bridging the gap between the user's mental model and the designer's mental model. Enhancing the usability of e-government websites requires continuous monitoring and evaluation efforts and these can be provided by evaluators. Table 7.4 presents the possible solutions that evaluators in SSA could use to help in addressing the identified usability issues among the region's e-government websites.

Table 7.4: Evaluator's role in addressing identified usability issues

Usability Issues	***Recommended Evaluator Roles***
Online Services dimension	
• Interactive forms • Interactive databases • E-commerce applications • Employment Information	Evaluators should examine the current level of interactive and transactional services on e-government websites in each SSA country and make recommendations for services that need to be included. Evaluations should not only end at indicating the services to include, but also to determine the ease of use of the service. These evaluations should be in line with the e-government website usability standards established for each country by the usability committee or any well-known international usability standards. For example, when Cardello (2013) evaluated the account setup process of the US healthcare.gov e-government website, he identified key usability issues. As such, simply having an interactive or transactional service is not enough if such a service cannot be easily used by the intended stakeholders.
• Chat areas/message boards • Email updates • Multimedia applications • Communications with officials	The evaluation criteria for these variables need to follow the government's responsiveness policy. Evaluators need to determine the presence or absence of these features on e-government websites. Also, evaluators should ensure that government officials play their own part in responsiveness by responding regularly to stakeholders, be it via emails, message boards, press releases, or social media.
• Governance oriented	Evaluators should determine the quality of governance

documentation	oriented documentation provided by governments for its websites and make recommendations on what should be included. Recommendations should consider the fact that transparency and openness of governments are important public values (Bertot *et al.*, 2010; Karkin & Janssen, 2014; Karunasena & Deng, 2012).
User-help & feedback dimension	
• PDA/wireless	Evaluators should adopt relevant automated tools for evaluating the responsiveness of e-government websites. Several free tools exist that could be used to show how websites will display on different mobile devices. A tool like Responsinator is widely used and tested (Kim, 2013; Ralins, 2016; Palani, 2014; Panhale, 2016). In addition to automated testing, evaluators should test the e-government websites on the actual devices of intended users to provide a comprehensive evaluation on how well the e-government websites deliver services and information via mobile devices.
• Index • Search feature	Evaluators need to rigorously test search features on SSA e-government websites to ensure that they return accurate and detailed information. Some criteria for evaluating search features were provided in prior literature (Kinsell & DaCosta, 2014). Additionally, they should check for the inclusion of an index on the websites.
• Feedback	Tools for gathering feedback are very important for citizen engagement and obtaining information about the usability of e-government websites. Evaluators should examine the feedback tools available on e-government websites in SSA and make recommendations on their suitability as well as indicate the feedback tools that should be incorporated on the websites. These tools could include citizen satisfaction questionnaires, feedback forms, forms for submitting proposals and complaint forms.

• Non-native language translations	The multi-language capability of e-government websites in SSA should be evaluated to ensure that all possible stakeholders could access government information and services without facing language barriers. Evaluators should provide recommendations on possible languages to include on SSA e-government websites for improving e-inclusion.
Navigation dimension	
• E-government services	Evaluators should compare the list of e-government services described on an e-government website against a list of all services offered by the government ministry or department to which the website belongs and make recommendations on services that need to be included in the e-government websites.
• Sitemap • Broken links	Evaluators should comprehensively check sitemaps to ensure that they capture the structure and details of the e-government websites. Additionally, broken links should be checked periodically using automated tools. A tool like Xenu's Link Sleuth can serve this purpose effectively as it produces a detailed report on the state of all links on an e-government website.
Legitimacy dimension	
• Disclaimer statements • Security policy • Authentication password/digital sign • Privacy policy • Security issues	As indicated earlier, the security of e-government websites requires both technical and non-technical security measures. Evaluators need to analyse both security measures to ensure that the relevant comprehensive security and privacy policies (Alshehri & Drew, 2011; Baker, 2009), as well as the technical security measures of the e-government websites, are put in place (Zhao & Zhao, 2010).
Information architecture dimension	
• Audience-focused areas • Personalised/customisable features	Evaluators should evaluate the state of audience-focused areas and the level of personalisation/customisable features on e-government websites and provide recommendations on improving these features. Benchmarking with other e-

	government websites could provide useful insights into possible audience-focused areas to include, as well as the type of personalised/customisable features to recommend to developers and governments.
Accessibility Accommodations dimension	
• Manual check alt Accessibility errors • Accessibility compliance with WCAG 2.0 and mobileOK standards.	Use appropriate methods and tools for evaluating the accessibility of e-government websites. Accessibility evaluation should clearly define the evaluation criteria and include both manual and automated evaluation methods to ensure comprehensive evaluation results (Akgul & Vatansever, 2016; Kuzma *et al*., 2009; Latif & Masrek, 2010; Lazar & Olalere, 2011). Additionally, users should be involved in accessibility evaluation (Aizpurua *et al.,* 2014; Koutsabasis, Vlachogiannis & Darzentas, 2010; W3C, 2010).

7.2.2.4. Specific strategies for the user's mental model

E-government websites are developed for the users. As such, users have a say in what is considered usable for them. In order to ensure that the developed websites have satisfactory usability levels for the users, it is imperative for users to play an active role in improving the usability of e-government websites. Table 7.5 highlights some key roles users could play in addressing some of the identified usability issues in SSA to ensure advancement in the usability of e-government websites in SSA.

Table 7.5: User's role in addressing identified usability issues

Usability Issues	***Recommended User Roles***
Online Services dimension	
• Interactive forms • Interactive databases • E-commerce applications • Employment Information	As indicated above, developing interactive and transactional e-government services necessitates a user-centred design approach so that users could play an active role in the design process of the e-government websites. During the user-centred design process of e-government websites, the

	participating users need to fully express their needs and concerns to make the process more effective (Jaeger & Bertot, 2010; Pribeanu, 2014).
• Chat areas/message boards • Email updates • Communications with officials	Dialogue is an important public value of e-government websites (Karkin & Janssen, 2014) and it entails using tools that capture citizen comments, as well as options for citizens to subscribe to government information and receive regular updates. These tools require active user participation in order to determine their ultimate usefulness (i.e. usability and utility).
• Governance oriented documentation	Citizen participation is vital for e-governance in ensuring the transparency and accountability of governments (Halachmi & Greiling, 2012). As such, it is important for citizens to hold governments accountable for delivering governance oriented documentation. Many governments around the world already provide governance oriented documentation (i.e. policies, budget, legal documents, etc.) on their websites (UNDESA, 2014). However, this is still to be significantly realised in SSA.
User-help dimension	
• Feedback	Feedback is very important in advancing the usability of e-government websites. When governments provide feedback mechanisms, they can only become effective tools if used by the e-government users to provide insights into existing issues that need to be addressed.
Navigation dimension	
• Broken links	Users of e-government websites need to report broken links when encountered. Broken links often frustrate users and degrade the UX (Alsaghier & Hussain, 2012; Karkin & Janssen, 2014), resulting in a lack of trust in governments (Dolan, 2015). Reporting broken links when encountered could ensure that governments are aware of the problem and fix it so that other users do not experience the same

	frustration, as it would negatively affect adoption and use of e-government websites.
Information architecture dimension	
• Audience-focused areas • Personalised/customisable features	User information is required for creating personalised/customisable features for e-government websites to ensure that the services are tailored to specific user profiles. To attain this, users need to supply the necessary information that could be used by recommender systems to automatically filter information and deliver e-government services according to user preferences. This information will also guide the e-government website development team to create audience-focused areas.
Accessibility Accommodations dimension	
• Manual evaluation of alternative text accessibility errors • Accessibility compliance with WCAG 2.0 and mobileOK standards.	While expert reviews and automated tests could identify most accessibility issues, some issues could, however, only be identified by actual users (Aizpurua *et al.*, 2014; Koutsabasis *et al.*, 2010). As such, user involvement in accessibility evaluation is important for identifying and addressing accessibility issues. As such, users should play an integral part in accessibility evaluation of e-government websites in SSA.

7.2.3. E-government website evaluation checklist for SSA

In addition to the general and specific strategies, the model is accompanied by a quick assessment checklist that could be used by IT staff of government institutions to evaluate the usability of their e-government websites. This checklist is provided in Appendix A. The goal of this checklist is to guide IT staff to quickly recognise usability areas of concern on the e-government websites, so that the general and specific strategies can be used to address the identified issues. The checklist is based on the set of common usability issues identified from SSA e-government websites, as depicted in Table 7.1. Guidelines on using the checklist are provided in Appendix A.

7.3. Role of National Indicators

In Chapter 6 (Section 6.5.3) the empirical evidence showed the relationships between nine national indicators and e-government development, as well as the usability of e-government websites. Of these nine national indicators, the only one with an insignificant relationship was cultural diversity. Consequently, cultural diversity was eliminated in the refined model. The summarised findings for the eight remaining national indicators are presented below (Table 7.6).

Table 7.6: Summary of significant results for national indicators

National Indicator	Coefficients of determinant (R-squared values)	
	E-government Development	Usability of e-government websites
National Income	0.567	0.178
Corruption	0.323	0.147
Global competitiveness	0.607	0.488
Innovation	0.650	0.569
Cybersecurity	0.240	0.368
Gender inequality	0.517	0.248
Population age distribution	0.463	0.156
Human development	0.780	0.208

7.3.1. Role of national income

National income has long been associated with e-government development with evidence showing that rich countries are more advanced in e-government than poor countries (UNDESA, 2016). This study confirmed this relationship for SSA and further showed that national income could also significantly be associated with the usability of SSA e-government websites. Poor countries often lack the resources for developing quality e-government projects. Since most countries in SSA are poor (Asogwa, 2015; Perry & Christensen, 2015), it was not surprising that many of them relied heavily on donor funding for e-government projects (Bwalya, 2009; Nabafu & Maiga, 2012; Souter, Adam, Butcher, Sibthorpe & Tusubira, 2013). However, SSA governments need to continuously find ways to internally fund e-government projects and not mostly rely on donors.

Another issue is that citizens from poor countries often lack the financial resources to pay for internet costs and gain access to e-government services (Alghamdi & Beloff, 2014; Komba & Ngulube, 2014; Susanto, 2014). This is a concern, as users play an important role in advancing the usability of e-government websites especially through providing feedback to government. SSA governments can mitigate this cost by providing access to free internet in resource-poor areas. Some governments around the world that have successfully adopted the free internet approach for increase e-government usage include the governments of Qatar (Al-Shafi & Weerakkody, 2011), Egypt (OECD, 2013) and the Western Cape in SA (Thompson, 2006). SSA governments could evaluate the feasibility of offering free or discounted internet access, either via government funded initiatives or through public-private partnerships.

7.3.2. Role of corruption

The limited funds available for development of quality e-government websites should not be mismanaged by corrupt officials as this could result in failure of the initiatives (Elkadi, 2013; Oreku & Menzi, 2012). Corruption has been known to negatively affect e-government development (Aladwani, 2016). This study showed that corruption has a negative influence on e-government development and the usability of e-government websites. Additionally, it negatively moderated the relationship between national income and e-government development and the usability of e-government websites. This clearly shows that where there is corruption, e-government usability is less likely to progress, even in the presence of financial resources (i.e. national income).

Governments need to implement necessary strategies to stop corruption. E-Government, if successfully implemented, could effectively reduce corruption (Abu-Shanab *et al.*, 2013; Elbahnasawy, 2014; Kim, 2014). However, the current high rate of corruption in developing countries is a huge contributing factor to the failure of e-government projects (Aladwani, 2016; Cloete, 2012; Singh *et al.*, 2007).

As previously indicated, some of the common forms of corruption relating to e-government include giving over-priced contracts to close allies and receiving bribes from under-qualified IT companies to give them contracts for developing e-government systems (Aladwani, 2016).

This often results in delivery of poor quality e-government products with a high likelihood of failure.

As such, to limit the negative consequences of corruption of e-government development and to provide a favourable environment for development highly usable e-government websites, governments need to:

- Ensure transparency in the process of awarding e-government website development contracts.
- Ensure that e-government websites are developed by highly skilled teams, either in-house or at the contracted IT Company.
- Ensure the rigorous evaluation of e-government websites before they are deployed for use. This process should include user acceptance testing and evaluation of how well the e-government website meets the usability standards established by the government.
- Impose fines and sanctions for IT companies that deliver poor quality e-government websites.

Additionally, donor organisations that fund e-government projects in SSA need to consider the level of corruption in a given SSA country before allowing project funds to be managed by the government. This is very pertinent as corrupt government officials and under-skilled IT companies misuse the funds to the detriment of citizens (Aladwani, 2016). Thus, donor organisations should put accountability measures in place to attempt to limit or reduce the level of corruption in the development and implementation of the funded e-services.

7.3.3. Role of global competitiveness

According to UNDESA (2016), global competitiveness within an economy brings about several economic and other benefits that provide a favourable environment for e-government development and progress. The findings in this study further showed that global competitiveness was positively associated with the usability of e-government websites.

Global competitiveness is a composite measure with twelve dimensions, thus improving global competitiveness has no single remedy. Some of the global competitiveness pillars that, if improved could create a favourable environment for e-government development and usability of e-government websites, include infrastructure (particularly ICT infrastructure) and higher education and training. ICT infrastructure is an integral part of e-government development (UNDESA, 2016) and so government investments in ICT infrastructure directly enhance e-government development.

This further creates a suitable environment for developing usable e-government websites. Similarly, higher education and training, especially for ICT related disciplines, are necessary for developing the national skills needed for developing high-quality e-government systems (including usable e-government websites). This is particularly important for SSA as e-government development in the region is currently hindered by a lack of ICT skills (Awotwi, 2011).

7.3.4. Role of innovation

Innovation plays an important role in fostering e-government development (Anthopoulos *et al.*, 2015). This study showed a significant positive influence of innovation on e-government development in SSA. Moreover, it was observed that innovation had one of the most profound effects on the usability of e-government websites in SSA. SSA countries that were more innovative tended to have e-government websites that were much better in terms of their usability. Enhancing the level of innovation within a country could increase the number of quality e-government services for SSA governments.

Since most e-government initiatives (including e-government websites) in SSA were products of public-private partnerships or developed by the private sector (Ampah & Sudan, 2016), SSA governments need to find ways to improve innovation in their respective countries. The following approaches could be used:

- Create or support technology innovation hubs that develop e-government solutions.
- Fund and promote research relating to e-government solutions.
- Promote technology entrepreneurship, as entrepreneurs are known to foster innovation in a country (Tiago, Faria, Couto & Tiago, 2015). Entrepreneurs should be encouraged to develop systems that could be integrated into e-government websites to enhance governments' service delivery.
- Lastly, SSA governments should adopt open innovation strategies in fostering e-government, as these have been proven to significantly improve the quality of e-

government initiatives (Christos, Xenia, Antonis, Panagiotis, Jain, Gangadharan & Yehia, 2013; Juntunen, 2012).

7.3.5. Role of cybersecurity

Governments' cybersecurity efforts are very important for e-government, especially in protecting e-government systems and ensuring information privacy. These issues significantly influence citizens' trust in e-government, which serve as a necessary precondition for adoption and use of e-government systems (Jacobi *et al.*, 2013; Khanyaako & Maiga, 2013). Governments' commitment to cybersecurity is also an important public value of e-government websites in terms of the privacy and security of the websites (Ha, 2016; Karkin & Janssen, 2014; Karunasena & Deng, 2012). This also overlaps with the legitimacy dimension of e-government website usability (Baker, 2009; Bouazza & Chebli, 2016; Dan *et al.*, 2013).

Since e-government websites are the primary platforms for governments' delivery of e-services to citizens, governments' cybersecurity efforts should incorporate security measures into these websites. In SSA, the national cybersecurity strategy (2014-2019) for Mauritius was a good example. Mauritius implemented the strategy to ensure that e-government initiatives conformed to security standards. The Mauritian government mandated "the implementation of global security best practices, business continuity management and cyber crisis management plan for all e-government initiatives to decrease the risk of disruption and improve security posture."[11] Such a mandate is very important for SSA government, as many SSA e-government websites at present are vulnerable to attacks (Asogwa, 2015; Cordell, 2015; Jacobi *et al.*, 2013).

Another key strategy for SSA governments should be the mandatory implementation of periodic security audits of e-government websites so that security and privacy vulnerabilities could be continuously identified and addressed. SSA countries like Cameroon, Mauritius and SA have clearly mandated cybersecurity audits in their national cybersecurity policies. Other SSA countries that have not created cybersecurity policies need to do so. More importantly, SSA governments should ensure that the conditions stated in the cybersecurity policies are fully implemented.

[11] Republic of Mauritius: Cyber Security strategy 2014-2017 (pg. 21). Retrieved from: http://mtci.govmu.org/English/Documents/Final%20National%20Cyber%20Security%20Strategy%20November%202014.pdf

7.3.6. Role of gender inequality

This study established that countries with high gender inequality had low e-government development as well as poor usability. As indicated by Moreno *et al.* (2013), e-government adoption is often higher in gender balanced countries. This increases both the demand and supply of e-government websites, which subsequently has a positive influence on e-government development and the usability of e-government websites.

Women account for about 50.01% of the total population in SSA. However, the region is characterised by high gender inequality, with women being more marginalised. The 2016 report by the UNDP (2016) showed that gender inequality cost SSA 95 billion US dollars every year. Bridging the gender gap in SSA could provide significant cost savings that could be used in development initiatives, for example, e-government development for effective public service delivery. Gender inequality is often characterised by disparities in IT literacy, income, and education (Choi & Park, 2013). All these factors limit the most SSA women's capabilities to participate in e-government. Empirical evidence from developing countries, including SSA countries, showed that if given an equal chance woman will outperform men in the effective use of ICTs (Hilbert, 2011).

Eliminating gender inequalities and creating more demand for e-government services should create a suitable environment for e-government progress. Governments can bridge the gender gap by providing education and training opportunities for women, as this has been proven over the years to be an effective solution for gender inequality (Antonio & Tuffley, 2014). These programs can range from formal education and training to adult and IT literacy training.

7.3.7. Role of population age distribution

Prior literature clearly depicted a consistent link between population age distribution and e-government services (Baker *et al.,* 2007; Gaulė & Žilinskas, 2013; Xu & Asencio, 2015; Wigand, 2011). Congruent with prior studies (Xu & Asencio, 2015; Wigand, 2011), this study found that the active population group was positively associated with e-government development, while the non-active population group was negatively associated with this development.

Understanding population dynamics is necessary for providing services to citizens. While the elderly population might have less demand for e-government services due to their limitations in technology use, providing e-government websites that take accessibility and user-centred design for the elderly into consideration could significantly improve the use of e-government services by the elderly. Improving the usability of e-government websites for the elderly would increase their usage of these websites for interaction with government (Akgul & Vatansever, 2016; Molnar, 2015). Rather than countries simply focusing on delivering services and improving usability for the active population group, the non-active population group, especially the elderly, should be taken into consideration in developing usable e-government websites.

7.3.8. Human development

Human development has been noted to significantly, enhance e-government development (Abdelsalam *et al.,* 2012; Holzer & Manoharan, 2009; Stier, 2015). This study indicated that there is a significant positive association between human development and e-government development. Likewise, it was observed that this association extended to the usability of e-government websites.

Human development stimulates both demand and supply of e-government (Stier, 2015), which is vital for SSA as it is currently characterised by low e-government development and poor usability of e-government websites. A key aspect of human development that would significantly influence e-government development is the education component of human development. Highly educated citizens will have more demand for e-government services (Alghamdi and Beloff, 2014; Al-Shafi, S & Weerakkody, 2010; Komba & Ngulube, 2015). This would, consequently, result in the supply of high-quality e-services, since user adoption will depend on usability. Additionally, education is required to develop the needed skills within a country to create usable e-government systems, including e-government websites.

7.4. Summary

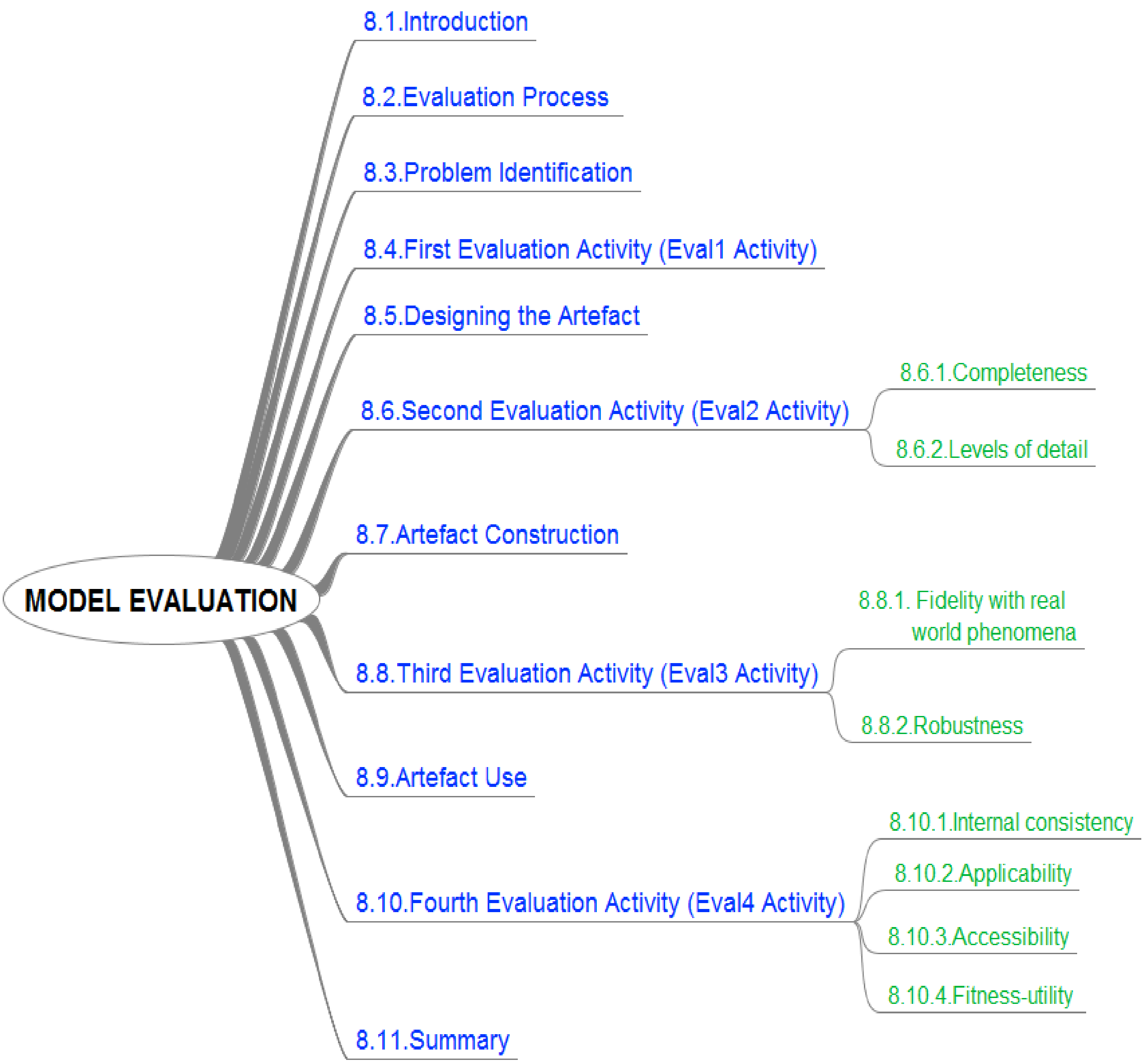
This chapter refined the model initially developed in Chapter 4 and provided guidelines for advancing the usability of e-government websites in SSA based on national indicators and four (government, designer, evaluator and user) mental models. For each of the mental models, both general and specific guidelines for improving usability were provided. The general guidelines depicted overall strategies for continuously improving the usability of e-government websites in SSA, while the specific guidelines addressed the identified usability issues currently dominant among SSA e-government websites. Moreover, the chapter presented a quick usability assessment checklist (Appendix A) that can be used by IT staff and practitioners associated with government agencies to evaluate their e-government websites.

The chapter culminated with a discussion on how an understanding of the selected eight national indicators (corruption, cybersecurity, gender inequality, global competitiveness, human development, innovation, national income, and population age distribution) could be used to create a favourable environment for e-government development and advancing the usability of e-government websites in SSA.

As previously indicated, artefacts created in DSR needed to be rigorously evaluated. To determine the usefulness of the policy ingrained model for advancing usability of e-government websites in SSA, a detailed evaluation of the model is presented in the next chapter.

CHAPTER EIGHT

MODEL EVALUATION



8.1. Introduction

As previously indicated, the evaluation of an artefact is one of the key steps in DSR. In evaluating the model developed in this study, three things were taken into consideration, namely the evaluation criteria, the evaluation patterns and an appropriate evaluation model. This chapter integrates these three vital components of DSR artefact evaluation into a comprehensive process to depict the rigour and relevance of the proposed model. Firstly, a description of how these different aspects of artefact evaluation were combined in this study is presented.

8.2. Evaluation Process

As indicated in Chapter 4 (Section 4.4.5), this study adopted the general DSR evaluation pattern by Sonnenberg and Brocke (2012). Prior research has often criticised the fact that evaluation activities often come late in most DSR projects, which could be problematic. This is because evaluations often fail to account for the fact that artefacts develop via interactions with organisational elements (Sein, Henfridsson, Purao, Rossi & Lindgren, 2011). In order to address this limitation of the sequential build and evaluation process of DSR projects, Sonnenberg and Brocke (2012) developed the general DSR evaluation pattern (Figure 8.1) to take into account the emergent nature of DSR artefacts and to produce a more robust artefact.

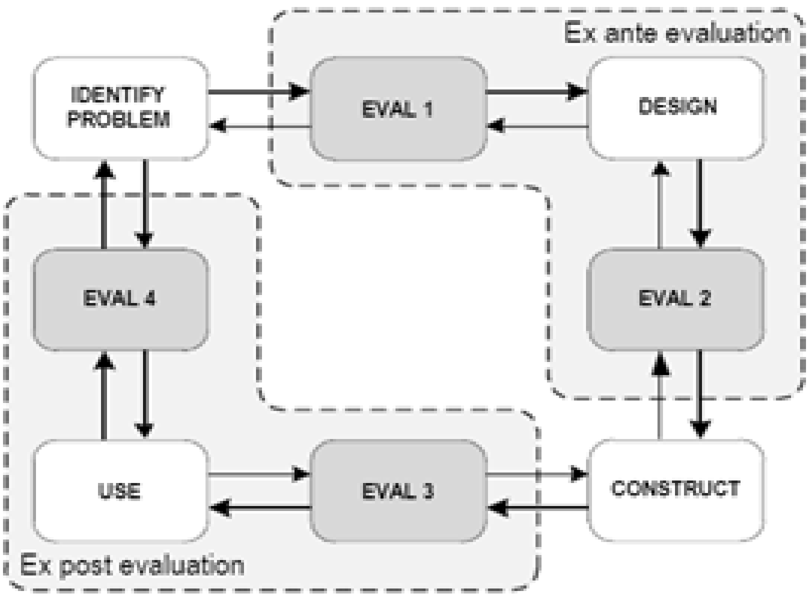


Figure 8.1: General DSR evaluation pattern (Source: Sonnenberg & Brocke, 2012)

The general DSR evaluation pattern depicts how evaluation activities need to be included within four key activities (identify problem, design, construct, and use) of the DSR process in a cyclic manner.

As indicated in Figure 8.1, each of the activities is immediately followed by an evaluation of the emerging artefact. The evaluations can broadly be classified into two categories, namely the ex-ante evaluation and the ex-post evaluation. This classification is in line with prior IS research when deciding when to conduct an evaluation (Johannesson & Perjons, 2014; Prat *et al.,* 2014; Venable, Pries-Heje & Baskerville, 2016). Basically, an ex-ante evaluation refers to an evaluation of an artefact that takes place before the actual construction or implementation of the artefact, while an ex-post evaluation denotes an evaluation that occurs after an artefact has been designed and constructed (Sonnenberg & Brocke, 2012; Venable *et al.,* 2016). The general DSR evaluation pattern (Figure 8.1) suggests the implementation of four evaluation cycles in a DSR project (i.e. two ex-ante evaluations and two ex-post evaluations).

During each of these four evaluation activities, Sonnenberg and Brocke (2012) explicated the key focus of the evaluation and the possible set of evaluation criteria to use. It is widely accepted that models can be evaluated using five criteria, namely completeness, the fidelity with real world phenomena, internal consistency, the level of detail and robustness. These evaluation criteria help in developing useful artefacts which are the key goal of DSR (Gregor & Hevner, 2013; Johannesson & Perjons, 2014; Niemoller *et al.*, 2016).

Another approach of making IS DSR artefacts useful to practice, is by applying the applicability checks created by Rosemann and Vessey (2008). These authors provided three dimensions (importance, accessibility, and relevance) of IS research that are critical to practitioners' efforts to internalise IS research findings. These applicability checks are also incorporated into the general DSR evaluation pattern to illustrate the relevance of the artefact to practice.

Additionally, Gill and Hevner (2013) added a complementary DSR evaluation approach to the widely used evaluation criteria. This complementary approach, known as the fitness-utility model, complemented the evaluation of the immediate usefulness of the design artefact (i.e. using the criteria mentioned above), with seven fitness-utility criteria (i.e. decomposability, malleability, openness, novelty, interestingness, elegance, and being embedded in a design system) for evaluating the artefacts' evolutionary fitness for sustainable impact. While an artefact might be useful today, its applicability might become redundant in the dynamic world of IS systems unless it is addressing static problems (Drechsler, 2014; Hevner, 2013). As such, Gill and Hevner (2013) argued that artefacts that were able to evolve with the dynamic environment (i.e. evolving to address new arising problems) would, in the long run, be more valuable than artefacts that simply addressed a static problem at a given point in time. In this light, this study also incorporated the fitness-utility criteria to evaluate the designed artefact for sustainable impacts. These evaluation criteria are also then incorporated into the general DSR evaluation pattern.

In the Eval1 activity (Figure 8.1), the primary goal is to justify why the study adopted a DSR approach by determining if an essential DSR problem has been identified and properly articulated. This should depict the research gap and how the envisioned design problem was important to practice. Two common methods used in this evaluation activity are assertions and literature reviews (Sonnenberg & Brocke, 2010). These authors did not specify any specific evaluation criteria for this activity. However, for the purpose of this study, the importance criteria by Rosemann and Vessey (2008) were added to this evaluation activity, as this criterion focused on determining whether the envisioned artefact addressed a real-world problem and was timely. After justifying the need for the DSR project, the design activity commenced.

The design process is followed by Eval2 activity which is generally referred to as assertion or demonstration (Sonnenberg & Brocke, 2010). This process uses artificial evaluation based on assertions to ingrain the artefact in prior theory in order to address the stated problem. When the designed artefact is a model, the evaluation criteria used at this stage are completeness or level of detail. Several methods can be used here, such as assertions, logical reasoning, expert reviews, benchmarking and demonstration. Full artefact construction takes place after the second evaluation activity.

Following the artefact construction is the third evaluation activity, namely Eval3. Eval3 activity provides a preliminary demonstration of how well the constructed artefact performs while interrelating with organisational variables. If the DSR artefact is a model, the key evaluation criteria to use here are fidelity with the real world and robustness. Inferences about the utility of the artefact can often be made at this stage of the evaluation. After this stage, the artefact is refined for use in the real world. This refinement is followed by the final rigorous evaluation (Eval4).

Eval4 involves the ultimate evaluation of the artefact and shows its applicability and usefulness in practice. In evaluating artefacts developed in the form of models, Sonnenberg and Brocke, (2010) highlighted that key evaluation criteria at this stage include fidelity with the real world and internal consistency. Similarly, the accessibility and applicability criteria by Rosemann and Vessey (2008) could be introduced here to determine how well the artefact could be understandable and useful to its intended users. Moreover, this study introduced the seven fitness-utility model's criteria at this evaluation activity to evaluate the sustainable impact of the artefact and to depict its potential for creating long-term impact. A refined DSR evaluation pattern of Figure 8.1, including the different evaluation criteria conducted at each stage, is presented in Figure 8.2 below.

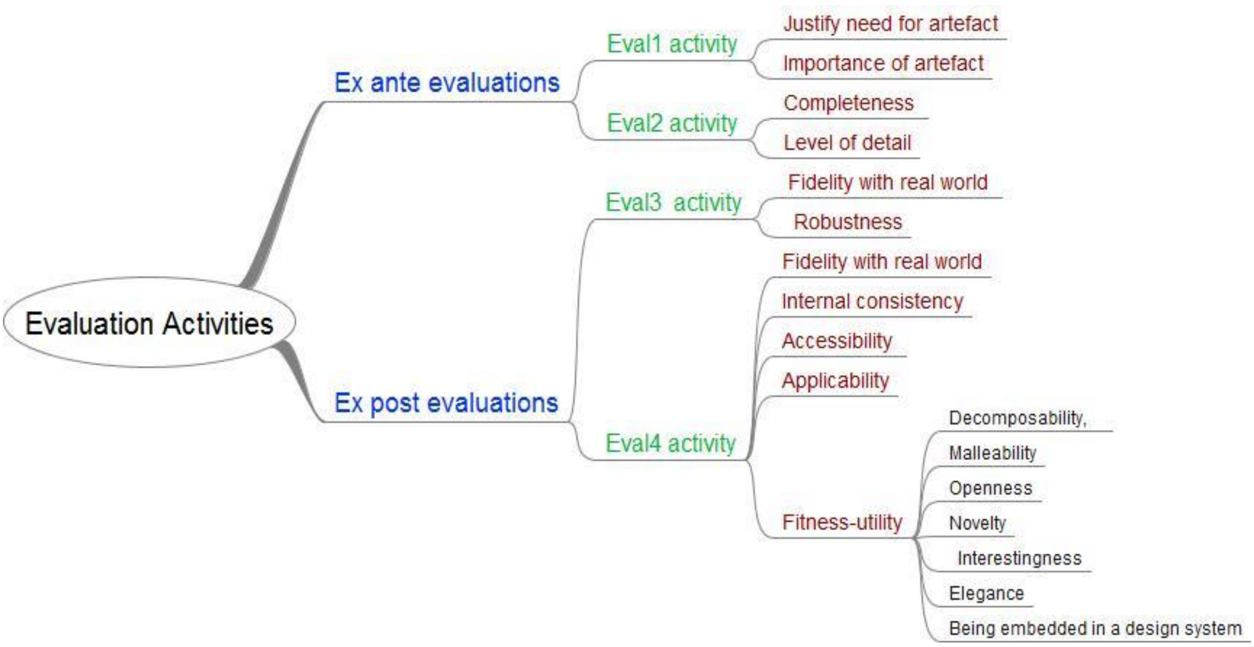


Figure 8.2: Evaluation activities for DSR artefact

After reviewing the evaluation activities by following the general DSR evaluation pattern, this study identified the different evaluation criteria that should be used for each of the four evaluation activities. During the first ex-ante evaluation (Eval1 activity), the need for the artefact will be justified, as well as a discussion given of its importance. In the second ex-ante evaluation (Eval2 activity), the artefact will be evaluated for its completeness and level of detail. For the first ex-post evaluation (Eval3 activity) the artefact will be evaluated to determine its fidelity with the real world and its robustness. Lastly, during the second ex post evaluation (Eval4 activity) the artefact will be evaluated to determine its fidelity with the real world, internal consistency, accessibility, applicability, and fitness-utility (i.e. using the seven criteria of decomposability, malleability, openness, novelty, interestingness, elegance, and being embedded in a design system). Using the wide array of evaluation criteria provides the ability to rigorously evaluate the designed model. The subsequent sections of this chapter follow the general DSR evaluation pattern as presented in Figure 8.1, and for each evaluation activity, the detail evaluation criteria presented above are discussed in relation to the designed artefact.

8.3. Problem Identification

Problem identification is the first step in a DSR project, as depicted by the DSR methodology (Peffers *et al.*, 2008). The goal of DSR is always to design an artefact for a relevant problem. Identifying an adequate problem is vital in DSR, as an understanding of the problem provides the foundations for developing an appropriate artefact to provide an improvement in the problem context (Peffers *et al.*, 2007; Wieringa, 2014). The research problem for this study was discussed in detail in Chapter 1 (Section 1.3) and is briefly summarised below.

The fundamental problem aroused from the fact that e-government progress around the world was being impeded by numerous usability barriers that needed to be identified and addressed (Zhao & Benyoucef, 2014). As such, maintaining high usability standards needed to become an integral part of any nation's strategy for advancing e-government development. This follows significant support from prior literature that has emphasised the importance of usability in e-government (AlFawwaz, 2012; Ansari *et al.*, 2016; Boon *et al.*, 2013; Donker-Kuijer *et al.*, 2010; Venkatesh *et al.*, 2014). However, this ideal is not a reality in many nations as extant literature (Ansari *et al.*, 2016; Venkatesh *et al.*, 2014) has depicted poor usability in most e-government websites. Additionally, researchers (Van Dijk, Pieterson, Van Deursen & Ebbers, 2007) have shown that poor usability is one of the key reasons for a meagre diffusion and substantial underutilisation of e-government systems. As a consequence, many e-government initiatives, especially in the developing world, are failing due to poor usability (AlFawwaz, 2012; Asiimwe & Lim, 2010; Bwalya & Healy, 2010; Kirui & Kemei, 2014; Ray, 2011).

This thesis is particularly interested in the case of SSA where e-government development is still very low, as recorded by the UN E-Government Development Surveys (UNDESA, 2016), but yet plagued by huge usability problems, as evident from existing studies (Asiimwe & Lim, 2010; Bwalya & Healy, 2010; Kaaya, 2004; Kirui & Kemei, 2014; Korsten &

Bothma, 2005; Pretorius & Calitz, 2014; Samuel, 2014). Additionally, Kirui and Kemei (2014) have argued that while e-government usability remained an important aspect of e-government development, research in the domain, especially in developing economies like SSA, has been very limited. This becomes a key concern as it is difficult to develop policies and guidelines for advancing e-government usability in SSA without a detailed understanding of the current state of e-government usability in the region.

In order to conduct a DSR project, the relevance of the research problem needed to be motivated by means of a thorough justification. As indicated earlier, determining the relevance of the research problem takes place during the first ex-ante evaluation activity (Eval1 activity). This evaluation activity is discussed below.

8.4. First Evaluation Activity (Eval1 Activity)

The first evaluation activity justifies the need for undertaking a DSR project by showing that an essential DSR problem has been identified and properly expressed. This section provides a justification for the relevance of the DSR project using assertions and prior literature as suggested by Sonnenberg and Brocke (2010), and also evaluates the importance of the proposed artefact, as discussed by Rosemann and Vessey (2008).

According to Hevner *et al*. (2004), a problem refers to the difference between an ideal state and the current state of affairs. In order to justify the relevance of a DSR problem, it is imperative to show how providing a DSR artefact could help in improving the current state of the problem towards the ideal state for a given constituent community. This is because the relevance of a DSR is always indicated with respect to a constituent community.

For the case of this study, the constituent community was made up of SSA countries (including stakeholders that could benefit from or were involved in e-government initiatives in SSA). Evidence from around the world has continuously shown that e-government was an extremely valuable strategy for governments to boost their administrative efficiency, gain the trust of citizens, uproot corruption of government officials, and eventually encourage democratic governance (Elbahnasawy, 2014; Jun *et al.*, 2014). According to Schuppan (2009), the fact that e-government enabled the efficient and effective administration of state institutions made it a vital precondition for a nation’s economic and social development. As such, the development of e-government competencies has become a central aspect of most government strategies around the globe (Hui *et al.*, 2014; Sorrentino & De Marco, 2013). However, the current state of e-government development in SSA was lower than that for the rest of the world (UNDESA, 2014 & 2016), and were increasingly being thwarted by poor usability (Asiimwe & Lim, 2010; Bwalya & Healy, 2010; Kirui & Kemei, 2014; Pretorius & Calitz, 2014; Samuel, 2014).

Researchers (Kirui & Kemei, 2014; Zhao & Benyoucef, 2014; Venkatesh *et al.*, 2014) have emphasised that usability issues in e-government projects had to be identified and addressed as a precondition for e-government to attain its full potential. While it is admirable that all governments in SSA have to date engaged in some form of e-government activity (Schuppan, 2009; UNDESA, 2016), these efforts will only be worthwhile if the implemented e-government initiatives could succeed. If e-government failed to attain its full potential, nations cannot fully enjoy the potential benefits of e-government development. This is a call for concern, as high e-government development could be very pertinent in SSA as a means of addressing the high inefficiencies, limited capacity, and poorly trained personnel that characterised public administration in the region (Awotwi, 2011). One possible means of advancing e-government development is by enhancing the usability of e-government systems. This would not only prevent failure of e-government initiatives, but also significantly increase the adoption and utilisation of e-government.

The current place to start advancement of e-government usability is with e-government websites, as they are currently known to be the primary platform for governments' interactions with citizens in light of delivering public values (Hui *et al.*, 2014; Karkin & Janssen, 2014; Nawafleh *et al.*, 2012). It is, therefore, not surprising that most e-government usability studies around the world have focused on understanding the usability of e-government websites (Kirui & Kemei, 2014; Pretorius & Calitz, 2014; Zhao & Benyoucef, 2014; Venkatesh *et al.*, 2014). As such, a DSR artefact developed to improve on the current state of usability of e-government websites in SSA would play a vital role in addressing the identified DSR problem. This, therefore, justified the need for using a DSR approach to develop an appropriate artefact for advancing usability of e-government websites in SSA. A model was selected as the appropriate artefact for addressing the identified DSR problem. The importance of this artefact is discussed below.

Following from arguments presented by Rosemann and Vessey (2008), the importance of a DSR artefact can be determined by its aptitude to address an identified problem in a timely manner, and in a way that could act as an initial point for developing an eventual solution. An effective artefact that addresses a DSR problem of interest will always be welcomed by the community for which the artefact was intended (Hevner *et al.*, 2004).

In SSA, Cloete (2012) suggested that ambiguous ICT and e-government policies that were insufficient to address the contemporary role of ICTs in government were a key barrier to the advancement of e-government initiatives. This suggested the need for a policy-ingrained artefact that could foster the development of applicable policies sufficient enough for addressing the contemporary role of ICTs usage in government. This is in line with the current arguments in DSR, emphasising the need for DSR artefacts focusing on e-government to be policy-ingrained (Goldkuhl, 2016).

Following from Cloete’s (2012) argument on e-government policies, it could be concluded that current e-government usability policies in SSA were inadequate to significantly advance the level of usability of the region’s e-government websites. Given that evaluated e-government websites in SSA so far were characterised by poor usability (Asiimwe & Lim, 2010; Kirui & Kemei, 2014; Samuel, 2014) and that failure of e-government projects in the region have been attributed to this poor usability (Asiimwe & Lim, 2010; Bwalya & Healy, 2010; Kirui & Kemei, 2014; Ray, 2011), a DSR artefact that attempted to address the problem was, therefore, timely. Isolated studies in some SSA countries have shown the need for improving usability, however, no comprehensive cross-country evidence in SSA to date has identified common usability problems and provided a possible approach for addressing the prominent usability issues in the region. Consequently, the model developed in this study was, therefore, very important as it served as a starting point developing an eventual solution for addressing the usability issues of e-government websites in SSA.

This model is important for three key reasons. Firstly, it is a policy carrier as expected of any e-government DSR artefact (Goldkuhl, 2016) and, thus, provides vital policy implications that could help to enhance the current insufficient e-government policies in SSA, as highlighted by Cloete (2012). Secondly, it paints a detailed picture of the current state of e-government website usability in SSA following a detailed usability evaluation of 279 e-government websites from 31 SSA countries. Such a detailed usability evaluation of e-government websites in SSA have not been attained to date. Lastly, it provides practical guidelines that could be followed for addressing the currently identified usability issues in

SSA e-government websites, thus serving as a roadmap that government agencies in SSA could adopt for advancing the usability of their e-government websites.

As previously discussed in Chapter 4 (Section 4.3.3), a DSR project must be completed by following three DSR cycles. The first of these cycles is the relevance cycle which focuses on determining the relevance of the identified research problem and the need for a DSR artefact in addressing the problem. The relevance cycle was covered in detail in Chapter 1 and has also been summarised above in Section 8.3. The relevance cycle covers the first two phases of the general DSR evaluation framework, which are identifying a DRS problem and justifying its relevance. After providing a detailed justification of the DSR project and the potential benefits of the proposed artefact, the next phase of the general DSR evaluation framework is to commence with the design of the artefact. This phase is discussed below.

8.5. Designing the Artefact

As indicated by Sonnenberg and Brocke (2012), the initial design of the artefact does not entail the actual development of the artefact, but the putting in place of necessary background information for constructing the actual artefact. This is synonymous to the creation of a software design pattern prior to actually engaging in the programming activities that result in the actual construction of the intended software program. In DSR, this is an act of the rigour cycle, as explicated in Chapter 4 (Section 4.3.3). A DSR artefact needs to be based on an existing knowledge base, thus necessitating a thorough review of prior literature before engaging in the actual artefact construction.

The rigour cycle was conducted in Chapter 2 and Chapter 3. This information provided the necessary theoretical background to guide the evaluation of the artefact. Chapter 2 reviewed the state of e-government development in SSA, while Chapter 3 provided a thorough review of e-government website usability. In Chapter 2, it was observed that e-government initiatives were increasingly focusing on delivering public value (UNDESA, 2014). As a result, a review of the public value perspective of e-government websites was discussed. This was particularly important as a review of e-government website usability dimensions discussed in Chapter 3 depicted a significant overlap between the public values of e-government websites and the usability of e-government websites, as discussed in the same chapter. This overlap depicts the fact that usability is an integral part of e-government development and confirms the existing views emphasising the central role of usability in the success of e-government initiatives (Ansari *et al*., 2016; Donker-Kuijer *et al.*, 2010; Venkatesh *et al.*, 2014). Moreover, a thorough review of e-government adoption models and evidence from SSA indicated that usability was central in ensuring user adoption and utilisation of e-government solutions. This review created the necessary theoretical background for linking e-government development with the usability of e-government websites.

Furthermore, prior empirical evidence had indicated that national indicators, such as national income, corruption and global competitiveness influenced e-government development (Hafeez & Sher, 2006; Perry & Christensen, 2015; UNDESA, 2014 & 2016). Understanding the link between national indicators and e-government development provided a basis for developing appropriate policies for fostering the growth and development of e-government initiatives. The close link between the usability of e-government websites and e-government development suggested that national indicators that influenced e-government development might also be associated with the usability of e-government websites. As such, they would play a vital policy role in fostering the creation of a suitable national environment for usability initiatives of e-government websites to flourish. This was not surprising, as prior literature has indicated a link between income per capita and usability of e-government websites (Gaulė & Žilinskas, 2013; Youngblood and Youngblood, 2013). As such, a detailed review of nine national indicators and their association with e-government development and the usability of e-government websites were presented in Chapter 3 (Section 3.7).

8.6. Second Evaluation Activity (Eval2 Activity)

The second evaluation activity, as depicted in the general DSR evaluation pattern, is an ex-ante evaluation, meaning that the actual artefact has not been constructed at this stage. The evaluation criteria at this stage focus on determining the completeness or level of detail of the proposed artefact. This analysis is based on the background information reviewed and also forms part of the rigour cycle. The completeness and level of detail of the artefact up to this stage is discussed below.

8.6.1. Completeness

Completeness of an artefact determines whether or not the proposed artefact is broad enough to include all relevant information. It is, however, difficult to always prove that the reviewed literature has taken into account the complete set of available information (Aier & Fischer, 2011). Nonetheless, models can still be very valuable while lacking many fundamental details (Aier & Fischer, 2011). In fact, it is widely acknowledged that the development of any model focuses on a given subject matter at a particular level of abstraction, taking into account some details, ignoring others, and aggregating some (Blythe, 2014; Jarvinen, 2005; Jarvinen, 2007; Smith, 1996). Furthermore, researchers have argued that models actually need to ignore some concepts because they have to focus on a given level of abstraction; otherwise, they would drown in the infinite richness of extant literature (Jarvinen, 2007). According to Jervinen (2007), these views should be used for the two criteria of completeness and level of detail when evaluating a DSR artefact. As such, the completeness and level of detail of the model evaluated in this study were based on the level of abstraction pertinent for designing the proposed model.

The completeness of the model primarily focused on the six-dimensional framework of e-government usability. After a review of prior literature, this study identified the six-dimensional framework for e-government usability as the most widely used set of heuristics for evaluating the usability of e-government websites. Several studies (Al-Khalifa, 2010; Al-Soud & Nakata, 2011; Asiimwe & Lim, 2011; Baker, 2007; Bouazza & Chebli 2016; Byun & Finnie, 2011; Cai, 2010; Dan *et al.*, 2013; Eidaroos *et al.*, 2009; Kinsell & DaCosta, 2014; Maheshwari *et al.*, 2007; Roach, 2007; Roach & Cayer, 2010) on e-government usability, specifically based on heuristic evaluation, have either used the complete set of variables from the six-dimensional frameworks or a subset of it. This framework was, therefore, used as the level of abstraction for the purpose of this study. This provided an appropriate and manageable scope for determining usability issues common among SSA e-government websites and suggesting comprehensive solutions for the identified usability issues. Similarly, the national indicators presented in the model were definitely not exhaustive, however, the selection of the initial nine national indicators were based on expected association with e-government development and usability of e-government websites following prior literature and logical assertions.

8.6.2. Levels of detail

Aier and Fischer (2011) explicated that the level of detail could be seen as the relationship between the aim and scope of a DSR artefact. It is imperative to ensure that the level of detail considered in the rigour cycle was sufficient to address the broad scope of the identified problem. The usability of e-government websites was of critical concern because e-government websites were the primary platform for government interaction with citizens, and their usability was influential on whether or not citizens adopted and used e-government solutions. As such, the poor state of e-government website usability in SSA was, therefore, considered concerning, because it hindered e-government development, thus causing SSA countries to lose out on the benefits of e-government.

To address the broad scope of the problem, the literature review took into account the current state of e-government development in SSA, the role of usability in the adoption and use of e-government solutions, the public value perspective of e-government websites, the importance of usability for e-government, the six-dimensional framework for e-government website usability, and nine national indicators with expected associations to e-government development and the usability of e-government websites. As indicated by Aier and Fischer (2011), a model is based on a given level of abstraction and these core aspects of the literature (covered in Chapter 2 and 3) were deemed sufficient to guide the development of a model that addresses the broad scope of the identified problem.

8.7. Artefact Construction

Artefact construction refers to the actual development/creation of the proposed artefact (Gill & Hevner, 2013; Venable *et al.*, 2016). Chapter 4 of this study was dedicated to describing the construction process of the proposed artefact in this study. The chosen artefact for this study was a model. The model titled "Policy-ingrained model for advancing E-government Website Usability in SSA" was constructed following four main phases. A key summary of this construction process is presented below.

During the first construction phase, a link was established between e-government development and the usability of e-government websites. E-Government websites are the primary platform for interaction between governments and citizens and, therefore, serve as a vital component in e-government development. It is, therefore, not surprising that in benchmarking e-government development (i.e. EGDI) the evaluation of government websites (i.e. OSI dimension of EGDI) forms an essential part.

Nonetheless, e-government websites will be of no use to governments if they have poor usability, as poor usability prevents citizens from using e-government websites for their day to day interaction with governments (Alghamdi & Beloff, 2014; Bwalya, 2009; Clemmensen

& Katre, 2012; Huang & Brooks, 2011; Shareef *et al.,* 2011). As such, the usability of e-government websites has been argued to be the most important aspect to consider in developing e-government websites (Donker-Kuijer *et al.,* 2010; Venkatesh *et al.,* 2014). As a result, the poor usability of e-government websites will lead to their failure and will subsequently influence the level of e-government development. Additionally, e-government development is increasingly focusing on delivering public values (UNDESA, 2014) and there is a momentous overlap between the public values of e-government websites and the usability of e-government websites, as elucidated in Chapter 3 (Section 3.6). This further confirmed the integral role of usability of e-government websites in e-government development. This relationship was presented in Chapter 5 (Figure 5.1).

The second construction phase entailed establishing the link between national indicators and e-government development and the usability of e-government websites. In benchmarking e-government development over the years, the UN E-Government Development Survey has also captured the role of national indicators in influencing e-government development. To date, three national indicators (i.e. national income, corruption, and global competitiveness) have been discussed in the E-Government Development Surveys. A review of prior literature and the possible association of six other national indicators (i.e. cybersecurity, innovation, population age distribution, gender inequality, human development, and cultural diversity) with e-government development, was discussed in Chapter 3 (Section 3.7). Additionally, the extension of the association of all nine national indicators with the usability of e-government websites was also presented.

E-government systems rest within the broader socio-technological context of a country and are influenced by national indicators (Khan *et al.,* 2011; Pereira *et al.,* 2016). Understanding how national indicators influenced e-government development and the usability of e-government websites could facilitate the development of national policies that could advance the usability of e-government websites. The possible association between national indicators and e-government development and the usability of e-government websites was illustrated in Chapter 5 (Figure 5.2).

The third phase of the construction process encompassed a detailed description of the four stakeholder groups that could play a vital role in advancing the usability of e-government websites in SSA. These four stakeholder groups were categorised in terms of mental models. These were the four mental models of governments, designers, evaluators, and users. An evaluation of the current state of e-government website usability in SSA indicated which usability problems were predominant and the how specific mental models could help to address the usability issues.

The last phase of the artefact construction combined the information from the first three phases to create a single model titled “Policy-ingrained model for advancing E-government Website Usability in SSA”. This phase emphasised the need for developing e-government artefacts that were policy carriers.

8.8. Third Evaluation Activity (Eval3 Activity)

The third evaluation activity (Eval3 activity) is also the first ex-post activity. When evaluating a model during this evaluation activity, the evaluation criteria to use are fidelity with real world phenomena and robustness (Sonnenberg & Brocke, 2012).

8.8.1. Fidelity with real world phenomena

Fidelity with real world refers to the external consistency of the artefact (Aier & Fischer, 2011). It is often expected of DSR artefacts to be consistent with the common knowledge base of a given discipline (Hevner *et al.*, 2004). This is a key goal of the rigour cycle in DSR to ensure that relevant knowledge is incorporated into the designed artefact. In evaluating fidelity with the real world, it is important to show that relevant parts of the knowledge base have been considered in designing the artefact and that constructs used in developing the artefact are consistent with constructs commonly used (Aier & Fischer, 2011). The fidelity of the designed artefact with the real world phenomena is discussed in below.

8.8.1.1. Including relevant parts of the knowledge base

The key aspect of the knowledge base vital in the development of the model was the information on the usability of e-government websites. After a review of the literature in Chapter 2, the six-dimensional framework of e-government usability was considered as the relevant theoretical framework for this study. The six dimensions encompassed most of the key usability relevant heuristics that have been widely used in e-government website usability literature (Asiimwe & Lim, 2011; Baker, 2007; Bouazza and Chebli 2016; Cai, 2010; Dan *et al.*, 2013; Roach, 2007; Roach & Cayer, 2010). Similarly, the three national indicators that have been reviewed in the UN E-Government Development Survey were included in the study. Additionally, the public values of e-government websites were considered in the development of the model in order to depict the integral role of usability in e-government development.

8.8.1.2. Consistency in use of constructs

The concept of mental models was introduced in discussing the role of the different stakeholders. These constructs were consistent with the extant knowledge base, as the role of mental models in improving usability has been discussed in prior literature. The key mental models covered in prior literature included the designer, evaluator and user mental models (Borsci *et al.,* 2014; Fakrudeen *et al.,* 2014; Nielsen, 2010). However, in the case of usability of e-government websites, governments also play an important role in advancing usability, such as enforcing usability policies and standards for e-government websites. As such, the government's mental model was introduced. Also, the measures used for depicting the national indicators were consistent with national indicators used in prior literature. For example, similar to the UN E-Government Development Surveys (UNDESA, 2016), national income was operationalised in terms of the GNI, corruption in terms of CPI and global competitiveness is terms of the GCI.

8.8.2. Robustness

Robustness of an artefact can be considered as the artefact's ability to respond to fluctuations in the environment (Prat *et al.,* 2014). It can also be considered as the usefulness of the artefact in addressing the whole spectrum of the purpose and scope of the relevant DSR problem (Aier & Fischer, 2011).

The DSR environment comprises of people (e.g. roles, capabilities and characteristics), organisations (e.g. strategies, structure and culture and processes) and technology (e.g. infrastructure, applications, communications architecture, and development capabilities). In terms of the people dimension of the environment, the constructed model included four key stakeholders (governments, designers, evaluators, and users) necessary for improving the usability of e-government websites in SSA. The model also explicitly defined the roles each of these stakeholders needed to play. If new usability issues are identified in future studies, the strategies for addressing that could easily be included into the roles of any of the suitable stakeholder groups. Stakeholder groups also require different capabilities and characteristics which can evolve with changing needs. For example, the model mandates periodic monitoring and evaluation of e-government websites, which can often result in the identification of new usability issues for which designers will need training to enhance their capabilities for addressing the usability issues. Likewise, government's capabilities can also evolve with time to incorporate new policies and standards for advancing usability.

The organisation dimension of the environment comprises of the government. The model proposed a set of strategies and processes that governments could use to address usability. A key aspect of the strategies suggested by the model was the formation of the usability committee. The usability committee could play a vital role in establishing further strategies and processes for governments to advance the usability of e-government websites. Any changes in the government processes could be addressed by this committee to make recommendations on new usability standards or policies for governments to enforce.

The key technology dimension of the environment includes the e-government websites and integrated web applications. The development of the model was based on a detailed evaluation of the current usability state of the SSA e-government websites. As such, the model provided specific strategies for addressing the identified usability issues. However, to cater for changes in this environment, the model also included general usability strategies that were robust enough to address a wide spectrum of usability issues that might be identified in future. For example, the role of the evaluator's mental model is a clear indication of expectations of new usability issues in future, while the general strategies of the government's mental model ensure that necessary standards and policies can be put in place to address emerging usability issues.

The last aspect of evaluating the robustness of an artefact is to ensure its usefulness across the whole spectrum of the identified DSR problem. The DSR problem identified for this study was summarised above in Section 8.3 and entailed the dire state of usability of e-government websites in SSA. Improving the usability of e-government websites is imperative, as these websites are the primary platform for e-government service delivery. If poor usability persists, e-government efforts are going to fail and the potential benefits of e-government will not be realised.

After a detailed evaluation of the state of usability of e-government websites in SSA (Chapter 5), several usability issues were identified. The constructed model took into account these usability issues and provided both general and specific strategies for addressing the usability issues plaguing e-government websites in SSA. The proposed strategies incorporated in the model encompassed the entire spectrum of possible usability issues.

The specific strategies targeted the usability issues identified in this study, while the general strategies provided a robust approach to significantly improve the overall state of usability in any given SSA country. The model also included the role of national indicators in creating a favourable environment for advancing the usability of e-government websites. As such, the model took into account the broad scope and purpose of the identified DSR problem.

8.9. Artefact Use

After evaluating the initial model, a refined model, ready for use, was constructed. Chapter 7 was dedicated to describing this model in detail. The model was presented in Figure 7.1 and the rest of Chapter 7 discussed the components of the model and how the model could be used to improve the usability of e-government websites. This refined model was further evaluated in the fourth evaluation activity.

8.10. Fourth Evaluation Activity (Eval4 Activity)

The fourth evaluation activity comprised of four key evaluation criteria, namely internal consistency, applicability, accessibility, and fitness-utility. The evaluation of the constructed model using these criteria is presented below.

8.10.1. Internal consistency

Internal consistency is generally concerned with ensuring that components of an artefact are consistent with the existing knowledge base (Aier & Fischer, 2011). Measures for internal consistency include form and function, artefact mutability and principles of implementation. However, for the evaluation of internal consistency in this study, only form and function and principles of implementation are discussed here.

This is because artefact mutability will be discussed in detail under the fitness-utility criteria below (Section 8.10.4) as the dimensions of decomposable, malleable and open focus on the mutability of a DSR artefact (Gregor & Jones, 2007; Gill & Hevner, 2013).

8.10.1.1. Form and function

In order to evaluate the form and function of an artefact, Aier and Fischer (2011) suggested the need to use testable propositions. The developed model included testable propositions which highlighted expected relationships between national indicators and e-government development and the usability of e-government websites. After evaluating the propositions for the initial nine indicators in Chapter 6, cultural diversity was eliminated, leaving eight national indicators with a significant relationship to e-government development and the usability of e-government websites.

To further evaluate these testable propositions, a case study of Israel was used. Using a case study is considered an appropriate evaluation measure for internal consistency (Aier & Fischer, 2011). In the context of this study, a case study of Israel was used to evaluate if assumptions made for SSA countries regarding testable propositions could still hold if a different context (i.e. Israel) was introduced. This would help to validate the form and function of the proposed artefact.

8.10.1.1.1. Selection of Israel as the case study

Israel was selected as the case study because Dan *et al.* (2013) conducted a usability evaluation of e-government websites in Israel using the six-dimensional framework for usability adopted in this study. These authors determined the usability of the e-government websites similarly to the methods used in this study to evaluate SSA e-government websites. Additionally, the set of websites used by the authors included similar ministry websites used in this study. Other possible case studies like Baker (2007) and Roach and Cayer (2010) were older, while newer studies like Bouazza and Chebli (2016) and Cai (2010) used the six-dimensional usability framework, but did not compute the usability scores in a manner easily comparable to the computations in this study. Consequently, selecting any other country apart from Israel would have implied that the researcher had to conduct the evaluation of websites for the selected country. This might have provided a biased assessment of the case study, as the findings of the selected case study country needed to be comparable to the findings from the SSA countries conducted by the same research. However, using data computed by different researchers (i.e. Dan *et al*, 2013) provided a better validity of the arguments.The alternative option could have been to find a different set of heuristic evaluators to conduct the evaluation for any selected case study country. However, the feasibility of this option, especially the cost implication, made this an unlikely choice for the researcher.

❖ *E-government development and national indicators: Israel vs. SSA countries*

The level EGDI for Israel is higher than that for any SSA country, as such, for the scope of the analysis, only the top two countries (in terms of EGDI) for SSA are compared with Israel. The data in Table 8.1 indicates that the EGDI for Israel for the years 2012, 2014 and 2016 were all higher than those for Mauritius and SA.

Table 8.1: National indicators for Israel, Mauritius and SA

	Israel*	Mauritius	SA
EGDI – 2012	0.8100	0.5066	0.4861
EGDI – 2014	0.8162	0.5338	0.4869
EGDI – 2016	0.7806	0.6231	0.5546
Usability (Six dimensional framework)	60%	50.73%	47.82%
Corruption (CPI)	61	53	44
Innovation (GII)	55.98	35.9	35.8
Global Competitiveness (GCI)	5.02	4.43	4.39
Gender Inequality	0.101	0.4190	0.5360
Human development (HDI)	0.900	0.777	0.666
Population Age distribution (Active population)	61.5	71.15	65.73
National income (GNI)	32, 720	19290	12830
Cybersecurity Index	0.676	0.5882	0.3824
*National indicators were captured for the period the usability analysis was conducted. This implies that national indicators for Israel depict 2013 data while those for Mauritius and SA depict 2016 data. The exception is the cybersecurity index which is the 2014 data as it was the first cybersecurity index and so is used as proxy for both studies (N.B. the second cybersecurity index in underway).			

Also, looking at the usability of e-government websites based on the six-dimensional framework, Dan *et al.* (2013) found that the mean overall usability of Israel government websites was 60%, while that for Mauritius and SA computed in this study are 50.73% and 47.82% respectively. This also shows that Israeli e-government websites performed better than the top SSA countries in terms of usability.

As such, following from the empirical analysis in Chapter 6 showing the association of national indicators with e-government development and the usability of e-government websites, one would expect Israel to have better national indicators than Mauritius and SA. This was exactly the case, as shown in Table 8.1 above. Israel was seen to be less corrupt (CPI), and had less gender inequality than Mauritius and SA. Similarly, Israel was more innovative (GII), competitive (GCI), and richer (GNI) with a higher quality of life (HDI) and stronger cybersecurity measures than Mauritius and SA. However, in terms of population distribution, it was seen that Israel had less active population (ages between 15 and 65) than Mauritius and SA. Consequently, more demand for e-government services could be expected for Mauritius and SA. However, this might not necessarily be the case, as a country like Israel, characterised by a very high HDI will likely have a high percentage of educated elderly citizens who might have a high demand for e-government services compared to the elderly populations in SSA. In fact, since 2004, Israel has been noted for bridging the digital divide by extending e-government services to the elderly (Frucht, 2004; Hafeez & Sher, 2006).

❖ *Usability comparison of Israel with top SSA countries*

To further ascertain if Israeli e-government websites performed better in usability than Mauritian and SA e-government websites, an ANOVA analysis was conducted. A comparable sample was pooled from the three countries. This was made possible by the fact that the evaluation of e-government websites in Israel by Dan *et al.* (2013) covered all the ministries' websites included for SSA in this study.

However, local government websites were not included in the analysis, as the case study from Israel did not evaluate local government websites. Consequently, a total of seven e-government websites from each of the countries were used to form a matching sample. These included websites for the Ministries of Education, Finance, Health, International affairs, Labour, Tourism and the websites of the Presidency.

The results of the ANOVA analysis are presented in Table 8.2 above.

Table 8.2: Usability comparison for Israel, Mauritius and SA

Usability Dimension	Israel (N=7)		Mauritius (N=7)		SA (N=7)		F-Value	Sig.
	M	SD	M	SD	M	SD		
Online Services	12.29	1.60	10.26	1.57	12.91	1.41	5.77	0.012**
User-help	9.29	2.14	10.26	0.01	8.79	2.39	1.14	0.343
Navigation	13.57	1.13	9.31	0.57	9.31	1.05	46.97	0.000**
Legitimacy	11.14	1.57	14.09	0.52	7.34	2.62	24.92	0.000**
Information Architecture	8.71	3.45	6.35	1.94	6.15	0.74	2.63	0.100
Accessibility Accommodation	10.43	1.13	5.66	2.88	0.89	1.11	44.21	0.000**
Overall Usability	65.0	4.47	55.92	3.37	45.40	7.00	25.13	0.000**

From Table 8.2, it is observed that significant differences in usability were found for the overall usability ($F=25.13$, $p<0.01$), and the usability dimensions of online services ($F=5.77$, $p<0.05$), navigation ($F=46.97$, $p<0.01$), legitimacy ($F=24.92$, $p<0.01$), and accessibility accommodation ($F=44.21$, $p<0.01$). To further understand the patterns in the significant differences Post-hoc Scheffe tests were conducted for each of the significant dimensions. The results are presented in Table 8.3 below.

In terms of the online services, there was no significant difference between Israel and Mauritius ($p = 0.071 >0.05$) or SA ($p = 0.747 > 0.05$). However, it was seen that online services in SA were significantly better than in Mauritius ($p = 0.016 < 0.05$). In terms of navigation, Israeli e-government websites perfumed significantly better than both Mauritius ($p = 0.000 < 0.01$) and SA ($p = 0.000 < 0.01$). In terms of legitimacy, it is observed that Israeli e-government websites performed significantly poorer than those in Mauritius (Mean Diff = -2.947, $p<0.05$) but significantly better than those in SA (Mean Diff = 3.800, $p <0.05$). For accessibility accommodation ($p<0.01$) and the overall usability ($p<0.05$), the e-government websites from Israel significantly outperformed both Mauritian and SA e-government websites. Similarly, Mauritian e-government websites significantly performed better than SA e-government websites ($p<0.05$).

The findings for the overall usability clearly indicate that countries with better national indicators are more likely to have e-government websites with better usability. Israel, with better indicators, performed better than Mauritius and SA, while Mauritius also had better indicators than SA and performed better.

Table 8.3: Post-hoc test for differences in usability between Israel, Mauritius and SA

Multiple Comparisons (Scheffe Test)							
Dependent Variable	(I) Group	(J) Group	Mean Diff. (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Online Services	Israel	Mauritius	2.027	0.817	0.071	-0.152	4.207
		SA	-0.629	0.817	0.747	-2.808	1.550
	Mauritius	SA	**-2.656***	0.817	**0.016**	-4.836	-0.477
Navigation	Israel	Mauritius	**4.262****	0.507	**0.000**	2.908	5.616
		SA	**4.262****	0.507	**0.000**	2.908	5.616
	Mauritius	SA	0.000	0.507	1.000	-1.354	1.354
Legitimacy	Israel	Mauritius	**-2.947***	0.958	**0.022**	-5.503	-0.392
		SA	**3.800****	0.958	**0.004**	1.245	6.356
	Mauritius	SA	**6.747****	0.958	**0.000**	4.192	9.303
Accessibility Accommodation	Israel	Mauritius	**4.772****	1.014	**0.001**	2.069	7.476
		SA	**9.536****	1.014	**0.000**	6.832	12.239
	Mauritius	SA	**4.763****	1.014	**0.001**	2.059	7.467
Overall Usability	Israel	Mauritius	**9.077***	2.766	**0.015**	1.702	16.453
		SA	**19.595****	2.766	**0.000**	12.219	26.971
	Mauritius	SA	**10.518****	2.766	**0.005**	3.142	17.894

*. Mean difference is significant at the 5% level. **. Mean difference is significant at the 1% level. A positive mean difference indicates outperformance, while a negative mean difference indicates underperformance.

The only case where Israel performed significantly lower was with legitimacy, which was led by Mauritius. As depicted from the SSA results in Chapter 6, it would be expected of countries with high cybersecurity indices to perform better in legitimacy because of their commitment to enforcing privacy and security in e-government. However, in the case here, the timing of the cybersecurity index could be an issue, as it was conducted one year after Dan *et al.* (2013) evaluated Israeli e-government websites and over one and a half years prior to the evaluations in this study. A detailed look at the 2014 cybersecurity index shows that Mauritius and Israel performed equally well in three dimensions namely technical, organisational and cooperation, while SA performed poorer than both countries (ABI Research, 2014). This could explain why both countries perform better than SA in the legitimacy dimension. It could also possibly explain why Mauritius performed better than Israel given than the evaluation of Mauritian e-government websites was ex-post the cybersecurity benchmark while that for Israel is ex-ante. Nonetheless, the only exception for SSA is Mauritius, as the evaluation of 24 Israeli e-government websites by Dan *et al.* (2013) found an average legitimacy score of 8.9 while all the evaluated SSA countries in this study (except for Mauritius) scored below this number. This, therefore, still supported the association between the cybersecurity index and the legitimacy dimension of e-government websites.

The above discussion used the case study of Israel to confirm the testable propositions presented in the developed model. The policy-ingrained model suggested that national indicators played a role in e-government development and the usability of e-government websites. The model subsequently provided guidelines and policy measures on how governments could improve national indicators or take them into account for creating a favourable environment for e-government development to thrive and for the creation of high quality and usable e-government websites.

8.10.1.1.2. Form and function of the artefact as a policy carrier

In addition to the testable propositions, the general nature of the artefact in the form of a policy-ingrained model could also be seen to be useful. The reason researchers suggest for e-government artefacts to be policy-ingrained is because policies play a central role in fostering government initiatives.

Looking at the analysis in Table 8.3 above, it is evident that e-government websites in Israel significantly outperformed those in Mauritius and SA in the domain of website accessibility. In fact, the total average for all 24 Israeli government websites computed by Dan *et al.* (2013) was 8.1, while in SSA, the country that scored the highest only scored a mean of 6.71 for accessibility (see Chapter 6, Table 6.9). This can be related to the policy measures for accessibility implemented in Israel, as the Israeli government has mandated compliance with WCAG 2.0 guidelines for all its e-government websites (Rogers, 2016). On the other hand, SSA countries have not implemented policies for website accessibility or enforced accessibility standards for its e-government websites which possibly accounts for their poor levels of accessibility. This argument could also be supported by evidence from Kuzma *et al.* (2009), which compared four SSA countries (Kenya, Liberia, Namibia, and SA) with eight countries from Europe (France, Germany, Switzerland, and UK) and Asia (Cambodia, China, India, and Philippines) and concluded that countries with stronger policies on accessibility performed better. In their study, the SSA countries performed the worst and were also the dominant countries without an enacted accessibility policy for its e-government websites.

It is, therefore, not surprising that many researchers (Akgul & Vatansever, 2016; Kamoun & Almourad, 2014; Kuzma *et al.,* 2009; Latif & Masrek, 2010) advocated for formal accessibility policies as a means of advancing accessibility of e-government websites. This emphasised the need for having a government's mental model for implementing necessary usability policies and guidelines. As such, creating a policy-ingrained model for advancing usability of e-government websites in SSA is a plausible solution.

Additionally, the central form of the artefact included e-government development and the usability of e-government websites. For rigorous evaluation of the six-dimensional usability frameworks, it was correlated with the UsabAIPO usability dimensions. The two were seen to have a strong correlation (Figure 6.24). Moreover, internal consistency evaluation using Cronbach's alpha was conducted to determine the suitability of aggregating the two usability measures. The results showed high internal consistency between the two usability measures with a Cronbach's alpha of 0.863 (Table 6.18). Additionally, a strong significant correlation was established between the usability of e-government websites and the EGDI, supporting the views that usability was highly associated with e-government development. Similarly, using EPI as the proxy for public values also provided a means to assess the overlap of public values with e-government website usability. The observed strong positive correlation between the EPI and the usability of e-government websites supported this proposed association (Chapter 6, Figure 6.23).

8.10.1.2. Principles of implementation

Principles of implementation basically refer to the guidelines for implementing an artefact in practice (Huysmans, Oorts, De Bruyn, Mannaert & Verelst, 2012). According to Aier and Fischer (2011), an artefact's principles of implementation should be supported by justificatory knowledge. This justificatory knowledge refers to the extant literature from social and/or natural sciences that guide the design guidelines (Gregor & Jones, 2007).

The model presented in Chapter 6 was accompanied by guidelines that could be implemented within each mental model to improve the usability of e-government websites in SSA. The guidelines were accompanied by justificatory knowledge supporting the choice of guidelines. For example, the guidelines for addressing accessibility issues in SSA e-government websites using government policies were backed by prior literature (Aizpurua *et al.*, 2014; Akgul & Vatansever, 2016; Kuzma *et al.*, 2009; Koutsabasis *et al.*, 2010; Latif & Masrek, 2010; Lazar & Olalere, 2011) along with key considerations on compliance with WCAG guidelines as discussed in Chapter 7 (Table 7.2).

Similarly, prior literature was used to support guidelines discussed across the four mental models (see Table 7.2, Table 7.3, Table 7.4, and Table 7.5). When guidelines are integrated within an artefact, Huysmans *et al.* (2012) emphasised that the guidelines characterise the artefact's principles of implementation. This is because the potential users of the artefact not only see the artefact, but can actually use the artefact to achieve its intended goals. This is closely linked to the principle of applicability, as highlighted by Rosemann and Vessey (2008).

8.10.2. Applicability

Applicability is important in determining the relevance of a DSR artefact. An applicable DSR artefact needs to be able to guide and inspire management decisions, as well as be immediately useful in practice (Drechsler, 2014; Nicolai & Seidl, 2010). With regards to guiding management decisions, the developed model in this study was constructed with the view of a policy-ingrained artefact for advising SSA governments on advancing usability of its e-government websites. The model explicitly discussed several policy measures that governments could use to advance usability of their websites. Management decisions regarding e-government websites mostly rest with the government. In this regard, the government's mental model section of the overall model focused primarily on guidance and inspiration for management decisions that could be undertaken by SSA governments to advance the usability of its e-government websites.

The other criterion for applicability is the immediate usefulness of the artefact in practice. This aspect was also fully covered by the developed model. In constructing the model, a detailed usability evaluation of 279 e-government websites from 31 SSA countries was conducted. This evaluation identified key usability areas of concern following the six-dimensional usability framework adopted for this study. The developed model then included detailed guidelines on the role each of the four mental models could play in addressing the identified usability areas of concern for SSA e-government websites. These guidelines were immediately useful as they presented solutions to current usability issues plaguing SSA e-government websites.

8.10.3. Accessibility

Making a DSR artefact accessible to practice entails ensuring that the artefact is presented in a way that could be easily understandable to its intended users (Rosemann & Vessey, 2008). When research output is difficult to understand, it becomes inaccessible to practitioners. It is, therefore, always important to make sure research outputs are accessible to the intended users (Grima-Farrell, 2016).

In developing the artefact in this study, significant consideration was given to enable easy comprehension of the model by intended users. Existing evidence indicates that most practitioners do not understand research output, because research often builds on existing knowledge and sometimes cannot be understood in isolation from the prior literature (Rosemann & Vessey, 2008). Even though the model was developed following a rigorous review of existing literature, most of the recommendations made for advancing usability of e-government for each of the mental models could be applied by the intended users without having to understand the fundamental theory behind the recommendation.

DSR artefacts are recommended to be policy carriers because the intended users often include government officials. This is important as it is vital for them to have an understanding of policy considerations established by the artefact, so that they can effectively use it in policy-making. As such, the policy-ingrained model developed in this study could easily be understood by government officials because it is a policy carrier with several policy recommendations that can be considered by governments in SSA.

8.10.4. Fitness-utility

As indicated earlier, fitness-utility is a complementary DSR evaluation criteria focused on evaluating the evolutionary fitness of an artefact for sustainable impact. It comprises seven criteria, namely decomposability, malleability, openness, novelty, interestingness, elegance, and being embedded in a design system. The evaluation of the constructed model against these seven fitness-utility criteria is presented below.

8.10.4.1. Decomposable

According to Gill and Hevner (2013), it is imperative for a DSR artefact to be decomposable into closely independent subsystems in order to ensure the evolution and sustainability of the artefact. This helps in facilitating the easy modification of the artefact. When artefacts cannot be decomposed and modified from the different subsystems, they are characterised by low fitness, as their evolution becomes a matter of all or nothing. Such systems might consequently become static or discarded. On the other hand, artefacts constructed from separable constructions exhibit high fitness and thus tend to evolve more rapidly (Hevner, 2012).

The model developed in this study was highly decomposable, thus exhibiting high fitness. The step by step construction of the model in Chapter 4 presented the different components of the model, which could be decomposed and worked on individually to easily advance the model. For example, research studies could simply extract the national indicators component of the model and extend it to provide more insights into how national indicators influenced e-government development and the usability of e-government websites. The UN E-Government Development Survey, which benchmarked e-government development, is increasingly documenting national indicators that are associated with e-government development (UNDESA, 2014). The relationships with national indicators introduced here are likely to evolve as new evidence emerges to advance this component of the model. This evolution will contribute to the model by providing a further understanding of possible policy measures that governments can adopt to improve e-government development and the usability of e-government websites without the need for recreating the whole model.

Similarly, the overlap between public values of e-government websites and the usability of these sites could also evolve independently. This overlap helps to indicate the integral role of usability in e-government development. Lastly, the different mental models for improvising usability proposed in the model could also evolve independently. Mental models were based on the key stakeholders' that could play a role in influencing the usability of e-government websites. Each of the mental models can be decomposed and expanded accordingly to address any new usability issues that arise, be it technical, operation or policy measures. For example, the government's mental model can be decomposed and enhanced in the light of developing acceptance criteria for e-government websites or online apps from public-private partnerships. Likewise, donor-funded e-government projects could also consider a separate donor mental model outlining the role that the donor organisation should play in ensuring the usability of the developed e-government solution. Donors could impose international usability standards not mandated by a given SSA country.

8.10.4.2. Malleable

Malleability refers to the extent to which a DSR artefact could be easily adapted by its intended stakeholders to address changing use conditions in the environment (Gregor and Jones 2007; Williams *et al.* 2010). Malleability is often enhanced by decomposability of the artefact. Malleability is an important DSR artefact characteristic as it enables an existing artefact to easily evolve and address user needs more effectively (Drechsler, 2014; Gill & Hevner, 2013).

The malleability of the proposed model is mostly evident in the mental models. Each of the mental models provided general and specific recommendations for addressing usability issues in SSA. While the usability issues identified in this study were definitely not exhaustive, the mental models provided room for adding new strategies for addressing any emerging usability issues. For example, if an SSA government decides to engage in user evaluation of e-government websites in the future and identifies some new usability issues only evident from user tests, solutions for addressing the issues can be included in any of the mental models. Where the solution required policy measures, modifications could be made to the mental model. Similarly, where solutions required technical measures, recommendations could be made to the designer and evaluator mental models. Furthermore, as new usability standards emerged over the years, governments could easily integrate them into the government's mental model and mandate the compliance with the new usability standards.

8.10.4.3. Open

This evaluation criterion defines the characteristic of a DSR artefact to be open for inspection, modification and reuse (Gill & Hevner, 2013). Open artefacts exhibit high fitness as it is easier to see how the artefact was constructed and also easy to modify existing components in the artefact to ensure its evolution.

Details of the artefact constructs were provided in Chapter 4, making it easy for others to modify the existing components of the artefact. Additionally, researchers could also introduce new national indicators not considered in the study. This study will be published as a thesis by the University of the Free State, thus making the model open to the wider research and practitioner communities. Additionally, the model will be made open for further modification via publication in academic journals.

8.10.4.4. Embedded in a design system

It is expected that DSR artefacts created in an environment where design is an unusual activity will exhibit low fitness and thus become less likely to evolve compared to artefacts in sustainable design system environments (Hevner, 2013).

This study produced a model as the desired outcome of the study. Models are not new in IS research, in general, or HCI research and e-government research in particular. As such, a model is likely to have high fitness and evolve faster in these research domains because they are not unusual activities. For example, Chapter 2 discussed several technology adoption models for e-government (Section 2.5), as well as e-government maturity models (Section 2.7). As such, developing a model to address DSR issues in IS research is in line with the general research environment in this domain. Also, this study incorporated the recent calls for a need to make e-government DSR policy carriers. Consequently, a policy-ingrained model for advancing usability of e-government websites in SSA was created.

8.10.4.5. Novelty

A DSR artefact is considered fully novel when it comes from an unexplored domain (Hevner, 2013). While novelty is important, novelty alone is considered insufficient for achieving design fitness (Gill & Hevner, 2013). Gill and Hevner (2013) argued that novel DSR artefacts were quite challenging to attain in traditional DSR, as their creative process often fell short of meeting the criteria for usefulness and rigour emphasised in DSR. The ultimate level of novelty is the creation of an invention. Gregor and Hevner (2013), in classifying DSR contributions, emphasised that a genuine invention is often a very difficult goal for a DSR project.

However, when the goal of the knowledge contribution is not an ultimate invention, the novelty of an artefact could be determined by its ability to contribute to the creation of new knowledge in a given domain (Brocke & Lippe, 2010; Hevner & Chatterjee, 2010). The novelty of DSR artefacts also helps to promote diversity (Gill & Hevner, 2013). Moreover, novel artefacts need to be applicable in more than one local context (Drechsler, 2015). The novelty of the model developed in this study is discussed below following these guidelines

8.10.4.5.1. Creating new knowledge

The creation of a DSR artefact to address a relevant research problem results in the creation and adding of new knowledge to the existing knowledge base (Hevner & Chatterjee, 2010). This study created a model policy-ingrained model for improving the usability of e-government websites in SSA.

The model made several contributions to the existing knowledge base. Firstly, the model provided an integral link between e-government development and usability of e-government websites via the overlap between public values of e-government websites and the usability of e-government websites. E-Government development in recent years has primarily focused on delivering public values (UNDESA, 2016). With regards to e-government websites, several researchers (Cordella & Bonina, 2012; Hui & Hayllar, 2010; Karkin & Janssen, 2014; Karunasena & Deng, 2012) clearly presented the different public values of e-government websites. However, a review of these public values with the six-dimensional framework of usability widely used in prior research (Baker, 2007; Bouazza & Chebi, 2016; Cai, 2010; Roach & Cayer, 2010) clearly showed an overlap between public values and usability of e-government websites. This association, in addition to evidence of the central role of usability in the success of e-government websites, established the integral link between usability of e-government websites and e-government development. This further extended the existing knowledge base by depicting that public values of e-government websites and their usability were not mutually exclusive and should be treated as such for advancing knowledge on e-government websites.

Secondly, the model introduced the association between several national indicators and e-government development and the usability of e-government websites. Prior to this study the existing knowledge base only contained the association between national income and e-government development (UNDESA, 2014). The 2016 UN e-government survey further introduced two other national indicators (i.e. corruption and global competitiveness). The five other national indicators included in this study included innovation, gender inequality, cybersecurity, population age distribution and human development. Since these associations were new with limited empirical evidence, they were introduced early on in the study to a peer review process (IST-Africa 2016 Conference). This was in line with DSR guidelines to communicate research outcomes early on to ensure rigorousness in the development of the model (Hevner *et al.*, 2004). The published outcome is depicted in Figure 8.3 below.

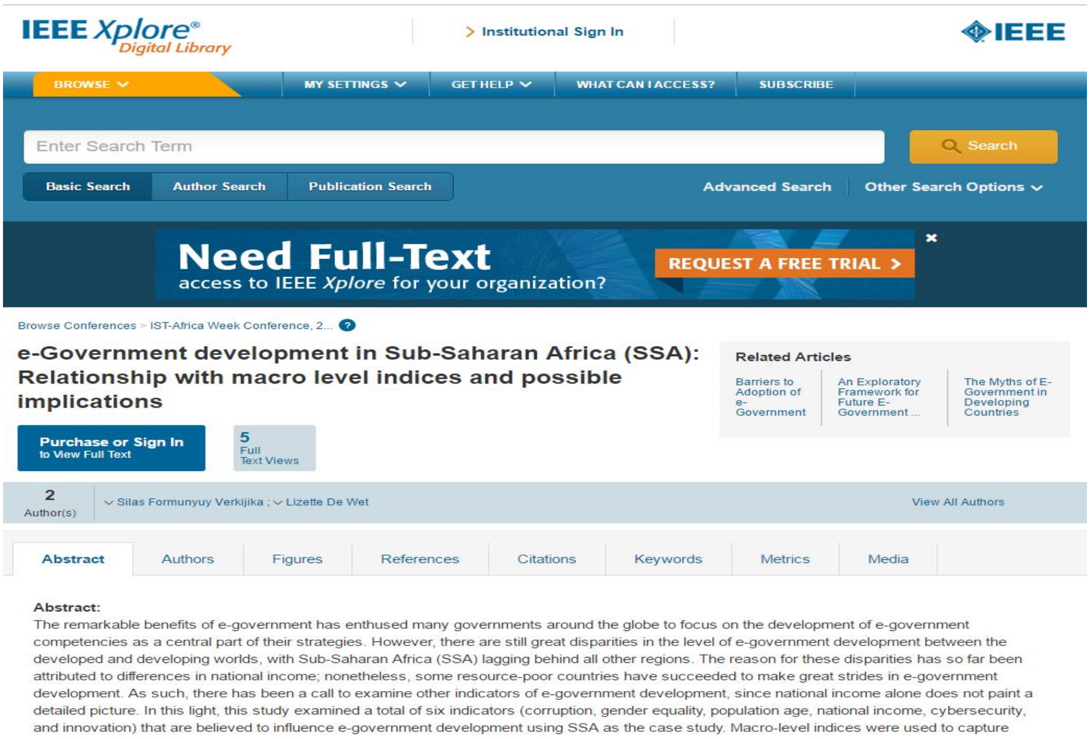


Figure 8.3: Graphical representation of published paper

The association between national indicators and e-government development was a new contribution to the knowledge base. Additionally, this study extended the association to the usability of e-government websites and empirically showed the relationship between national indicators and the usability of e-government websites in SSA.

Lastly, this study extended the concept of mental models. Designer, evaluator, and user mental models have been discussed in prior usability literature. However, when it comes to usability of e-government websites, governments play a central role in advancing the usability of the websites via policy measures. This study, therefore, introduced the concept of the government's mental model and its role in improving the usability of e-government websites in SSA.

Extant e-government website usability studies have focused on evaluating the usability of e-government websites without providing detailed guidelines on how to address the identified issues. This model provided a robust approach for improving the usability of e-government websites in SSA by expounding both general and specific strategies to be implemented by the government, designers, evaluators and users in improving the usability of e-government websites in SSA.

8.10.4.5.2. Promoting diversity

The novelty of a DSR artefact promotes diversity when new or extended ideas are presented (Gill & Hevner, 2013; Hevner, 2013). As indicated above, this model presented new ideas when new national indicators were introduced to show their relationships with e-government development. Additionally, showing the empirical association between national indicators and the usability of e-government websites introduced new ideas that would probably be discussed further in future studies. Furthermore, this study extended the concept of mental models with the introduction of the government's mental model to guide e-government website usability efforts. This created diversity regarding how to view the usability of e-government websites.

8.10.4.5.3. Applicable to more than one local context

Existing evidence suggested that usability of e-government websites was a critical concern around the world. However, the case was worse for developing countries, including SSA (Kirui & Kemei, 2014).

This study focused on SSA as the case study and constructed the policy-ingrained model based on data from SSA. Nonetheless, the model could also be useful in other developed or developing countries outside of SSA. The general strategies presented for each of the mental models could be used in other countries outside SSA to improve the usability of e-government websites. Additionally, usability studies in non-SSA developed and developing countries have also identified several usability issues that could be addressed by the specific strategies suggested in this model. For example in developed countries like Oman and Israel researchers found that lack of online services, lack of privacy policies, poor user help and poor accessibility were some of the critical usability issues plaguing e-government websites (Bouazza & Chebi, 2016; Dan *et al.*, 2013).

Similarly, e-government usability research in most developing countries (e.g. Malaysia and Jordan) have focused primarily on evaluating the accessibility of e-government websites and found that most of the evaluated websites suffered from severe accessibility issues (Isa *et al*., 2011; Latif & Masrek, 2010). All these usability issues identified in non-SSA regions could also be addressed using the policy-ingrained model developed in this study. This, therefore, indicates its potential applicability in more than one local context.

8.10.4.6. Interesting

Generally, DSR artefacts are characterised as being interesting when they depict unexpected budding behaviours that stimulate a need for further research and the creation of successive artefacts (Gill & Hevner, 2013). Researchers are often interested in artefacts that highly conform to the existing knowledge base, yet, that also integrate some startling elements (Hevner, 2013).

The development of the model in this study was primarily based on a rigorous evaluation and use of the existing knowledge base (Chapter 2 and Chapter 3). However, the link between national indicators and the usability of e-government websites was introduced as an unexpected element to depict other issues to consider. Mostly, when studies focused on the usability of e-government websites, they engaged detailly on the evaluation of the websites and what designers should incorporate to improve the websites. However, they failed to consider the view that, unlike commercial websites, e-government websites were influenced by many issues, ranging from government decisions to national indicators, which might not be directly involved during the development process, but played a vital role in the outcome of the e-government websites.

Additionally, the link between e-government development and the usability of e-government websites, based on the public value perspective of e-government websites, was expected to stimulate further research into this overlap. Instead of viewing usability and public values as disparate research goals, researchers could begin to merge these two concepts to provide better artefacts for advancing e-government development in general.

8.10.4.7. Elegance

Elegance refers to the characteristics of a DSR artefact that do not directly influence the usefulness of the artefact, but play a vital role in enhancing the user's utility of the artefact (Hevner, 2013). Gill and Hevner (2013) proposed that simplicity could be used to determine the elegance of a DSR artefact. Likewise, Aier and Fischer (2011) combined elegance and simplicity into one DSR evaluation criteria, termed simplicity, because of the overlap between elegance and simplicity. Prior DSR has suggested that elegance and simplicity were criteria for evaluating artefacts designed in the form of constructs (March & Smith, 1995; Prat *et al*., 2014; Sonnenberg & Brocke, 2012). As such, the evaluation of elegance might not be suitable for evaluating a model. Additionally, the general goal of evaluating elegance based on simplicity was to ensure that the designed artefact was easy to understand and manage (Aier & Fischer, 2011). This overlaps with the criteria of accessibility discussed in Section 8.10.3. As such, a separate discussion for evaluating elegance of the constructed model in this study is not necessary.

8.11. Summary

This chapter provided a detailed evaluation of the constructed model. The general DSR evaluation pattern by Sonnenberg and Brocke (2012) was used. This evaluation pattern comprised of four evaluation activities of which two were ex-ante and two ex-post. The evaluations were based on illustrating the constructed model's adherence to DSR artefact evaluation criteria. In addition to the five criteria (i.e. completeness, level of detail, fidelity with real world phenomena, robustness and internal consistency) widely accepted as criteria for evaluating a DSR model, other relevant criteria, such as applicability checks (i.e. importance, accessibility, and relevance) and fitness-utility (i.e. decomposability, malleability, openness, novelty, interestingness, elegance, and being embedded in a design system) were also used.

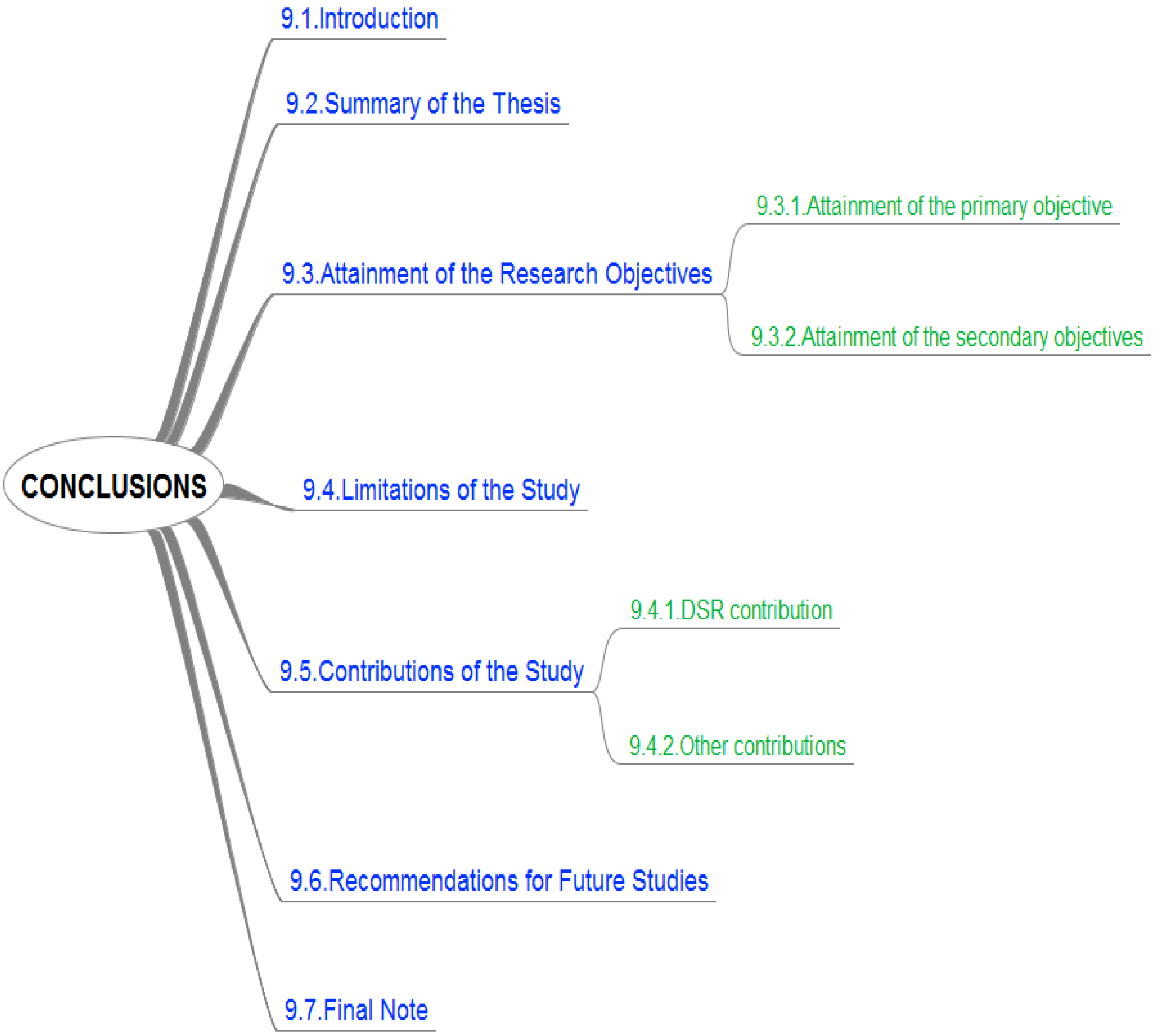
A detailed evaluation of the constructed policy-ingrained model served as a means to clearly demonstrate the utility, efficacy and quality of the designed artefact. This chapter also served to assure the rigour of the research, as well as validate the process for creating the policy-ingrained model. The last evaluation activity of the model (Eval4 activity) focused on evaluating the artefact for use. As such, this concludes the process of developing the artefact (i.e. the policy-ingrained model for improving the usability of e-government websites in SSA).

The outcome of the evaluation is deemed satisfactory by the researcher based on the view that the developed artefact satisfactorily met all the criteria against which it was evaluated. A strong case was particularly made for the completeness (Section 8.6.1), fidelity with the real world (Section 8.8.1), robustness (Section 8.8.2), internal consistency (Section 8.10.1), applicability (Section 8.10.2) and fitness-utility (Section 8.10.4). These sections, along with the other evaluation criteria, clearly highlighted the fact that the proposed model was developed from the extant knowledge-base with features that noticeably provided evidence of the artefact's utility. This, therefore, confirmed the suitability of using the proposed model for advancing the usability of e-government websites in SSA.

The conclusion of this thesis is presented in the next chapter.

CHAPTER NINE

CONCLUSIONS



9.1. Introduction

This chapter presents a discussion on the conclusions arrived at in this thesis. It commences with a brief summary of what the theses entailed. Following the summary is a discussion on the attainment of each of the research objectives. Next, the knowledge contributions of the study are presented. This includes both DSR knowledge contribution and other scientific research contributions. The study culminates with an articulation of the limitations, recommendations for future studies and a final note on the thesis.

9.2. Summary of the Thesis

This section presents a recap of the chapters in this thesis. A brief overview of the focus of each chapter was presented in Chapter 1 (Section 1.8). Vital summaries for each of the chapters are recapped below.

Chapter 1 provided a detailed background to the study and highlighted the DSR problem that needed to be addressed. Also, the primary research question was formulated and posed as follows:

- How can the current state of e-government website usability in SSA inform the development of a model for improving the usability of these sites?

This research question, along with the secondary research questions outlined in Chapter 1 (Section 1.4) guided the formulation of the objectives of this study (Section 1.5). A discussion on the attainment these objectives is presented below (Section 9.3). The argument for the research presented the view that e-government development brought about numerous benefits for governments, citizens, businesses, and other stakeholders. However, with e-government websites being the primary platform for delivery of e-government services, their current poor usability state was hampering the diffusion of e-services, thus undermining e-government's potential for delivering the expected benefits. Consequently, a DSR approach was adopted to develop a model that can be used to improve the usability of e-government websites in SSA. The chapter culminated with a concise description of the contributions of the study, which were also expanded below (Section 9.4).

A review of the existing knowledge base was provided in Chapters 2 and 3. E-Government was defined in Chapter 2 along with a detailed evaluation of the state of e-government development in SSA. Additionally, a review of e-government adoption models was presented to depict an underlying view of the factors fostering the adoption and use of e-government solutions. A summary of existing e-government maturity models was presented, which linked the chapter to the emerging views on public values of e-government.

Chapter 3 focused on reviewing the literature on the usability of e-government websites. The six-dimensional usability framework (i.e. online services, user-help & feedback, navigation, accessibility accommodation, information architecture and legitimacy) was presented as the core theoretical framework for evaluating the usability of e-government websites in SSA. Moreover, a discussion on the overlap between public values and the usability of e-government websites was presented. Lastly, a presentation and postulation of the possible association of national indicators with e-government development and the usability of e-government websites were presented.

Chapter 4 focused on the research design and methodology used in this study. The research pyramid served as the guiding framework for the chapter. The DSR paradigm was selected as the paradigm of choice. As such, the DSR methodology was followed. A combination of usability evaluation methods and mixed methods were used in the study. Furthermore, the set of research techniques (i.e. heuristic evaluation tools, automated testing tools, and data sources for national indicators) used, were discussed. The chapter culminated with a discussion of the selection process for e-government websites included for evaluation.

Chapter 5 presented the initial version of the constructed model. The model illustrated the integral role of usability in e-government development. Also, the testable propositions regarding national indicators were presented. Additionally, the four mental models (government, designer, evaluator, and user) necessary for advancing the usability of e-government websites in SSA were discussed.

Chapter 6 presented a detailed evaluation of the usability of e-government websites in SSA, as well as testable propositions of the association of national indicators with e-government development and the usability of e-government websites. This served as an initial evaluation of the constructed model and provided feedback for further construction of the model.

Chapter 7 presented the refined model, taking into account the evaluations in Chapter 6. In the refined model, detailed guidelines on how to improve the usability of e-government websites in SSA were provided. The guidelines were classified into both specific and general guidelines for each of the mental models. Moreover, considerations for creating a favourable environment for improving e-government development and usability of e-government websites based on national indicators were presented.

Chapter 8 described the complete evaluation of the model. The general DSR evaluation pattern was adopted for evaluating the model. A detailed description of both the ex-ante and ex-post evaluations was presented. The detailed evaluation of the model validated the rigour of the research process.

The subsequent sections of this chapter present the research objectives and how they were attained, the contributions of the study, the limitations of the study, and recommendations for future studies.

9.3. Attainment of the Research Objectives

In Chapter 1, the primary and secondary objectives of this study were presented. This section reflects on the fulfilment of these objectives.

9.3.1. Attainment of the primary objective

The primary objective of the study was to develop a model for improving the usability of e-government websites in SSA as a response to the inadequacies of comprehensive evidence-based usability solutions to the region's poor usability state of e-government websites.

In order to successfully achieve this objective, a DSR approach was adopted for the study, as this design's ultimate goal is the construction of an artefact (i.e. a model in the case of this study). Following the relevance and rigour cycles in Chapters 1 to 3, the first version of the proposed model was presented in Chapter 5. DSR is often an iterative process, therefore, the initial model was evaluated in Chapter 6 and the feedback and outcomes of the evaluation used to develop the final policy-ingrained model presented in Chapter 7. The constructed model was presented in Figure 7.1, while the rest of Chapter 7 was dedicated to present how the model could be used to improve the usability of e-government websites in SSA. Chapter 8 further presented a detailed evaluation of the final model and demonstrated its utility. Ultimately, a tangible DSR artefact in the form of a policy-ingrained model for improving the usability of e-government websites in SSA was presented as the outcome of this study to satisfy the requirements of the primary objective.

9.3.2. Attainment of the secondary objectives

A total of nine secondary objectives were presented to aid the achievement of the primary objective. The first secondary objective was *to review the literature on e-government diffusion in SSA*. This objective was achieved in Chapter 2, as the chapter was dedicated to reviewing the literature on the diffusion of e-government, with a special emphasis on SSA. As previously defined, e-government diffusion encompasses the development and adoption of e-government solutions. The chapter provided supporting analysis from E-Government Development Surveys to paint the picture of e-government development in the region. Likewise, a detailed review of adoption models was presented, with a special emphasis on models used in SSA and the factors affecting the adoption of e-government in SSA.

The second secondary objective was *to compare the rate of e-government diffusion in SSA with the rest of the world*. This objective was achieved in Chapter 2. Section 2.4.1 was dedicated to comparing the diffusion of e-government in SSA with other regions. The primary data for comparison was obtained from the UN E-Government Development Surveys from 2010 to 2016. The comparison showed that SSA lagged behind other regions in e-government diffusion.

The third secondary objective was *to review the literature on usability with a particular interest in e-government website usability*. This objective was achieved in Chapter 3. The chapter presented an overview of usability and laid more emphasis on the usability of e-government websites. The six-dimensional usability framework was identified as the most suitable theoretical framework for examining the usability of e-government websites. The review of extant literature showed that many e-government website usability studies have either fully or partially used the six-dimensional usability framework.

The fourth secondary objective was *to review the literature on the association of national indicators with e-government development and the usability of e-government websites*. Associating national indicators with e-government development or the usability of e-government websites was not a new phenomenon. However, national income was the only national indicator that had been widely studied. As such, this study reviewed prior literature to suggest how other national indicators could influence e-government development and the usability of e-government websites. In total, nine national indicators were reviewed, namely national income, corruption, global competitiveness, cybersecurity, innovation, population age distribution, gender inequality, human development, and cultural diversity. This detailed review that was presented in Chapter 3 served as the attainment of the third secondary objective.

The fifth secondary objective was *to conduct a large-scale evaluation of the state of e-government websites usability in SSA.* While usability has been coined as a critical factor accounting for the failure of e-government initiatives, existing evidence on the state on e-government website usability in SSA was still limited. As such, in order to develop a comprehensive model to address e-government usability issues in SSA, there was a need for a large-scale evaluation of the current status of e-government websites in SSA. This evaluation was presented in Chapter 5 by using both the six-dimensional usability framework (as the primary evaluation tool) and the UsabAIPO heuristics (as the supplementary evaluation tool). In addition, the evaluations were augmented with the use of automated testing tools. In total, 279 e-government websites from 31 SSA countries were evaluated. This large-scale usability evaluation served as the achievement of the fourth secondary objective.

The sixth secondary objective was *to identify dominant usability issues plaguing e-government websites in SSA and provide detailed guidelines for addressing them within the context of a proposed model*. After evaluating the usability of e-government websites in SSA, a set of prominent usability issues plaguing the majority of SSA websites were identified and presented in Table 7.1 (21 key issues were identified). This identification of the usability issues complied with the requirements for achieving the fifth secondary objective and also served as the foundation for developing specific strategies to improve the usability of e-government websites in SSA.

The seventh secondary objective was *to evaluate the role of usability in the diffusion of e-government solutions*. This study provided both theoretical and empirical evidence of the role of usability in the diffusion of e-government. E-Government adoption literature in Chapter 2 showed that usability was an influential factor in the adoption of e-government solutions. Similarly, this study showed the association of e-government development and usability of e-government websites via the overlap between public values of e-government (i.e., a focus on e-government development) and the usability of e-government websites. Additionally, a review of the existing knowledge base indicated that usability was a precondition for e-government progress. Furthermore, empirical analysis for SSA showed a significant positive association was between e-government development and the usability of e-government websites. All these information served as the attainment of the sixth secondary objective and a basis for validating the link between e-government development and usability of e-government websites presented in the constructed model.

The eighth secondary objective was *to examine the differences in usability between national and local e-government websites.* Local e-government websites are often considered as being under-developed in terms of usability, even though they are critical in the delivery of e-government services to communities. In Chapter 6 (Section 6.10) an evaluation was conducted to determine the differences in usability between national and local e-government websites. Using the six-dimensional framework, it was observed that national websites performed significantly better in online services, user-help, navigation, information architecture and overall usability. However, a closer look at the results for each of the 31 SSA countries showed that national e-government websites only performed significantly better in 8 countries. In one case, the local e-government websites even performed significantly better in terms of usability compared to national e-government websites. For the majority of SSA countries, there was no significant difference in performance between national and local e-government websites. This analysis resulted in achievement of the seventh secondary objective and from the findings, there was no need to separate national and local e-government websites in the model.

The ninth secondary objective was *to identify national indicators with significant associations to e-government development and the usability of e-government websites*. After selecting and reviewing nine national indicators, statistical analysis was conducted to determine if they had a significant association with e-government development and the usability of e-government websites. The results indicated that all the national indicators, except for cultural diversity, showed a significant association with both e-government development and the usability of e-government websites. This resulted in achievement of the eighth secondary objective and the findings were also incorporated into the construction of the model.

9.4. Limitations of the Study

While significant efforts were made to ensure the rigour of this research study, there were, however, some limitations that needed to be highlighted.

Firstly, the sample size used was not a comprehensive list of e-government websites in SSA. Only nine websites were taken from each of the 31 SSA countries. This number was considered sufficient for the scope of the study as it required a lot of time to evaluate the total of 279 websites from 31 SSA countries. Nonetheless, taking only nine websites from a country like Kenya, with over 100 e-government websites, might provide a limited understanding of the complete picture of e-government website usability in the country. Nevertheless, it is also important to acknowledge that not all countries in SSA even had up to nine websites, as countries like Guinea, Swaziland, South Sudan, Togo, Guinea-Bissau, Niger, Equatorial Guinea, Central African Republic, and Congo were eliminated for having too few websites to be considered. Additionally, the reputable UN E-Government Development Survey also used a similar set of websites as those used in this study to evaluate online for e-government development across the globe.

Secondly, it was observed during the usability evaluation of e-government websites in SSA that some governments were updating their websites. At times, this delayed the evaluation process until the downtime was over (the highest experienced downtown was over a week). The continuous updating of e-government websites by governments suggested that e-government websites were evolving regularly and so the state of usability of a website a month ago might not be an actual representation of its current state. However, this updating process was experienced for only 4 out of the 279 evaluated websites.

Lastly, this study used heuristic evaluations and automated testing without including user-based methods. This posed a limitation to the comprehensiveness of the identified usability issues, as some usability issues could only be found primarily through user-testing methods (Tan *et al.*, 2009). Also, the usability heurtics were limited to the six-dimensional framework and the UsabAIPO heuritics. Nevertheless, prior e-government studies (Albayrak & Çaģiltay, 2010; Alfawwaz, 2012; Darem & Suresha, 2012; Venkatesh *et al.*, 2014) based on user-testing methods have found limitations in the number of websites that could be evaluated due to time constraints, with most focusing on only about 1 to 5 e-government websites. Since this study wanted to provide a comprehensive evaluation of the usability of e-government websites in SSA, a significant number of websites were required for evaluation and such a huge number could not possibly undergo user-testing within the timeframe for a thesis and the available resources. Additionally, heuristic evaluation has been known to be effective and to identify over 70% of usability issues in several studies (Sivaji *et al.*, 2011; Tan *et al.*, 2009).

9.5. Contributions of the Study

The primary contribution of a DSR is always the construction of an artefact. However, in the process, other scientific contributions to the existing knowledge base are also created. This section presents both the DSR contributions, as well as other scientific research contributions, of the study.

9.5.1. DSR contribution

As previously indicated, the goal of a DSR is to develop an artefact. However, for the artefact to be useful, it needs to provide an adequate knowledge contribution. Prior research (Hevner, 2012; Gregor & Hevner, 2013) has presented two dimensions on which the knowledge contributions from a DSR study can be judged. These dimensions were the maturity of solution domain and the maturity of the application domain. The two dimensions present a four quadrant framework (Figure 9.1) for judging a DSR contribution.

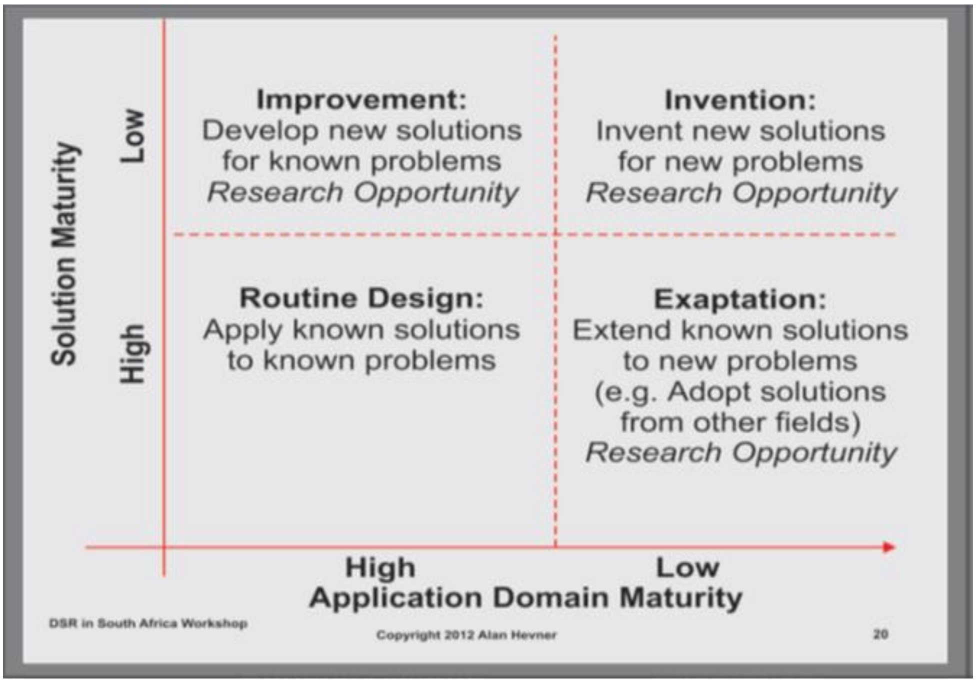


Figure 9.1: Four quadrant framework for DSR contributions (Source Gregor & Hevner 2013, p.345)

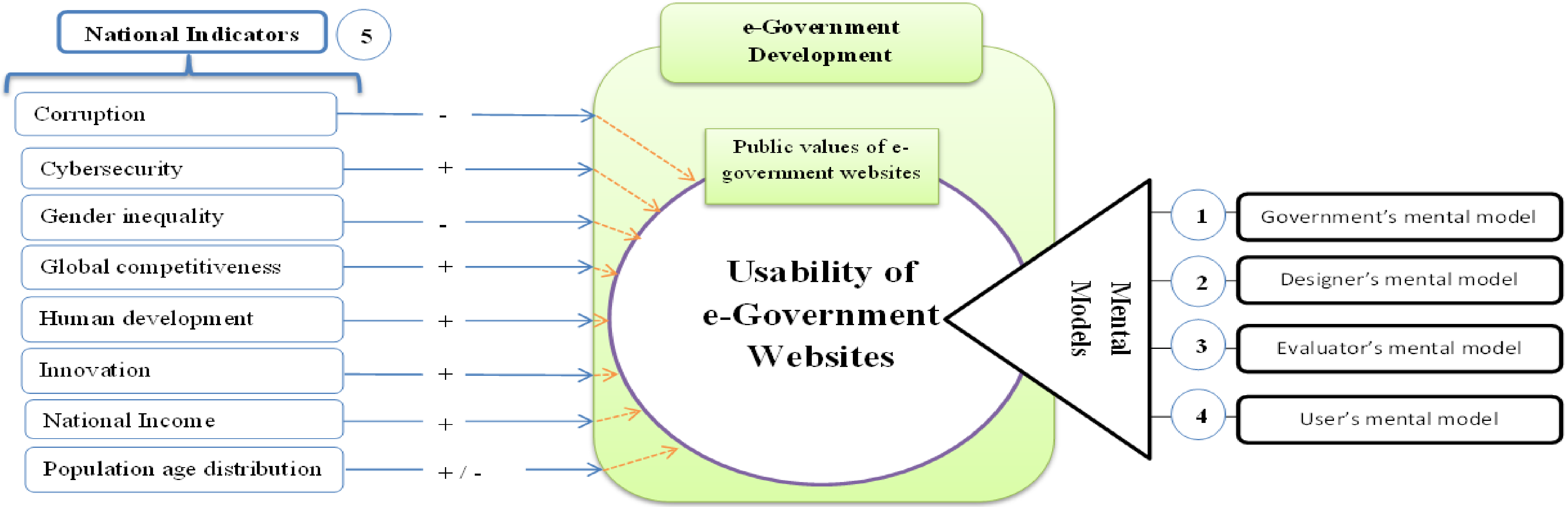
Based on Figure 9.1, it can be said that the model developed in this study served as a new solution for known problems, and so could be considered as an improvement in the DSR knowledge contribution framework. Gergor & Hevner (2013) noted that most of the existing DSR studies in IS research belonged to the improvement quadrant.

The poor state of usability of e-government websites has been widely pronounced in prior literature. However, there was a lack of comprehensive solutions for improving the usability of e-government websites. Following a detailed evaluation of the state of usability of e-government websites in SSA, this study developed a policy-ingrained model for improving the usability of e-government websites in SSA (Figure 7.1 and re-presented here as Figure 9.2 for the reader's convenience).

The model presented four mental models (i.e. government, designer, evaluator, and user) for advancing the usability of e-government websites in SSA. Each of these four mental models was accompanied by both general and specific strategies for improving the usability of SSA e-government websites. Additionally, the model incorporated the role of national indicators in advancing e-government development as a whole and usability of e-government websites in particular.

National indicators provided a favourable environment for improving the usability of e-government websites and the model depicted how governments could make use the information from national indicators to improve on e-government development in general and usability in particular.

After describing the constructed artefact, Gregor and Hevner (2013) explicated the need to evaluate it in order to provide convincing evidence of its knowledge contribution. This is often achieved by evaluating the artefact against a set of evaluation criteria (Aier & Fischer, 2011; Sonnenberg and Brocke, 2012; Rosemann & Vessey, 2008; Venable *et al.*, 2016). A detailed evaluation of the model was presented in Chapter 8. The evaluation criteria used included the five DSR model evaluation criteria (i.e. completeness, level of detail, fidelity with real world phenomena, robustness and internal consistency), the applicability checks (i.e. importance, accessibility, and relevance) and the fitness-utility criteria (i.e. decomposability, malleability, openness, novelty, interestingness, elegance, and being embedded in a design system). The outcome of the evaluation was considered positive as the model was shown to satisfactorily meet the criteria against which it was evaluated.



Notes:

1. General and specific strategies necessary to be implemented by governments for improving the usability of e-government websites. Detailed guidelines for governments are provided in section 7.2.1.1 and section 7.2.2.1.
2. General and specific strategies to be implemented by IT staff responsible for developing e-government websites in order to improve usability of e-government websites. Detailed guidelines for IT staff are provided in section 7.2.1.2 and section 7.2.2.2.
3. General and specific strategies to be implemented by evaluators in improving usability of e-government websites in SSA. Detailed guidelines for evaluators are presented in section 7.2.1.3 and section 7.2.2.3.
4. General and specific strategies needed from users to advance usability of e-government websites in SSA. Detailed guidelines for users are presented in section 7.2.1.4 and section 7.2.2.4.
5. National indicators necessary for creating a favourable environment for e-government development and advancing the usability of e-government websites in SSA. Detailed discussion on the role of these national indicators is presented in section 7.3.

Figure 9. 2: Contribution of the study - Policy-ingrained model

The developed and evaluated model could serve as a roadmap for guiding various stakeholders involved in the e-government website development process to thrive towards developing usable e-government websites in SSA. While the model was developed with SSA as the case study, it could also be applicable to other regions with similar characteristics and usability issues. In addition to the main DSR contribution, which is the policy-ingrained model, the study also presented other knowledge contributions.

9.5.2. Other contributions

This thesis provided several contributions to the existing knowledge base. Firstly, Kirui and Kemei (2014) have highlighted the shortage of e-government website usability studies in SSA. E-Government websites have been noted as the primary platform for e-government development, and the current poor state of their usability was hampering e-government progress. Researchers (Asiimwe & Lim, 2010; Bwalya & Healy, 2010; Kirui & Kemei, 2014; Ray, 2011) have highlighted that poor usability was a key contributing factor to the failure of e-governments initiatives. However, usability issues cannot be addressed if there is limited understanding of extant usability issues plaguing e-government websites in SSA. This study bridged the gap by providing one of the most comprehensive usability evaluations of SSA e-government websites to date. This conclusion is based on a thorough review of the literature on the usability of e-government websites in SSA using popular research databases (e.g. EBSCOhost, Science direct) and search engines (e.g. Google). The evaluation included 279 e-government websites from 31 SSA countries using both heuristic evaluations and automated usability testing methods.

Secondly, this study adopted the six-dimensional usability framework for e-government development because it was specifically designed for e-government websites. This study showed that the six-dimensional framework was comprehensive enough to present a detailed overview of the state of e-government development in SSA. Even though only a few studies have used the complete framework (Baker, 2004, 2007 & 2009; Bouazza & Chebli, 2016; Cai, 2010; Dan *et al.*, 2013; Kaan, 2007; Roach, 2007; Roach & Cayer, 2010; Stowers, 2002) a review of prior usability studies (Al-Khalifa, 2010; Al-Soud & Nakata, 2011; Asiimwe & Lim, 2010; Byun & Finnie, 2011; Eidaroos *et al.*, 2009; Harfoushi *et al.*, 2012; King & Youngblood, 2016; Kinsell & DaCosta, 2014 Kituyi & Anjoga, 2013; Maheshwari *et al.*, 2007; Venkatesh *et al.*, 2014) indicated that the variables used in the studies were often a subset of variables included in the six-dimensional framework. This showed that the six-dimensional framework was useful in the evaluation of e-government websites, as its tenets could be observed across a wide range of e-government usability studies.

Additionally, some e-government usability studies have focused on the Nielsen heuristics. However, a review of accessibility evaluation based on WCAG 2.0 indicated an overlap between WCAG 2.0 guidelines and Nielsen heuristics (Table 3.6). Consequently, Nielsen heuristics were taken into account when conducting the evaluation as WCAG 2.0 was used as the standard for evaluating the accessibility of e-government websites in SSA. This formed the evaluation under the accessibility accommodation dimension of the six-dimensional framework.

Furthermore, this study used the UsabAIPO website usability heuristics to evaluate the usability of e-government websites in SSA and showed that the findings from the UsabAIPO had a significant strong positive correlation with the six-dimensional framework, as well as a reliability Cronbach's alpha of 0.863. This suggested that the six-dimensional usability framework painted a similar picture of a website's usability compared to the general website usability metrics of the UsabAIPO, which have been rigorously evaluated by 15 HCI teams from different universities (Gonzalez *et al.*, 2009).

Thirdly, several researchers (Hui & Hayllar, 2010; Karkin & Janssen, 2014; Karunasena & Deng, 2012) have presented the public value perspective of e-government websites as an important dimension for evaluating the quality of e-government websites. This study further extended the literature on e-government website public values by showing its apparent overlap with the usability of e-government websites based on the six-dimensional framework. As such, the apparent calls for incorporating user-oriented website design approaches for improving public values of e-government websites (Karkin & Janssen 2014) was by some means a demonstration of the importance of enhancing the usability of e-government websites.

Fourthly, Chapter 2 presented a concise systematic review of the factors influencing the adoption of e-government solutions in SSA and found usability to be of utmost importance. Most studies in SSA were based primarily on the TAM and showed that ease of use and usefulness played a significant role in the adoption of e-government solutions (Bwalya, 2011; Lin *et al*., 2011; Rukiza *et al.*, 2011). While ease of use is an apparent usability construct, this study also showed that usefulness was highly dependent on usability (Buchanan & Salako, 2009).

Moreover, other factors that influence e-government adoption in SSA, such as accessibility, local language, trust (i.e. security and privacy), and user-help (Asianzu & Maiga, 2012; Bwalya, 2011; Muraya, 2015; Rukiza *et al.*, 2011) are all components of the six-dimensional usability framework. Likewise, Komba and Ngulube (2015) in Tanzania showed that website quality influenced citizen adoption of e-government. This, too, could be associated with e-government usability, as website quality relates to public values of e-government websites (Karkin & Janssen 2014), which are seen to overlap with the usability of e-government websites. This, therefore, further confirms the view that usability plays a central role in the adoption and overall diffusion of e-government services in SSA, especially as e-government websites are the main platforms for e-government service delivery.

Fifthly, this study extended the current knowledge on e-government development in SSA by providing additional secondary analysis from the existing UN E-Government Development Survey reports. For example, this study used independent sample T-tests to examine the existence of significant changes in e-government development across the four regions in SSA. The findings also showed that overall e-government developing in SSA was significantly on the rise between 2014 and 2016. Additionally, countries that were progressing and those plummeting were presented along with the percentage changes in their e-government development. This provided an additional level of analysis of e-government development in SSA that was not covered in the analysis published in the UN E-Government Development Survey.

Sixthly, this study also makes a valuable contribution through the presentation of a quick assessment checklist that can be used by IT staff of government agencies to evaluate the usability of their websites. Checklists for usability diagnostics have been commended for their quick approach to easily highlight usability issues (Gomez, Caballero & Sevillano, 2014; Ji, Park, Lee & Yun, 2006; Singh, 2010). The checklist created and recommended by this study consolidates the extant knowledge on e-government usability and operationalises the heuristic evaluation variables in a simple and straightforward manner. The significance of this is that it can be used effortlessly by novice evaluators and government practitioners for diagnostic purposes in order to easily determine priority areas for addressing the usability of e-government websites. The checklist could also stimulate the development of further literature, especially with regards to checklist-based evaluation of e-government websites. Furthermore, future studies could integrate this checklist as part of the measurement tools for usability evaluation.

Lastly, this study presented eight national indicators that significantly influenced e-government development. For over a decade, national income was the only national indicator associated with e-government development (UNDESA, 2016). However, there were several outliers in the association between national income and the EGDI that suggested that national income alone was not sufficient to capture the whole variance in e-government development (UNDESA, 2014). As such, this study presented other national indicators significantly associated with e-government development and published the findings in a peer-reviewed conference paper (Appendix G). One of the national indicators introduced in the publication was corruption, operationalised in terms of the CPI by transparency international.

The release of the 2016 UN e-government development index included corruption and global competitiveness in addition to national income. The inclusion of corruption suggested that the initial findings published from this study were consistent with the views from the UN E-Government Development Survey. As such, the other five national indicators (i.e. innovation, gender inequality, human development, cybersecurity and population age distribution) shown in this study to influence e-government development were likely to further contribute to the existing knowledge base and provide a basis for inclusion in future UN E-Government Development Surveys.

9.6. Recommendations for Future Studies

After completing this study, there are several recommendations for future studies. The first one is for future studies to focus on country-specific e-government usability studies in SSA to evaluate all, or at least the majority, of e-government websites within the country. This study painted a picture of the usability of e-government websites with just nine websites from each of the 31 countries. However, country-specific studies could be conducted to evaluate the entire set of e-government websites to identify all possible usability issues plaguing a country’s e-government websites.

The second recommendation relates to the extension of the developed model, as discussed in Chapter 8. Future studies in SSA could conduct user-based usability evaluations of e-government websites and incorporate unique usability issues identified from the user-testing into the mental models proposed in this study.

The last recommendation is for future studies to extend the evaluation of the association of national indicators with e-government development and the usability of e-government websites. This study showed eight national indicators that had a significant association with e-government development and the usability of e-government websites. A case study of Israel was also introduced to further evaluate this association. However, it is imperative for future studies to use a broader set of countries across the world to further confirm this association. These associations could also be introduced in future UN E-Government Development Surveys.

9.7. Final Note

This chapter provided a conclusion to this study by summarising the main activities of the study and discussing how the objectives were attained. After establishing an awareness of the poor usability state of e-government websites and its negative consequences on the diffusion of e-government, this study sought to develop a model for improving the usability of e-government websites in SSA. The DSR paradigm and associated methodology were adopted to develop the model. Following the three DSR cycles of relevance, rigour, and design, a policy-ingrained artefact (in the form of a model was developed) for improving the usability of e-government websites in SSA. This artefact served as the primary research contribution of the study.

In an attempt to achieve the primary objective, several secondary objectives were established. The process of attaining these secondary objectives also resulted in the creation of new knowledge contributions to both theory and practice. This chapter then culminated with a discussion of the limitations of the study and recommendations for future studies.

REFERENCES

Abdelsalam, H.M., Reddick, C.G., & Elkadi, H.A. (2012). Egyptian local government website portals: Examining maturity levels and Human Development Indicators. In K.J. Bwalya & S. Zulu (Eds). *Handbook of Research on E-Government in Emerging Economies: Adoption, E-participation, and Legal Frameworks* (pp. 20-36). Hershey, PA: Information Science Reference

ABI Research. (2014). Global cybersecurity index & Cyber wellness profiles. Retrieved from: https://www.itu.int/dms_pub/itu-d/opb/str/d-str-secu-2015-pdf-E.pdf

Abu-Shanab, E.A. (2016). E-government familiarity influence on Jordanians' perceptions. *Telematics and Informatics*, 34(1), 103-113. Doi:http://dx.doi.org /10.1016/j.tele.2016.05.001

Abu-Shanab, E.A. (2016). Global Competitiveness Improvement: E-Government as a Tool. *International Journal of Innovation, Management and Technology*, 7(3), 111-114. Doi: 10.18178/ijimt.2016.7.3.655

Acharya, K.R. (2015). Aging, E-literacy, and Technology: Participatory 25 User-Centered Design for Older Adults' Digital 26 Engagement. *Journal of Literacy and Technology*, 16(2), 2-32.

Adamson, K. A., & Prion, S. (2013). Reliability: Measuring Internal Consistency Using Cronbach's α. *Clinical Simulation In Nursing*, 9(5), e179-e180. doi:10.1016/ j.ecns.2012.12.001

Adepoju, S., Shehu, I., & Baker, P. (2016). Accessibility Evaluation and Performance Analysis of E-government Websites in Nigeria. *Journal of Advances in Information Technology*, 7(1), 49-53

Affisco, J., & Soliman, K. (2006). E-government: A strategic operations management framework for service delivery. *Business Process Management Journal*, 12(1), 13−21

Agarwal, R., & Prasad, J. (1998). A conceptual and operational definition of personal innovativeness in the domain of information technology. *Information Systems Research*, 9, 204–215

Agerfalk, P. (2013). Embracing diversity through mixed methods research. *European Journal of Information System*, 22(3), 251–256. doi:10.1057/ejis.2013.6

Ahmad, N., Shoaib, U., & Prinetto, P. (2015). Usability of Online Assistance From Semiliterate Users' Perspective. *International Journal Of Human-Computer Interaction*, 31(1), 55-64. doi:10.1080/10447318.2014.925772

Ahmed T.T. (2013). Factors influencing citizen's usage of e-government services in developing countries: the case of Egypt. *International Journal of Information Technology and Business Management*, 15(1), 113–121

Aida, A., & Majdi, M. (2014). National Culture and E- Government Services adoption Tunisian case. *International Journal of Business & Economic Strategy (IJBES)*, 1, 1-5

Aier, S., & Fischer, C. (2011). Criteria of Progress for Information Systems Design Theories. *Information Systems and e-Business Management*, 9, 133-172

Aizpurua, A., Arrue, M., Harper, S., & Vigo, M. (2014). Are users the gold standard for accessibility evaluation? New York, NY: ACM. doi:10.1145/2596695 .2596705

Aliyu, A.Y., Bello, M.U., Kasim, R., & Martin, D. (2014). Positivist and Non-Positivist Paradigm in Social Science Research: Conflicting Paradigms or Perfect Partners? *Journal of Management and Sustainability*, 4(3), 79-95

Al-Soud, A.R., & Nakata, K. (2011). Evaluating e-government websites in Jordan: Accessibility, usability, transparency and responsiveness. *Progress in Informatics and Computing*, 761-765

Ajzen, I. (1991): The Theory of Planned Behavior. *Organizational Behavior and Human Decision Processes*, *50*, 179—211

Aken, J.V. (2013). Two hurdles to take for maximum impact of Design Science research in the IS-Field. In M. Helfert, B.Donnellan & J. Kenneally (Eds), *Design Science: Perspectives from Europe* (pp. 21- 27). Switzerland: Springer International Publishing

Akgul, Y. (2015). Web Content Accessibility of Municipal Websites in Turkey. In C. Addams (Ed). *Proceedings of the 15th European Conference on eGovernment 2015: ECEG 2015* (pp. 1- 8). University of Portsmouth, UK

Akgul, Y., & Vatansever, K. (2016). Web Accessibility Evaluation of Government Websites for People with Disabilities in Turkey. *Journal of Advanced Management Science*, 4(3), 201-210

Akkaya, C., Wolf, P., & Krcmar, H. (2012, January 4-7). Factors Influencing Citizen Adoption of E-Government Services: A cross-cultural comparison (Research in Progress). *Paper presented at 45th Hawaii International Conference in System Science* (HICSS)(pp. 531-2540), . DOI 10.1109/HICSS.2012.278

Al Mourad, B., & Kamoun, F. (2013). Accessibility Evaluation of Dubai E-government Websites: Findings and Implications. *Journal of E-Government Studies and Best Practices*. Article ID. 978647, DOI: 10.5171/2013. 978647

Aladawi, Z., Yousafzai, S., & Pallister, J. (2005, September 26-28). Conceptual Model Of Citizen Adoption Of E-Government. *The Second International Conference on Innovations in Information Technology (IIT'05)*. Dubai, UAE

Aladwani, A. (2016). Corruption as a source of E-government projects failure in developing countries: A theoretical exposition. *International Journal of Information Management*, 31(1), 105-112

Alawadhi, S., & Morris, A. (2009). Factors Influencing the Adoption of E-government Services. *Journal of Software*, 4(6), 584-590

Alawneh, A., Al-Refai, H., & Batiha, K. (2013). Measuring user satisfaction from e-Government services: Lessons from Jordan. *Government Information Quarterly, 30(3),* 277-288. DOI: http://dx.doi.org/10.1016/j.giq.2013.03.001

Al-Badi, A.H. (2009). Designing Usable Localised Websites: Differences between Western and Arab Cultures. *IBIMA Business Review, 2, 9-19*

Albayrak, D., & Çaġiltay, K. (2013, October 23-26). Analyzing Turkish e-government websites by eye tracking. *International Workshop on Software Measurement (IWSM) and International Conference on Software Process and Product Measurement*. Ankara, Turkey. DOI: 10.1109/IWSM-Mensura.2013.39

Albers, M.J., & Still, B. (2011). *Usability of Complex Information Systems: Evaluation of User Interaction*. Broken Sound Parkway, NW: CRC Press

Aldrich, D., Bertot, J. C., & McClure, C. R. (2002). E-Government: Initiatives, Developments, and Issues. *Government Information Quarterly*, 19(4), 349-55

Aleixo , C., Nunes, M., & Isaias, P. (2012) Usability and Digital Inclusion: Standards and Guidelines. *International Journal of Public Administration*, 35(3), 221-239. DOI: 10.1080/01900692.2011.646568

Alesina, A., & Zhuravskaya, E. (2012). Segregation and the Quality of Government in a Cross Section of Countries. *American Economic Review, 101*, 1872-1911

Alexander, D. (2003, July 5-9). How accessible are Australian university Web sites? *In Proceedings of AusWeb03, Ninth Australian World Wide Web Conference* (pp. 70–82). Gold Coast, Queensland, Australia

AlFawwaz, B., M., (2012). Evaluation of E-government Websites Usability in Jordan (Doctoral thesis, Brunel University, London, United Kingdom). Retrieved from: http://bura.brunel.ac.uk/handle/2438/6155

Alghamdi, S., & Beloff, N. (2014). Towards a Comprehensive Model for E-Government Adoption and Utilisation Analysis: The Case of Saudi Arabia. *In Proceedings of the 2014 Federated Conference on Computer Science and Information Systems,* Poland (pp. 1217–1225). DOI: 10.15439/2014F146

Alguliyev, R. (2015). The Effective Mechanisms in Monitoring and Management of E-Government. *Journal of Public Administration and Governance*, 5(2), 55-61

Al-Hassan, M. (2014). Semantic-Enhanced Hybrid Recommender Systems for Personalised E-Government Services (Doctoral thesis, University Of Technology, Sydney, Australia). Retrieved from: https://opus.lib.uts.edu.au/bitstream/10453/30504/2/02 whole.pdf

Al-Hassan, M., Lu, H., & Lu, J. (2009, December 14 -19). A framework for delivering personalized e-government services from a citizen-centric approach. The Eleventh International Conference on Information Integration and Web-based Applications and Services. Kuala Lumpur, Malaysia: ACM. DOI: 10.1145/1806338.1806419

Al-Hujra, O., Al-dalahmeh, M., & Aloudat, A. (2011). The Role of National Culture on Citizen Adoption of eGovernment Services: An Empirical Study. *Electronic Journal of E-government*, 9(2), 93 – 106

Al-Hujran, O., Al-Debei, M., Chatfield, A., & Migdadi, M. (2015). The imperative of influencing citizen attitude toward e-government adoption and use. *Computers in Human Behavior*, 53, 189-203

Ali, M., Weerakkod, V., & El-Haddadeh, R. (2009, August 6-9). The Impact of National Culture on E-Government Implementation: A Comparison Case Study. Fifteenth Americas Conference on Information Systems, San Francisco, California

Alison, H., & Hobbs, R. (2012). *Science and Policy in Natural Resource Management: Understanding System Complexity*. Cambridge: Cambridge University Press

Al-Khalifa, H.S.. (2010). Heuristic evaluation of the usability of e-government websites: a case from Saudi Arabia. *ICEGOV*. DOI: 10.1145/1930321.1930370

Al-Khattab, A., Al-Shalabi, H., Al-Rawad, M., Al-Khattab, K., & Hamad, F. (2015). The Effect of Trust and Risk Perception on Citizen's Intention to Adopt and Use E-Government Services in Jordan. *Journal of Service Science and Management, 8*, 279-290

Alomari, M. (2014). Discovering citizen's reaction toward e-government: factors in e-government adoption. *Journal of Information Systems and Technology Management, 11(1)*. DOI: http://dx.doi.org/10.4301/S1807-17752014000100001

Alsaeed, A., Adams, C., & Boakes, R. (2014). The Need for Policies to Overcome eGov Implementation Challenges. *International Journal Of Electronic Government Research*, 10(3), 66-79. Doi:10.4018/ijegr.2014070105

Alsaghier, H., & Hussain, R. (2012). Conceptualization of Trust in the E-government Context: A Qualitative Analysis. In A. Manohran & M. Holzer (Eds). *Active Citizen Participation in E-Government: A Global Perspective* (pp. 528-557). New York, NY: Information Science Reference

Al-Shafi, S & Weerakkody, V. (2010, April 12-13). Factors affecting e-government adoption in the state of Qatar. European and Mediterranean Conference on Information Systems, Abu Dhabi, UAE. Retrieved from: http://core.ac.uk/download/pdf/336 865.pdf

Al-Shafi, S., & Weerakkody, V. (2011). Implementing Free Wi-Fi in Public Parks: An Empirical Study in Qatar. In V. Weerakkody (Ed.), *Applied Technology Integration in Governmental Organizations: New E-Government Research* (pp. 201-214). Hershey, PA: Information Science Reference. Doi:10.4018/978-1-60960-162-1.ch012

Alshehri, M., & Drew, S. (2010, December 10-11). E-Government Fundamentals. *IADIS International Conference ICT, Society and Human Beings*, Algarve, Portugal. Retrieved from: http://www98.griffith.edu.au/dspace/bitstream/handle/10072/37709/67525_1.pdf

Alshehri, M., & Drew, S.J. (2011). E-government principles: implementation, advantages and challenges. *International Journal of Electronic Business*, *9*(3), 255–270

Alsmadi, I. (2014). Website Performance Measurement: Process & Product Metrics. In Information Resources Management Association (Ed). *Software Design and Development: Concepts, Methodologies, Tools, and Applications* (pp. 1801-1826). Hershey, PA: Information Science Reference

Al-Sobhi, F., & Weerakkody, V. (2011). The roles of intermediaries in E-government Difussion and adoption: A case study of Madinah City in Saudi Arabia. In M.A. Shareef, V. Kumar, U. Kumar & Y.K. Dwivedi (Eds). *Stakeholder Adoption of E-Government Services: Driving and Resisting Factors* (pp. 103-115). Hershey, PA: Information Science Reference

Altschiller, D. (2014). The Government and politics of the Middle East and North Africa. *Choice: Current Reviews For Academic Libraries*, 51(6), 982-983

Al-Zaabi, H. (2013). Adoption, Diffusion and Use of E-Government Services in the Abu Dhabi Police Force. (Doctoral thesis, University of Hertfordshire, England) Retrieved from: https://uhra.herts.ac.uk/bitstream/handle/2299/10757/05115377%20Al-Zaabi%20Hassan%20final%20PhD%20submission.pdf?sequence=1

Alzahrani, L., Al-Karaghouli, W., & Weerakkody, V. (2016). Analysing the critical factors influencing trust in e-government adoption from citizens' perspective: A systematic review and a conceptual framework. *International Business Review*, Doi: http://dx.doi.org/10.1016/j.ibusrev.2016.06.004

Ampah, M., & Sudan, R. (2016). Ghana's e-government public-private partnership and the value of long-term strategies. Retrieved from: http://blogs.worldbank.org/ppps/ghana-s-e-government-public-private-partnership-and-value-long-term-strategies

Andersen, K.V. & Henriksen, H.Z. (2006) E-government maturity models: extension of the Layne and Lee model. *Government Information Quarterly*, 23(2), 236-248

Ansari, R. F., Baqar, A., Hassan, H., & Saeed, F. (2016). Heuristic, accessibility and usability evaluations of Pakistan's e-government websites. *Electronic Government: An International Journal*, 12(1), 66-85. Doi:10.1504/EG.2016.074247

Anthopoulos, L., & Fitsilis P. (2014). Trends in e-strategic management: How do governments transform their policies? *International Journal of Public Administration in the Digital Age*, 1(1), 15–38

Anthopoulos, L., Reddick, C., Giannakidou, I., & Mavridis, N. (2015). E-government as an Innovative Product: Theories and Case Study. In C. Reddick & L. Anthopoulos (Eds). *Information and Communication Technologies in Public Administration* (pp.125-140). Broken Sound Parkway, NW: CRC Press

Antonio, A., & Tuffley, D. (2014). The Gender Digital Divide in Developing Countries. *Future Internet,* 6, 673-687. Doi:10.3390/fi6040673

Aramo-Immonen, H. (2013). Mixed Methods Research Design. Communications in Computer and Information Science, 278, 32-43. Doi: 10.1007/978-3-642-35879-1_5

Arslan, A. (2009). Cross-Cultural Analysis of European E-Government Adoption. *World Applied Sciences Journal*, 7(9), 1-14

Asianzu, E., & Maiga, G. (2012, May 9-11). A Consumer Based Model for Adoption of E-Tax Services in Uganda. *IST-AFRICA Conference*, Dar es Salaam, Tanzania. Retrieved from: http://www.ist-africa.org/home/outbox/ISTAfrica_Paper_ref_564772.pdf

Asiimwe, E., & Lim, N. (2010). Usability of Government Websites in Uganda. *Electronic Journal of E-government,* 8 (1), 1 – 12

Asogwa, B. (2015). E-government Development in Africa: An Assessment of Status of Sub-Regional practices (pp. 1-20). In S. Sohdi (Ed.). *Emerging Issues and Prospects in African E-Government*. New York, NY: Information Science Reference

Avison, D. and Pries-Heje, J. (2005) *Research in Information Systems: A handbook for research supervisors and their students.* Oxford: Elsevier Ltd

Awotwi, J.A. (2011). The Ghana Community Services LTD (GCNet) Implementation Challenges. In P. Danilo (Ed). Global Strategy and Practice of E-Governance: Examples from Around the World (pp. 209-230). New York, NY: Information Science Reference

Bagui, L., & Bytheway, A. (2013). Exploring E-Participation in the City of Cape Town. *The Journal of Community Informatics*, 9(4). Retrieved from: http://ci-journal.net/ index.php/ciej/article/view/982/1052

Baker, D. L. (2009). Advancing E-Government performance in the United States through enhanced usability benchmarks. *Government Information Quarterly*, 26(1), 82-88. Doi:10.1016/j.giq.2008.01.004

Baker, D.L. (2004). E-government: Website Usability of the Most Populous Counties. (Unpublished doctoral dissertation, Arizona State University, USA)

Baker, D.L. (2007). Website usability of the most populous counties in the United States. *Journal of E-government,* 3(3), 65-89

Bakhsh, M., & Mehmood, A. (2012, December 17-19). Web Accessibility for Disabled: A Case Study of Government Websites in Pakistan. *In proceedings of the 10th International Conference on Frontiers of Information Technology* (pp. 342-347). Islamabad, Pakistan. DOI 10.1109/FIT.2012.68

Baker, E., Al-Gahtani, S., & Hubona, G. (2007). The Effects of Gender and Age on New Technology Implementation in a Developing Country: Testing the Theory of Planned Behaviour (TPB). *Information Technology and People,* 20(4), 352-375

Beldad, A, Van der Geest, T., De Jong, M., & Steehouder, M. (2012). A Cue or two and Trust You: Determinants of Trust in Government Organizations in Terms of their Processing and Usage of Citizens' Personal Information Disclosed Online. *Government Information Quarterly,* 29(1), 41–49

Baležentis, A., & Paražinskaitė, G. (2012). The Benchmarking of the Government to Employee (G2E) Technology Development: Theoretical Aspects of the Model Construction. *Social Technologies*, 2(1), 53-66

Bannister, F., & Connolly, R. (2015). The great theory hunt: Does e-government really have a problem?. *Government Information Quarterly*, 32(1), 1-11

Bannister, F., & Connolly, R. (2014). ICT public values governance: a framework and programme for research. *Government Information Quarterly*, 31(1), 119-128

Barber, W., & Badre, A. (1998). *Culturability: The merging of culture and usability. Presented at the Conference on Human Factors and the Web, Basking Ridge*. New Jersey, NJ: AT&T Labs

Barzilai-Nahon, K. (2006). Gaps and Bits: Conceptualizing Measurements for Digital Divide/s. *Information Society,* 22(5), 269-278. Doi:0.1080/01972240600903953

Baskerville, R.L., Kaul, M., & Storey, V.C. (2015). Genres of Inquiry in Design-Science Research: Justification and Evaluation of Knowledge Production. *MIS Quarterly,* 39(3), 541-564

Bertot, J.C., Jaeger, P.T., & Grimes, J.M. (2010). Using ICTs to create a culture of transparency? E-government and social media as openness and anti-corruption tools for societies. *Government Information Quarterly*, 27, 264–271

Bevan, N. (2005). Guidelines and Standards for Web Usability. Retrieved from: http://www.nigelbevan.com/papers/web%20usability%20standards.pdf

Bevan, N. (2009, July 19-24) Extending quality in use to provide a framework for usability measurement. HCI International 2009, San Diego, California, USA

Bevan, N., Kirakowski, J., & Maissel, J. (1991). What is Usability? In H.J. Bullinger, (Ed.). *Human Aspects in Computing: Design and use of interactive systems and work with Terminals*. Amsterdam: Elsevier

Bevan, N., Petrie, H., & Claridge, N. (2007). Tenuta: Strategies for Providing Guidance on Usability and Accessibility. *Lecture Notes in Computer Science*, 4556, 20-27

Beynon-Davies, P. (2013). *Business Information Systems*. London: Palgrave Macmillan

Bishop, S., Shuman, J., & Vodnik, S. (2015). T*he Web Collection Revealed Creative Cloud*. Boston, MA: Cengage Learning

Blasius, M., & Greenacre, J. (2006). *Multiple Correspondence Analysis and Related Methods*. Broken Sound Parkway, NW: Chapman & Hall

Blythe, J. (2014). *Principles and Practice of Marketing (3rd Edition)*. London: SAGE Publications Ltd

Boon, N., Ramayah, T., Ping, T., & Lo, M. (2013). Intention to use E-government Websites among University Sains Malaysia (USM) students. In O. Pablos et al. (Eds). *E-Procurement Management for Successful Electronic Government Systems* (pp. 169-180). New York, NY: IGI Global

Borsci, S., Kurosu, M., Federici, S., & Mele, M.L. (2014*).* *Computer Systems Experiences of Users with and Without Disabilities: An Evaluation guide for professionals*. Broken Sound Parkway, NW: CRC Press

Botella, F., Alarcon, E., & Penalver, A. (2013). A new proposal for improving heuristic evaluation reports performed by novice evaluators. *Proceedings of the 2013 Chilean Conference on Human - Computer Interaction (72-75)*. New York, NY: ACM

Botella, F., Alarcon, E., & Penalver, A. (2014). How to classify to experts in usability evaluation. *In Proceedings of the XV International Conference on Human Computer Interaction* (pp. 25:1 – 25:4). New York, NY: ACM. DOI: 10.1145/ 2662253.2662278

Bouazza, A., & Chebi, H. (2016). Digital Governance: A Usability Study of Omani E-government Websites. In S.I. Singh (Eds). *Trends, Prospects, and Challenges in Asian E-Governance*. New York, NY: Information Science Reference

Bozeman, B. (2007). *Public Values and Public Interest: Counterbalancing Economic Individualism*. Washington, DC: Georgetown University Press

Brink, H., Van der Walt, C. & Van Rensburg, G. (2006). *Fundamentals of research methodology for health care professionals (2nd ed)*. Cape Town: Juta

British Standard Institute. (2005). British Standard 7000-6:2005. Design Management Systems Managing Inclusive Design

Brocke, J., & Lippe, L. (2010). Taking a project management perspective on design science research. *Lecture Notes in Computer Science*, 6105, 31-34

Brown, M. M. (2003). Digital government innovation. School of Government, University of North Carolina at Chapel Hill. Retrieved from: http://ncinfo. iog.unc.edu/ pubs/ electronicversions/pdfs/dgib0301.pdf

Buchanan, S., Salako, A. (2009). Evaluating the usability and usefulness of a digital library. *Library Review*, 58 (9), 638 – 651. Doi: http://dx.doi.org/10.1108/002 4253091099 7928

Buffat, A. (2015). Street-Level Bureaucracy and E-Government. *Public Management Review*, 17(1), 149-161. Doi:10.1080/14719037.2013.771699

Burke, M. (2012). A Decade of e-government Research in Africa. *The African Journal of Information and Communication*, 12, 1-25

Butt, M. (2014). Result-oriented e-government evaluation: Citizen's perspective. *Webology*, 11(1), 1-33

Bwalya, K.J. (2009). Factors affecting adoption of e-government in Zambia. *Electronic Journal of information Systems in Developing countries, 38*(4), 1-13

Bwalya, K.J. (2011). *E-government adoption and synthesis in Zambia: context, issues and challenges* (Doctoral thesis, University of Johannesburg, Johannesburg, South Africa). Retrieved from: http://hdl.handle.net/10210/7905

Bwalya K. J., & Healy, M. (2010). Harnessing E-government Adoption in the SADC Region: a Conceptual Underpinning. *Electronic Journal of E-government*, 8 (1), 23 – 32

Bwalya, K.J., & Mutula, S. (2014). *E-Government: Implementation, Adoption and Synthesis in Developing Countries*. Berlin: Walter de Gruyter GmbH

Byun, D.H., & Finnie, G. (2011). Evaluating usability, user satisfaction and intention to revisit for successful e-government websites. *Electronic government, an international journal*, 8(1), 1-19

Cai, J. (2010). Evaluation of Health Service on Hong Kong government website. (Master's Dissertation, The University of Sheffield, England). Retrieved from http://dagda.shef.ac.uk/dispub/dissertations/2009-10/External/Jcai_CAI_090125214.pdf

Cardello, J. (2013). HealthCare.gov's Account Setup: 10 Broken Usability Guidelines. Nielsen Norman Group. Retrieved from: https://www.nngroup.com/articles/affordable_care_act_usability_issues/

Cardello, J. (2014). The difference between information architecture (IA) and navigation. Retrieved from: https://www.nngroup.com/articles/ia-vs-navigation/

Carmien, F., & Mohamad, Y. (2008). Analysis of User Requirements in E-Accessibility Training Materials for Industry. Retrieved from: http://www.dfaei.org/deliverables/D5.1.pdf

Carson, D., Gilmore, A., Perry, C., & Gronhaug, K. (2001). *Qualitative marketing research*. London: Sage

Carter, L., & Bélanger, F. (2004a, January 5-8). Citizen adoption of electronic government initiatives. *Hawaii International Conference on System Sciences*, Big Island, Hawaii

Carter, L., & Bélanger, F. (2004b). The Influence of Perceived Characteristics of Innovating on E-government Adoption. *Electronic Journal of E-government, 2(1), 11-20*

Carter, L., & Bélanger, F. (2005). The utilization of e-government services: citizen trust, innovation and acceptance factors. *Information Systems Journal*, 15(1), 5-25. Doi:10.1111/j.1365-2575.2005.00183.x

Chadwick-Dias, A., McNulty, M., & Tullis, T. (2003). Web usability and age;: how design changes can improve performance. *Proceedings of the 2003 Conference on Universal Usability – CUU '03* (pp. 30 – 37). New York, NY: ACM Press

Chamorro-Koc, M., Popovic, V., & Emmison, M. (2009). Human experience and product usability: Principles to assist the design of user-product interactions. *Applied Ergonomics*, 40(4), 648-656. Doi:10.1016/j.apergo.2008.05.004

Chen, J., Yan, Y., & Mingins, C. (2011). A Three-Dimensional Model for E-Government Development with Cases in China's Regional E-Government Practice and Experience. In Management of e-Commerce and E-government (ICMeCG), 2011 Fifth International Conference on (pp. 113–120). Retrieved from http://ieeexplore.ieee.org/xpls/abs_all.jsp?arnumber=6092643

Chen, Y. (2010). Citizen-Centric E-Government Services: Understanding Integrated Citizen Service Information Systems. *Social Science Computer Review*, 28(4), 427-442. Doi: 10.1177/0894439309359050

Cheng, L., Wen, C., Li, E., & Lin, T. (2012). Service innovation activities in e-government initiatives: the Taiwan experience. *International Journal of Services Technology and Management*, 17(1), 54-71

Cho, E., & Kim, S. (2015). Cronbach's Coefficient Alpha: Well Known but Poorly Understood. *Organizational Research Methods*, 18(2), 207-230. doi:10.1177/10 94428114555994

Choi, Y., & Park, S. (2013). Understanding gender inequality in central e-government: A Korean case study. *Government Information Quarterly, 30*(3), 300-309

Chotisarn, N., Plengvittaya, C., Sanpote, D., & Ratchakom, M. (2016) Usability Heuristic Evaluation for Phayao Province E-Government Portal, Thailand. *International Journal of Science*, 13(1), 8 – 16

Choudrie, J., Wisal, J., & Ghinea, G. (2009). Evaluating the usability of developing countries' e-government sites: a user perspective. *Electronic Government*, 6(3), 265-281

Christos, G., Xenia, Z., Antonis, R., Panagiotis, K., Jain, A., Gangadharan, G. R., & Yehia, T. (2013). Applying Open Innovation Strategies to eGovernment for Better Public Services. In J. Gil-Garcia (Ed.), *E-Government Success Factors and Measures: Theories, Concepts, and Methodologies* (pp. 308-331). Hershey, PA: Information Science Reference. doi:10.4018/978-1-4666-4058-0.ch017

Claringbould, I., & Knoppers, A. (2013). Understanding the lack of gender equity in leadership positions in (sport) organisations. In P., Leisink, P., Boselie, D.M., Hosking, & M. van Bottenburg (Eds). *Managing Social Issues: A Public Values Perspective* (pp. 162 – 182). Cheltenham, UK: Edward Elgar Publishing Limited

Clay, B. (2015). *Search Engine Optimization All-in-One For Dummies (3rd Edition).* Hoboken, NJ: John Wiley & Sons, Inc

Clemmensen, T., & Katre, D. (2012). Adapting e-gov usability evaluation to cultural contexts. In E. Buie & D. Murray (Eds). *Usability in Government Systems: User Experience Design for Citizens and Public Servants* (pp. 331-334). Waltham, MA: Morgan Kaufmann

Cloete, F. (2012). E-Government lessons from South Africa 2001- 2011: Institutions, state of progress and measurement. *The African Journal of Information and Communication*, 12, 128-142

Coleman, R., Lieber, P., Mendelson, A. L., & Kurpius, D.D. (2008). Public life and the Internet: If you build a better website, will citizens become engaged? *New Media & Society*, 10(2), 179–201

Coleman, S., Morrison, D. E., & Svennevig, M. (2008). New Media and Political Efficacy. *International Journal of Communication*, 2, 771-791

Cordell, D. (2015, February 28). Cyber Attacks In West Africa Spark It Debates. Retrieved from: https://hacked.com/cyber-attacks-west-africa-spark-debates/

Cordella, A., & Bonina, C.M. (2012). A public value perspective for ICT enabled public sector reforms: a theoretical reflection. *Government Information Quarterly,* 29(4), 512-520

Cordella, A., & Iannacci, F. (2010) Information systems in the public sector: The e-Government enactment framework. *Journal of Strategic Information Systems*, 19(1), 52-66

Costa, D., Fernandes, N., Neves, S., Duarte, C., Hijón-Neira, R., & Carriço, L. (2013, September 2-6). Web Accessibility in Africa: A Study of Three African Domains. *Proceedings of the 14th IFIP TC 13 International Conference*, (pp. 331-338). Cape Town, South Africa

Costa-jussà, M.R., & Fonollosa, J.A. (2015). Latest trends in hybrid machine translation and its applications. *Computer Speech & Language*, 32(1), 1-10

Covington, P. (2008). *Success in Sociology: AS Student Book AQA*. Buckinghamshire: Folens Publishers Limited

Cox, S.A. (2014). *Managing Information in Organizations*. New York, NY: Palgrave Macmillan

Cremers, A., Jansen, Y., Neerinex, M., Schouten, D., & Kayal, A. (2014). Inclusive Design and Anthropological Methods to Create Technological Support for Societal Inclusion. In C. Stephanidis and M.Antona (eds). *Universal Access in Human-Computer Interaction: Design andDeelopment Methods for Universal Access* (pp. 31-42). New York, NY: Sringer

Creswell, J. (2012). Educational research: Planning, conducting, and evaluating quantitative and qualitative research (4th ed.). Upper Saddle River, NJ: Pearson Education

Creswell, J.W. (2014). R*esearch Design: Qualitative, Quantitative, and Mixed Methods Approaches.* London: SAGE Publications Ltd

Cruz-Cunha, M., & Moreira, F. (2011). *Handbook of Research on Mobility and Computing: Evolving Technologies and Ubiquitous Impacts*. Hershey, PA: IGI Global. Doi:10.4018/978-1-60960-042-6

Cyr, D., & Bonanni, C. (2005). Gender and Website design in e-business. *International journal of Electronic business, 3*(6), 565-582

da Silva, H.P., & da Silva, L.O. (2010). Digital inclusion and electronic government: Looking for convergence in the decade 1997 – 2008. In H. Rahman (Ed). *Handbook of Research on E-Government Readiness for Information and Services Exchange: Utilizing progressive information communication technologies* (pp. 21- 47). New York, NY: Information Science reference

Dabalen, A., Narayan, A., Saavedra-Chanduvi, J., & Suarez, C. (2015). *Do African Children Have an Equal Chance?: A Human Opportunity Report for Sub-Saharan Africa*. New York, NY: World Bank

Dan, B., Yahel, G., & Nitzan, G. (2013). The Usability of Israel‟s Government Websites. *International Journal of E-Business Development*, 3(4), 188-198

Danila, R., & Abdullah, A. (2014). User's Satisfaction on E-government Services: An Integrated Model. *Procedia - Social and Behavioral Sciences, 164,575-582*

Darem, A.B. & Suresha (2012). Experimental Evaluation of Effectiveness of E-Government Websites. *International Journal of Emerging Technology and Advanced Engineering*, 2(11), 469-473

Davis, F., Bagozzi, R., Warshaw, P. (1989). User acceptance of computer technology: A comparison of two theoretical models. *Management Science,* 35, 982–1003

De Bruin, J.A., Malan, K.M., Eloff, J.H.P. and Zielinski, M.P. (2014). The use of a benchmark fixation deviation index to automate usability testing. In Pedro Gamito and Pedro Rosa (Eds) *I see me, you see me: inferring cognitive and emotional processes from gazing behaviour (pp. 104-124).* United Kingdom: Cambridge Scholars Publishing

De Róiste, M. (2013). Bringing in the users: The role for usability evaluation in eGovernment. *Government Information Quarterly,* 30(4), 441-449. doi:10.1016/ j.giq.2013.05.007

De Vet, H., Terwee, C., Mokkink, L., & Knol, D. (2011*). Measurement in Medicine: A Practical Guide.* Cape Town: Cambridge University Press

De Vet, H.C., Terwee, C.B., Mokkink, L.B., & Knol, D.L. (2011). *Measurement in Medicine: A Practical Guide.* New York, NY: Cambridge University Press

Deka, G. C. (2013). Role of E-Governance in Citizen Centric E-Government. In Z. Mahmood (Ed.). *Developing E-Government Projects: Frameworks and Methodologies* (pp. 182-203). Hershey, PA: Information Science Reference. doi:10.4018/978-1-4666-4245-4.ch009

Dekker, R., & Bekkers, V. (2015). The contingency of governments' responsiveness to the virtual public sphere: A systematic literature review and meta-synthesis. *Government Information Quarterly*, 32(4), 496-505

Delopoulos, H.N. (2015). A usability evaluation of e-government services: the case of e-deliberation service of Greece. *International Journal of Electronic Governance,* 7(2), 93 – 112

Desikan, S., & Ramesh, G. (2006). *Software Testing: Principles and Practice*. India: Dorling Kindersley

Dillon, A. (2001). Evaluation of software usability. In W. Karwowski (Eds). *International Encyclopedia of ergonomics and human factors*. (pp. 1110 - 1112). New York, NY: Taylor & Francis

Ding, W., & Lin, X. (2010). *Information Architecture: The Design and Integration of Information Spaces*. San Rafael, CA: Morgan & Claypool Publishers

Dolan, T. (2015). A Six-Dimensional Assessment Tool for e-government development Applied to Homepage Sites of 25 U.S States. In C. Adams (Ed.), *Proceedings of the 15th European Conference on eGovernment 2015: ECEG 2015* (pp. 87-92).Reading, UK: Academic Conferences and Publishing International Ltd

Domatob, J.K. (2011). The Media, Culture, and Human Rights in Sub-Saharan Africa. In A. Mus & J.K. Domatob (Eds). *Communications, Culture, and Human Rights in Africa* (pp.33-50) . Maryland, MD: University Press of America Inc

Dombeu, J. (2009). Ontology Supporting E-Government Initiatives for Development Projects Monitoring In Sub Saharan Africa, *International Journal Of E-business and E-government Studies*, 1(1), 41-52

Donker-Kuijer, M. W., Jong, M. and Lentz, L. (2010) “Usable guidelines for usable websites: an analysis of five e-government heuristics”, *Government Information Quarterly*, 27, 254-263

Doong, H., Wang, H., & Foxall, G. R. (2010). Psychological traits and loyalty intentions towards E-government services. *International Journal of Information Management*, 30(5), 457-464. doi:10.1016/j.ijinfomgt.2010.01.007

Douglas, C., Goulding, R., Farris, L., & Atkinson-Grosjean, J. (2011). Socio-Cultural characteristics of usability of bioinformatics databases and tools. *Interdisciplinary Science Reviews*, 36(1), 55-71. Doi:10.1179/030801811X129 41390545726

Downey, L.L., & Rosales, S. (2012). A brief history of user experience in government systems. In E., Buie & D., Murray (Eds). *Usability in Government Systems: User Experience Design for Citizens and public servants* (pp. 1-17). Waltham, MA: Morgan Kauffmann.

Drechsler, A. (2014). Extending the Fitness-Utility Model for Management Artifacts in IS Design Science Research. *Lecture Notes in Computer Science, 8463, 337-344*

Drechsler, A. (2015). A postmodern perspective on socio-technical design science research in information systems. *Lecture Notes in Computer Science, 9073*, 152-167

Dresch, A., Pacheco, D., & Antunes, J.A. (2015). *Design Science Research: A Method for Science and Technology Advancemen*t. New York, NY: Springer

Dwivedi, Y., Papazafeiropoulou, A., & Gharavi, H. (2006). Socio-Economic Determinants of Adoption of the Government Gateway Initiative in the UK. *Electronic Government*, 3(4), 404-419

Eidaroos, A.M., Probets, S.G., & Dearnley, J.A. (2009). Heuristic evaluation for e-government websites in Saudi Arabia. In A.., Aloqbi, I., Alsini, & AK.. lzimani (Eds.). Proceedings of the Third Saudi International Conference, 5th-6th June 2009. Guildford, United Kingdom

Elbahnasawy, N. G. (2014). E-Government, Internet Adoption, and Corruption: An Empirical Investigation. *World Development*, 57114-126

Elbanna, A., & Linderoth, H.C. (2015). The Formation of Technology Mental Models: The Case of Voluntary Use of Technology in Organizational Setting. *Information Systems Frontiers*, 17(1), 95-108.

Eliassen, K.A., & Sitter, N. (2007). *Understanding Public Management*. London: Sage publications

Elkadi, H. (2013). Success and failure factors for e-government projects: A case from Egypt. *Egyptian Informatics Journal*, 14(2), 165-175

Ellcessor, E. (2016). *Restricted Access: Media, Disability, and the Politics of Participation*. New York, NY: New York University Press

Elling, S., Lentz, L., Jong, M., & Bergh, H. (2012). Measuring the quality of governmental websites in a controlled versus an online setting with the 'Website Evaluation Questionnaire'. *Government Information Quarterly*, 29(3), 383–393

Elsheikh, Y., & Azzeh, M. (2014). What Facilitates the Delivery of Citizen-Centric Government Services in Developing Countries: Model Development and Validation Through Structural Equation Modeling. *International Journal of Computer Science & Information Technology (IJCSIT*), 6(1), 77-98

Erricson. (2014). Sub-Saharan Africa: Ericsson Mobility Report Appendix. Retrieved from: http://www.ericsson.com/res/docs/2014/emr-june2014-regional-appendices-ssa.pdf

Fakrudeen, M., Ali, M., Yousef, S., & Hussein, A.H. (2013). Eliciting usability from blind user mental model for touch screen devices. In G. Yang, S. Ao & L. Gelman (Eds). *Transactions on Engineering Technologies* (pp. 581-595). Netherlands: Springer Netherlands

Faouzi, K., Basel M. Al, M., & Emad, B. (2014). E-Government Web Accessibility: WCAG 1.0 versus WCAG 2.0 Compliance. *International Journal of Digital Information and Wireless Communications*, 3(4), 56-65

Farivar, C. (2011). *The Internet of Elsewhere: The Emergent Effects of a Wired World*. New Jersey, NJ: Rutgers University Press

Fath-Allah, A., Cheikhi, L., Al-Qutaish, R.E. & Idri, A. (2014) E-government maturity models: a comparative study. *International Journal of Software Engineering & Applications*, 5(3), 71-91

Fenn, T., & Hobbs, J. (2014). The Information Architecture of Meaning Making. In A. Resmini (Eds.), *Reframing Information Architecture* (pp. 11-30). Switzerland: Springer International Publishing

Fernandez, A., Insfran, E., & Abrahao, S. (2011). Usability evaluation methods for the web: A systematic mapping study. *Information and Software Technology*, 53(8), 789–817

Feyi-Sobanjo, O. T. (2013). Legal issues on E-commerce development in West-Africa : a review of the draft guidelines on the protection of personal data in the UEMOA-ECOWAS space. *Journal Of African And International Law*, 6(2), 443-474

Findt, K., Scott, D.B., & Lindfeld, C. (2014). *Sub-Saharan Africa Power Outlook*. KPMG Africa Infrastructure & Major Projects Group. Retrieved, March 3, 2015 from: http://www.kpmg.com/ZA/en/IssuesAndInsights/ArticlesPublications/General-Industries-Publications/Documents/2014%20Sub-Saharan%20Africa%20Power%20 Outlook.pdf

Firat, O., Cho, K., Sankaran, B., Vural, F., & Bengio, Y. (2016). Multi-way, multilingual neural machine translation. *Computer Speech & Language*, 45, 236–252. DOI: http://dx.doi.org/10.1016/j.csl.2016.10.006

Fishbein, M., & Ajzen, I. (1975). *Belief, Attitude, Intention, and Behavior: An Introduction to Theory and Research*. Reading, MA: Addison-Wesley

Fogg, B.J. (2003). *Persuasive technology using computers to change what we think and do.* Burlington, MA: Morgan Kaufmann

Gacenga, F., Cater-Steel, A., Toleman, M., & Tan, W. (2012, June 28-29). Alleviating Design Science in Design Science Research: a Proposal of Design Method. 11th European Conference on research methods, Bolton, England

Galvez, R.A., & Youngblood, N.E. (2016). E-government in Rhode Island: what effects do templates have on usability, accessibility, and mobile readiness? *Universal Access in the Information Society, 15(2),* 281-296. Doi: 10.1007/s10209-014-0384-x

Gant, D.B., Gant, J.P., & Johnson, C.L. (2002). *State Web Portals: Delivering and Financing e-Service*. Arlington, VA: The PricewaterhouseCoopers

Garcia, A.C., Maciel, C., & Pinto, F.B. (2005). A quality inspection method to evaluate e-government sites. *Lecture Notes in Computer Science, 3591*, 198–209

Gaulė, E., & Žilinskas, G. (2013). E-Governance Development Factors In Lithuania: The Study Of Municipal Websites. *Viešoji politika ir administravimas, 12(1), 80-93*

Gayathri, K. (2014). Investigating the influence of perceived characteristics of innovation on the relationship between knowledge, attitudes and purchase intention towards eco-conscious apparel (Doctoral thesis, Kansas State University, USA). Retrieved from: https://krex.k-state.edu/dspace/bitstream/handle/2097/18721/GayathriKandiraju2014.pdf? sequence=2

Gil-Garcia, J.R. (2012). *Enacting Electronic Government Success: An Integrative Study of Government-wide websites, organizational capabilities, and institutions*. New York, NY: Springer Science+Business Media

Gil-Garcia, J.R., & Hernandez-Tella, F.R. (2011). Access Indiana: Managing a website through a successful public-private partnership. In E. Downey, C.D. Ekstrom & M.A. Jones (Eds). E-*Government Website Development: Future Trends and Strategic Models: Future Trends and Strategic models*.(pp. 190-210). New York, NY: Information Science Reference

Gill, T.G., & Hevner, A.R. (2013). A fitness-utility model for design science research. *ACM Transactions on Management Information Systems, 4(2), Article 5. DOI:http://dx.doi.org/10.1145/2499962.2499963*

Goes, B.P. (2014). Design science research in top information systems journals. MIS Quarterly, 38, iii-viii

Goldkuhl, G. (2012). Pragmatism vs interpretivism in qualitative information systems research. *European Journal of Information Systems,* 21(2), 135-146

Goldkuhl, G. (2016). E-government design research: Towards the policy-ingrained IT artifact. *Government Information Quarterly*, 33(3), 444-452

Gómez, R.Y., Caballero, D.C., & Sevillano, J. (2014). Heuristic Evaluation on Mobile Interfaces: A New Checklist. *The Scientific World Journal*. Article ID 434326

Gonzalez, M., Granollers, A., Pascual, A, Lorés, J. (2008). Testing website usability in Spanish-speaking academia through heuristic evaluation and cognitive walkthroughs. *Journal of Universal Computer Science*, *14*(9), 1513–29

González, M., Masip, L., Granollers, A., & Oliva, M. (2009). Quantitative analysis in a heuristic evaluation experiment. *Advances In Engineering Software*, 40(12), 1271-1278. doi:10.1016/j.advengsoft.2009.01.027

Goodin, D. (2015). Joomla bug puts millions of websites at risk of remote takeover hacks. Retrieved from: http://arstechnica.com/security/2015/10/joomla-bug-puts-millions -of-websites-at-risk-of-remote-takeover-hacks/

Goren, E. (2013). Economic Effects of Domestic and Neighbouring Countries' Cultural Diversity. *SSRN Electronic Journal*, Retrieved from: http://www.etsg.org/ETSG2013/Papers/042.pdf

Gosebo, N., & Obono, S. (2012). Revisiting the theory of planned behavior for the preparation of the adoption of municipal e-services in less developed countries. *Proceedings of the South African Institute for Computer Scientists and Information Technologists Conference* (pp.159-166). New York, NY: ACM. DOI:10.1145/2389836.2389856

Government Communication and Information System. (2012). Policy Guidelines for South African Government Websites. Retrieved from: http://www.gcis.gov.za/sites/default/files/docs/resourcecentre/guidelines/ Government%20website_guidelines_version1_final121015_layout.pdf

Gracia, D., Alino, L., & Blanco, C. (2012). Understanding the influence of social information sources on e-government adoption. *Information Research*, 17(3) paper 531. Retrieved from: http://InformationR.net/ir/17-3/paper531.html

Graycar, A. (2016). Corruption and Public Value. *Public Integrity*, 18(4), 339-341, DOI: 10.1080/10999922.2016.1184518

Gregor, S., & Hevner, A. R. (2013). Positioning and Presenting Design Science Research for Maximum Impact. *MIS Quarterly*, 37(2), 337-A6

Gregor, S., & Jones, D. (2007). The Anatomy of a Design Theory. *Journal of the Association of Information Systems*, 8(5), 312-335

Grima-Farrell, C. (2016). *What Matters in a Research to Practice Cycle?: Teachers as Researchers*. New York, NY: Springer Science and Business Media

Grossman, J.L., & McClain, L.C. (2009). *Gender Equality: Dimensions of Women's Equal Citizenship.* New York, NY: Cambridge University Press

Ha, H. (2013). A New SWOT Analysis of an E-Government System: Singapore Case. In C. Rückemann (Ed.), *Integrated Information and Computing Systems for Natural, Spatial, and Social Sciences* (pp. 74-95). Hershey, PA: IGI Global

Ha, T.T. (2016). Empirically Testing the Public Value Based Conceptual Framework for Evaluating E-Government Performance in Vietnam. *Modern Economy*, 7, 140-152

Hafeez, S., & Sher, S. (2006). *UN Global E-Government Readiness Report 2005: From E-government to E-inclusion*. New York, NY: United Nations

Halachmi, A., & Greiling, D. (2012). Transparency, E-Government, and Accountability. *Public Performance & Management Review, 36(4), 562-584*

Hammond, J., Gross, T., & Wesson, J. (2002). *Usability: Gaining a Competitive Edge*. New York, NY: Springer Science+Business Media

Hansen, T., Jensen, J., & Solgaard, H. (2004). Predicting online grocery buying intention: a comparison of the theory of reasoned action and the theory of planned behavior. *International Journal of Information Management, 24(6), 539-550*

Hanson, V. (2009). Age and Web Access: The Next Generation. Retrieved from: https://static.aminer.org/pdf/PDF/000/240/762/developing_guidelines_for_designing_usable_web_pages_for_older_chinese.pdf

Harfoushi, O., AlFawwaz, B., Obiedat, R., Faris, H., & Al-Sayyed, R. (2012). Usability Assessment of the Government Web Services in the Hashemite Kingdom of Jordan. *Journal of American Science, 8*(12), 340-252

Harvey, C., Stanton, N. A., Pickering, C. A., McDonald, M., & Zheng, P. (2011). Context of use as a factor in determining the usability of in-vehicle devices. *Theoretical Issues In Ergonomics Science*, *12*(4), 318-338. Doi:10.1080/14639221003717024

Haynes, J. (2010). Democratisation in the Middle East and North Africa: What is the Effect of Globalisation?. Totalitarian Movements & Political Religions, 11(2), 133-149. Doi:10.1080/14690764.2010.511463

Heeks, R. (2002). E-Government in Africa: Promise and Practice. Information Polity, 7(2-3), 97-114

Heeks, R. (2015). A Better E-government Maturity Model. iGovernment Briefing No. 9. Retrieved from: http://www.seed.manchester.ac.uk/medialibrary/IDPM/working_papers/igov/short_papers/igov_sp09.pdf

Heeks, R., & Bailur, S. (2007). Analyzing e-government research: Perspectives, philosophies, theories, methods, and practice. *Government Information Quarterly*, *24*, 243–265

Hermawati, S., & Lawson, G. (2016). Establishing usability heuristics for heuristics evaluation in a specific domain: Is there a consensus? *Applied Ergonomics, 56, 34-51. DOI:* http://dx.doi.org/10.1016/j.apergo.2015.11.016

Hertzum, M., & Jacobsen, N.E. (2001). The evaluator effect: a chilling fact about usability evaluation methods. International Journal of Human-computer interaction, 13, 421-443

Hertzum, M., Molich, R., & Jacobsen, N.E. (2014). What You Get Is What You See: Revisiting the Evaluator Effect in Usability Tests. *Behaviour & Information Technology*, 33(2), 143-161

Hevner, A.R. (2007). A Three Cycle View of Design Science Research. *Scandinavian Journal of Information Systems*, 19(2), 87-92

Hevner, A.R. (2013). Beyond Usefulness: A Fitness-Utility Model for DSR: Extended Abstract Based on EDSS 2012 Keynote. *Communications in Computer and Information Science*, *388, 14-19*

Hevner, A.R. (2014). *Design Science Research. In H. Topi & A. Tucker (2014). Computing Handbook, Third Edition: Information Systems and Information Technology* (pp. 22:1 – 22:23). Broken Sound Parkway, NW: CRC Press

Hevner, A.R., & Chatterjee, S. (2010). *Design Research in Information Systems: Theory and Practice*. New York, NY: Springer Science+Business Media

Hevner, A.R., March, S.T., Park, J., & Ram, S. (2004). Design Science in Information Systems Research, *MIS Quarterly*, 28(1), 75-15

Hicks, N.L. (2011). *The Challenge of Economic Development: A Survey of Issues and Constraints facing Developing Countries*. Bloomington, IN: Author House

Hilbert, M. (2011). Digital gender divides or technologically empowered women in developing countries? A typical case of lies, damned lies, and statistics. *Women's Studies International Forum, 34*(6), 479-489. DOI: http://dx.doi.org/10.1016/ j.wsif.2011.07.001

Hoff, K., & Preminger, M. (2015). Usability testing of an annotation tool in a cultural heritage context. In Garoufallou et al. (Eds). *Metadata and Semantics Research* (pp. 237-248).Switzerland: Springer International Publishing

Holzer, M., & Kim, S. T. (2004). *Digital governance in municipalities worldwide: An assessment of municipal web sites throughout the world*. Newark, NJ: National Center for Public Productivity

Horan, T., Abhichandani, T., & Rayalu, R. (2006, January 4-7). Assessing User Satisfaction of E-Government Services: Development and Testing of Quality-in-Use Satisfaction with Advanced Traveler Information Systems (ATIS). 39th Annual Hawaii International Conference, Kauai, USA. DOI: 10.1109/HICSS.2006.66

Horst, M., Kuttschreuter, M., & Gutteling, J. (2007). Perceived usefulness, personal experiences, risk perception and trust as determinants of adoption of e-government services in The Netherlands. *Computers in Human Behavior*, *23*(4), 1838–1852

Hsieh, H.C. (2014). Evaluating the Effects of Cultural Preferences on Website usability. In P.L Rau (Ed), *Cross-Cultural Design* (pp. 162-173). Switzerland: Springer International Publishing

Huang, W., D'Ambra, J., & Bhalla, V. (2002). An empirical investigation of the adoption of e-government in Australian citizens: some unexpected research findings" Journal of Computer Information Systems, 43(1), 15-22

Huang, Z. (2009). U.S Counties' Efforts and Results: An Empirical Research on Local Adoption and Difussion of E-government. In C.G. Reddick (Eds), *Handbook of Research on Strategies for Local E-Government Adoption and Implementation: Comparative Studies* (pp. 367-389). New York, NY: Information Science Reference

Huang, Z., & Brooks, L. (2011). Evaluating Usability of Web-Based Electronic Government: Users' Perspective. *Lecture Notes in Computer Science*, 6764, 456-465

Huang, Z., Brooks, L., Chen, S. (2009). The assessment of credibility of e-government: Users' perspective. *Lecture Notes in Computer Science, 5618*, 26–35

Hui, G., & Hayllar, M.R. (2010). Creating Public Value in E-Government: A Public-

Private-Citizen Collaboration Framework in Web 2.0. *Australian Journal of Public Administration*, 69(S1), S120-S131. Doi:10.1111/j.1467-8500.2009.00662.x

Hui, Z., Xiaolin, X., & Jianying, X. (2014). Diffusion of e-government: A literature review and directions for future directions. *Government Information Quarterly*, 31(4), 631-636. Doi:10.1016/j.giq.2013.10.013

Hung, S., Chang, C., & Yu, TJ. (2006). Determinants of user acceptance of the e-governmentservices: the case of online tax filing and payment system. *Government Information Quarterly*, (23), 97-122

Huysmans, P., Oorts, G., De Bruyn, P., Mannaert, H., & Verelst, J. (2012). Positioning the Normalized Systems Theory in a Design Theory Framework. *Lecture Notes in Business Information Processing*, 142, 43-63

Hvannberg, E., Law, E., & Larusdottir, M. (2007). Heuristic evaluation: Comparing ways of finding and reporting usability problems. *Interacting with computers*, 19(2), 225-240

Ifinedo, P. (2006). Towards e-government in a Sub-Saharan African Country: Impediments and Initiatives in Nigeria. Retrieved 2 March 2015 from: http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.92.4012&rep=rep1&type=pdf

Isa, W.A., Suhami, R.M. Safie, NI., & Semsudin, S.S. (2011). Assessing the Usability and Accessibility of Malaysia E-Government Website. *American Journal of Economics and Business Administration 3* (1), 40-46

Isbister, K., & Schaffer, N. (2008). *Game Usability: Advancing the player experienc*e. Burlington, MA: Morgan Kaufmann

ISO. (2010). ISO 9241-210(E): Human-centred design for interactive systems. Switzerland: ISO. Retrieved from: https://www.iso.org/obp/ui/#iso:std:iso:9241:-210:ed-1:v1:e

Jabble, A., & Sharma, A.K. (2015). Evaluation of Website. *International Journal of Advanced Research in Computer Science and Software Engineering, 5(6), 55-59*

Jacobi, A., Jensen, M., Kool, L., Munnichs, G. & Weber, A. (2013). Security of e-Goernment Systems. European Parliament. Retrieved from: http://www.europarl.europa.eu/RegData/_etudes/etudes_/join/2013/513510/IPOL-JOIN_ET(2013)513510(ANN02)_EN.pdf

Jaeger, P.T., & Bertot, J. C. (2010). Designing, Implementing, and Evaluating User-centered and Citizen-centered E-government. *International Journal of Electronic Government Research (IJEGR),* 6(2), 1-17. Doi:10.4018/jegr. 2010040101

Jain, P., & Akakandelwa, A. (2014). Adopton of e-government in Africa: Challenges and Recommendations. In P.M. Sebina et al. (Eds.), *Digital Access and E-Government: Perspectives from Developing and Emerging* (pp. 101-124). New York, NY: Information Science Reference

Janowski, T. (2015). Digital Government Evolution: From Transformation to Contextualization. *Government Information Quarterly,* 32(3), 221-236

Jarvinen, P. (2005). Action research as an approach in design science. Retrieved from: http://www.sis.uta.fi/cs/reports/dsarja/D-2005-2.pdf

Jarvinen, P. (2007). Action Research is Similar to Design Science. *Quality & Quantity,* 41, 37-54. DOI:10.1007/s11135-005-5427-1

Jaspers, M. M. (2009). A comparison of usability methods for testing interactive health technologies: methodological aspects and empirical evidence. *International Journal Of Medical Informatics*, 78(5), 340-353. Doi:10.1016/j.ijmedinf .2008.10. 002

Javahery, H., Gower, M., Sinnig, D., & Forbrig, P. (2011). Patterns for Usable Accessible Design. In J.A Jacko (Eds.), *Human-Computer Interaction: Design and Development Approaches* (pp. 248 -257). Heidelberg: Springer-Verlag

Jensen, M.J. (2010). Images of Citizenship: A Content Analysis of Local Government Websites in the United States. In C. Reddick (Ed.), *Citizens and E-Government: Evaluating Policy and Management* (pp. 91-109). Hershey, PA: IGI Global

Ji, Y.G., Park, J.H., Lee, C., & Yun, M.H. (2006). A Usability Checklist for the Usability Evaluation of Mobile Phone User Interface. *International Journal of Human–Computer Interaction*, 20(3), 207–231

Johannesson, P., & Perjons, E. (2014). *An Introduction to Design Science*. Switzerland: Springer International Publishing

Johari, J. (2009). Interpretivism in Information System (IS) Research. *Integration & Dissemination, 4,* 25-27

Jonker, J., & Pennink, B. (2010). *The Essence of Research Methodology: A Concise Guide for Master and PhD in Management Science*. Berlin: Springer-Verlag

Johnson-Laird, P.N. (1989). *Mental models*. In M.I. Posner (Ed.), Foundations of cognitive science (pp. 469-499). Cambridge, MA: MIT Press

Jordan, R., Buranapunsri, W., & Berge, Z. (2006). Sustaining Internet Accessibility. In H. Rahman (Ed), *Empowering Marginal Communities with Information Networking* (pp. 300-317). London: Idea Group Publishing

Jorgensen, T. B., & Bozeman, B. (2007). Public values: An inventory. *Administration and Society*, 39(3), 354–381

Jugurnath, B., Chuckun, N., &Fauzel, S. (2015). Foreign Direct Investment & Economic Growth in Sub-Saharan Africa: An Empirical Study. *Theoretical Economics Letters*, 6, 798-807. DOI: http://dx.doi.org/10.4236/tel.2016.64084

Jukic, T., Kunstelj, M., Decman, M., & Vintar, M. (2009). E-government in Slovene Municipalities: Analyzing Supply, Demand and its Effects. In C.G. Reddick (Eds). *Handbook of Research on Strategies for Local E-Government Adoption and Implementation: Comparative Studies* (pp. 163-185). New York, NY: Information Science Reference

Jun, K., Wang, F., & Wang, D. (2014). E-Government Use and Perceived Government Transparency and Service Capacity. *Public Performance & Management Review*, 38(1), 125-151. Doi:10.2753/PMR1530-9576380106

Juntunen, A. (2012). Open Innovation in the E-Government Strategy Planning: A Case Study. In S. Aikins (Ed.), *Managing E-Government Projects: Concepts, Issues, and Best Practices* (pp. 290-311). Hershey, PA: Information Science Reference. doi:10.4018/978-1-4666-0086-7.ch012

Kaan, K.A. (2007). Online Usability among Arizona Local Governments. PhD Dissertation, Arizona State University

Kaaya, J. (2004). Implementing E-government Services in East Africa: Assessing Status through Content Analysis of Government Websites. E*lectronic Journal of eGovernment (EJEG), 2* (1), 39-54

Kamal, I.W., Alsmadi, I.M., Wahsheh, A.H., & Al-Kabi, M.N. (2016). Evaluating Web Accessibility Metrics for Jordanian Universities. *International Journal of Advanced Computer Science and Applications, 7(7), 133-122*

Kamoun , F., & Almourad, M.B. (2014). Accessibility as an integral factor in e-government web site evaluation: The case of Dubai e-government. *Information Technology & People*, 27(2), 208 – 228

Kanellis, P., & Papadopoulos, T. (2009). Conducting Research in Information Systems: An Epistemological Journey. In A. Cater-Steel, & L. Al-Hakim (Eds.), *Information Systems Research Methods, Epistemology, and Applications* (pp. 1-34). Hershey, PA: IGI Global

Kapsi, M., Vlachogiannis, E., Darzentas, J., & Spyrou, T. (2009b). The usability of web accessibility guidelines: An approach for evaluation. *In Proceedings of the 5th international conference on universal access in human computer interaction* (pp. 716–724). Berlin: Springer-Verlag

Karampelas, P. (2013). *Techniques and Tools for Designing an Online Social Network Platform*. New York, NY: Springer-Verlag

Karkin, N., & Janssen, M. (2014). Evaluating websites from a public value perspective: A review of Turkish local government websites. *International Journal of Information Management*, 34, 351-363

Karunasena, K., & Deng, H. (2009). A Conceptual Framework for Evaluating the Public Value of E-government: A Case Study from Sri Lanka. ACIS 2009 Proceedings (pp. 1002 – 1012). Retrieved from: http://aisel.aisnet.org/acis2009/8

Karunasena, K., & Deng, H. (2012). Critical factors for evaluating the public value of e-government in Sri Lanka. *Government Information Quarterly*, 29(1), 76-84

Karunasena, K., Deng, H., & Singh, M. (2011). Measuring the public value of e-government: A case study from Sri Lanka. *Transforming Government People Process and Policy*, 5(1), 81-99. DOI: 10.1108/17506161111114671

Katz, J.E. (2011). *Mobile Communication: Dimensions of Social Policy*. New Jersey, NJ: Transaction Publishers

Kauda, J. (2012). *Research methodology: A project guide for University Students*. Denmark: Samfundslitteratur

Keengwe, J. (2015). *Promoting Active Learning through the Integration of Mobile and Ubiquitous Technologies.* Hershey, PA: IGI Global

Keoduangsine, S., Goodwin, R. (2009, December 14-16). User Satisfaction Model For Mobile E-Government Service. Proceedings of the Eleventh International Conference on Information Integration and Web-based Applications and Services) DOI: 10.1145/1806338.1806453

Khajouei, R., Hasman, A., & Jaspers, M. (2011). Determination of the effectiveness of two methods for usability evaluation using a CPOE medication ordering system. *International Journal Of Medical Informatics*, 80(5), 341-350. doi:10.1016/j.ijm edinf.2011.02.005

Khan, G.F., Moon, J., Park, H.W., Swar, B., & Rho, J.J. (2011). A socio-technical perspective on e-government issues in developing countries: a scientometrics approach. *Scientometrics*, 87 (2), 267-286

Khanyako, E., & Maiga, G. (2013). An Information Security Model for E-government Kieffer, K.S. (2015). Aging, E-literacy, and Technology: Participatory User-Centered Design for Older Adults' Digital Engagement. Journal of Literacy and Technology, 16(2), 2-32

Khasawneh, R.T., Abu Shamaa, R.A., & Rabayah, A.W. (2014). E-Participation: A Way for Creating Public Value. In C. Akrivopoulou, & N. Garipidis (Eds.), *Human Rights and the Impact of ICT in the Public Sphere: Participation, Democracy, and Political Autonomy* (pp. 14-30). Hershey, PA: IGI Global

Khella, A. (2002). Knowledge and Mental Models in HCI. Retrieved from: https://www.cs.umd.edu/class/fall2002/cmsc838s/tichi/knowledge.html

Kim, B. (2013). *The Library Mobile Experience: Practices and User Expectations*. Chicago, IL: American Library Association (ALA)

Kim, C.K. (2014). Anti-corruption initiatives and e-government: a cross-national study. *Public Organization Review*, 14(3), 385–396

King, B.A., & Youngblood, N.E. (2016). E-government in Alabama: An analysis of county voting and election website content, usability, accessibility, and mobile readiness. *Government Information Quarterly*, 33(4), 715–726

Kinsell, C., & DaCosta, B. (2014). A 15 Factor and 157 Item Checklist for Assessing Website Usability and Accessibility. In B. DaCosta, & S. Seok (Eds.), *Assistive Technology Research, Practice, and Theory* (pp. 252-276). Hershey, PA: Medical Information Science Reference. Doi:10.4018/978-1-4666-5015-2.ch017

Kinuthia, J.M. (2013). Government Websites Usability and User Experience in Kenya (Masters dissertation, University of Nairobi, Kenya)

Kinyanjui, F. (2015). E-government in east Africa: Towards and understanding of the evolution of electronic governance in Kenya, 1990-2013. In I.S. Sodhi (Ed.), *Emerging Issues and Prospects in African E-Government* (pp. 82 -96). Hershey, PA: Information Science Reference

Kirui, E., Baguma, R., & Kemei, P.K. (2016). Usability Framework for E-Government Services in Developing Countries. *International Journal of Computer Applications*, 137(11), 43-47

Kirui, E., & Kemei, K. (2014). Usability of E-Government Services in Developing Countries. *International Journal of Computer Trends and Technology (IJCTT),* 15(3), 102-107

Kituyi, G.M., & Anjoga, H. (2013). Improvement of E-Government Service Usability in Developing Countries: Empirical Experiences of Uganda. *Journal of Emerging Trends in Computing and Information Sciences*, 4(3), 263-269

Klenke, K. (2016). *Qualitative Research in the Study of Leadership*. Bingley: Emerald Group Publishing Limited.

Komba, M.C., & Ngulube, P. (2015, July 24-25). Factors That Influence E-Government Adoption in Selected Districts of Tanzania. International Conference on eBusiness, eCommerce, eManagement, eLearning and eGovernance, Greenwich University, United Kingdom

Komba, M.M., & Ngulube, P. (2014). Socioeconomic determinants of e-government adoption in selected districts of Tanzania. ESARBICA Journal: *Journal of the Eastern and Southern Africa Regional Branch of the International Council on Archives*,33, 71

Koopmans, R., & Zimmermann, A. (2010). Transnational political communication on the internet: Search engine results and hyper networks. In R. Koopmans & P. Statham (Eds). *The Making of a European Public Sphere: Media Discourse and Political Contention* (pp. 171-194). New York, NY: Cambridge University Press

Kopackova, H., Michalek, K., & Cejna, K. (2010). Accessibility and findability of local e-government websites in the Czech Republic. *Universal Access in the Information Society*, 9(1), 51–61

Korsten, H., & Bothma, T.J. (2005). Evaluating South African government Web sites: methods, findings and recommendations. *South African Journal of Information Management*, 7(2). Retrieved from: http://www.sajim.co.za/index.php/SAJIM/ article/viewFile/260/251

Koutsabasis, P., Vlachogiannis, E., & Darzentas, J.S. (2010). Beyond Specifications: Towards a Practical Methodology for Evaluating Web Accessibility. *Journal of Usability Studies*, 4(4), 157-171

Kovacic, Z.J. (2005). The Impact of National Culture on Worldwide eGovernment Readiness. *Informing Science Journal, 8,143-158*

Krug, S. (2014). *Don't Make Me Think, Revisited: A Common Sense Approach to Web Usability (3rd Edition) (Voices That Matter)*. Berkeley, CA: New Riders

Kuechler W and Vaishnavi V (2012) A framework for theory development in design science research: multiple perspectives. *Journal of the Association for Information Systems*, 13(6), 395–423

Kumar, H., Singh, M.K., & Gupta, M.P. (2016). Smart governance for smart cities: A conceptual framework from social media practices. *Lecture Notes in Computer Science*, 9844, 628 – 634. DOI: 10.1007/978-3-319-45234-0_56

Kumar, V., Mukerji, B., Butt, I., & Persaud, A. (2007). Factors for Successful e-Government Adoption: a Conceptual Framework. *The Electronic Journal of E-government*, 5(1), 63 – 76

Kurt, S. (2014). Accessibility issues of educational websites. In Information Resources Management Association (Ed.), *Assistive Technologies: Concepts, Methodologies, Tools, and Applications* (pp. 54-62). Hershey, PA: Information Science Reference

Kuster, M.V. (2007). Cultural Diversity in eGovernment and eGovernment Standardization in Europe. Retrieved from: https://www.w3.org/2007/06/eGov-dc/papers/cultural _diversity_europe.pdf

Kuzma, J. (2010). Accessibility design issues with UK e-government sites. *Government Information Quarterly*, 27(2), 141-146

Kuzma, J., Dorothy, Y., & Oestreicher, K. (2009, May 7-9). Global e-government web accessibility: An empirical examination of EU, Asian and African sites. Paper presented at the ICTA'09, Hammamet, Tunisia

Lallmahomed, M.Z.I. (2016). Factors influencing the adoption of E-government services. Retrieved from: http://www.mrc.org.mu/English/Documents/Programme%20for %20event.pdf

Lanzilotti, R., Ardito, C., Costabile, M., & De Angeli, A. (2011). Do patterns help novice evaluators? A comparative study. *International Journal Of Human-Computer Studies*, 69(1/2), 52-69. Doi:10.1016/j.ijhcs.2010.07.005

Latif, M.A., & Masrek, M.N. (2010). Accessibility Evaluation on Malaysian E-Government Websites. *Journal of E-government Studies and Best Practices*. Article ID 935272

Lau, E. (2007). Electronic Government and the Drive for growth and equity. In Mayerschon-berger, V., & Lazer, D. (Eds.), *Governance and Information technology: From Electronic Government to Information Government*. Cambridge, Massachusetts: MIT Press

Lavanya, D., & Gayatri, R. (2015). Societal Challenges and E-Governance – Engaging Citizens through Technology. *International Journal of Applied Engineering Research*, *10*(17), 13906 -13911

Law, E.C., & Hvannberg, E.T. (2008). Consolidating usability problems with novice evaluators. *In Proceedings of the NordiCHI 2008 Conference on Human-Computer Interaction* (pp. 495-498). New York: ACM Press

Layne, K. & Lee, J. (2001) Developing fully functional e-government: a four stage model, *Government Information Quarterly*, 18(2), 122-136

Lazar, J., & Wentz, B. (2012). Ensuring Accessibility for People with Disabilities. In E. Buie & D. Murray (Eds.), *Usability in Government Systems: User Experience Design for Citizens and Public Servants* (pp. 191 - 204). Waltham, MA: Morgan Kaufmann

Lazar, J., Feng, J., & Hochheiser, H. (2010). *Research Methods in Human-Computer Interaction*. West Sussex: John Wiley & Sons Ltd

Lean, O.K., Zailani, S., Ramayah, T., & Fernando, Y. (2009). Factors influencing intention to use e-government services among citizens in Malaysia. *International Journal of Information Management*, 29, 458-475

Lee, J. (2010) 10 year retrospect on stage models of e-government: a qualitative meta-Synthesis. *Government Information Quarterly*, 27(3), 220-230

Lee, Y., & Kozar, K. (2012). Understanding of website usability: Specifying and measuring constructs and their relationships. *Decision Support Systems, 52*(2), 450–463

Legrenzi, P., & Girotto, V. (1996). Mental Models in Reasoning and Decision Making. In A. Garnham & J. Oakhill (Eds.), *Mental Models in Cognitive Science* (pp. 95-118). Hove, UK: Psychology Press

Leist, E., & Smith, D. (2012). Accessibility issues in E-government. In A. Kő and E. Francesconi (Eds.), *Electronic Government and the Information Systems Perspective* (pp. 15 -25). Switzerland: Springer

Lessa, L., Negash, S., & Amoroso, D. (2011, August 4-7). Acceptance of WoredaNet E-Government Services in Ethiopia: Applying the UTAUT Model. Seventeenth Americas Conference on Information Systems, Detroit, Michigan, USA.

Leuffen, D., Shikano, S., & Walter, S. (2013). Measurement and Data Aggregation in Small-n Social Scientific Research. *European Political Science*, 12(1), 40-45. Doi:10.1057/eps.2012.8

Li, F. (2007). *Social Implications and Challenges of E-Business*. Hershey, PA: Information Science Reference

Lianjie, M., Jongpil, C., & Thorson, S. (2005). E-government in China: Bringing economic development through administrative reform. *Government Information Quarterly*, 22(1), 20-37

Lightner, N. (2014). A Systematic approach to providing accessible electronic communication. In V. Duffy & N. Lightner (Eds.), *Advances in Human Aspects of Healthcare* (pp. 149-156). Krakow, Poland: AHFE International

Lin, F., Fofanah, S., & Liang, D. (2011). Assessing citizen adoption of E-government initiatives in Gambia: A validation of the technology acceptance model in information systems success. *Government Information Quarterly,28(2),271-279*

Ling, C., & Salvendy, G. (2009). Effect of evaluators' cognitive style on heuristic evaluation: Field dependent and field independent evaluators. *International Journal of Human-Computer Studies, 67(4),* 382-393

Loiacono, E.T., Watson, R.T., and Goodhue, D.L. (2007). WebQual: An instrument for consumer evaluation of web sites. *International Journal of Electronic Commerce*, 11(3), 51-87

Lorenzi, D., Vaidya, J., Shafiq, B., Chun, S., Vegesna, N., Alzamil, Z., Adam, N., Wainer, S., Atluri, V. (2014). Utilizing social media to improve local government responsiveness. *In Proceedings of the 15th Annual International Conference on Digital Government Research* (pp. 236-244). New York, NY: ACM

Lutu, P.E. (2015). Web 2.0 Computing and Social media as solution enables for economic development in Africa. In A. Gamatie (Ed.), *Computing in Research and Development in Africa: Benefits, Trends, Challenges and Solutions* (pp. 103-124). Switzerland: Springer International Publishing, Switzerland.

Maake, B.M., Oino, N.N., & Awuor, F.M. (2015). M-Powering: How Mobile Money (M-PESA) Services Promote Realization of a Digital Society in the Kenyan Government. In I. Sodhi (Ed.), *Emerging Issues and Prospects in African E-Government* (pp. 97-107). Hershey, PA: Information Science Reference doi:10.4018/978-1-4666-6296-4.ch007

Mack, L. (2010). The philosophical Underpinnings of Educational Research. *Polyglossia, 19*, 5- 11

Macueve, G. (2011). Influence of the e-government implementation process on outcomes: case study of the Land management Information System in Mozambique. In T.M Waema & E.O Adera (Eds.), *Local Governments and ICTs in Africa* (pp. 190-211). Cape Town: Pambazuka Press

Mahajan, K. (2012). Expert Usability Evaluation of Government Web Portal: A Case Study. *Viewpoint*, 3(2), 68-74

Maheshwari, B., Kumar, V., Kumar, U., & Sharan, V. (2007, December 28-30). E-government portal effectiveness: managerial considerations for design and development. 5th International Congress of E-governance, Hyderabad, India

Manzombi, P. (2015). Estimating Trade Flows: Case of South Africa And BRICS Masters Dissertation, University of South Africa. Retrieved from: http://uir.unisa.ac.zaxmlui/bitstream/handle/10500/18532/dissertation_manzombi_p.pdf?sequence=1&isAllowed=y

Mareschal, P., & Rudin, J. (2010). E-Government vs E-Business: A Comparison of Online Recruitment in the Public and Private Sectors. *The American Review of Public Administration*, 41(4), 453 – 467

Markovic, I. (2010). *Semantic business process modelling.* Karlsruhe: KIT Scientific Publishing

Marlow, J., Clough, P., & Dance, K. (2007): Multilingual needs of cultural heritage website visitors: A case study of Tate Online, International Cultural Heritage Informatics Meeting - ICHIM07, Toronto, Ontario, Canada

Matatu, S., & Magoqwana, B. (2015). E-government Implementation for Internal Efficiency: Perceptions and Experiences of Control at City of Cape Town, South Africa. In I.S. Sodhi (Eds.), *Emerging Issues and Prospects in African E-Government* (pp. 269-279). Hershey, PA: Information Science Reference

Mates, P., Lechner, T., Rieger, P., & Pekna, J. (2013). Towards E-Government Project Assessment: European Approach. *Proceedings Of Rijeka School Of Economics: Journal Of Economics And Business, 31*(1), 103-125

Millard, J. (2011). Are You Being Served?: Transforming E-Government through Service Personalisation. *International Journal of Electronic Government Research (IJEGR)*, 7(4), 1-18. Doi:10.4018/jegr.2011100101

Mishra, D., Akman, I., & Mishra, A. (2014). Theory of Reasoned Action application for Green Information Technology acceptance. *Computers in Human Behavior, 36, 29-40. Doi:10.1016/j.chb.2014.03.030*

Mohameda, E., & Sadat, F. (2015). Hybrid Arabic–French machine translation using syntactic re-ordering and morphological pre-processing. *Computer Speech & Language*, 32(1), 135-144

Molnar, T. (2015). Improving Usability of E-government for the Elderly. *The Electronic Journal of E-government*, 13(2), 122-135

Monoharan, A., & Holzer, M. (2012). *E-Governance and Civic Engagement: Factors and Determinants of E-Democracy*. Hershey, PA: Information Science Reference

Moon, M.J. & Welch, E.W. (2015). Managing E-Government. In J.L. Perry & R.K. Christensen (Eds.), *Handbook of Public Administration* (pp. 436 – 455). Hoboken, NJ: Jossey-Bass

Moon, M.J. (2002). The evolution of e-government among municipalities: Rhetoric or reality? *Public Administration Review, 6,* (4), 424–433

Moore, G.C. & Benbasat, I. (1991). Development of an instrument to measure the perceptions of adopting an information technology innovation. *Information Systems Research,* 23, 192- 220

Moreno, L., Martinez, P., & Ruiz-Mezcua, B. (2009). A Bridge to Web Accessibility from the Usability Heuristics. In A. Holzinger & K. Miesenberger (Eds.), *HCI and Usability for e-Inclusion* (pp. 290-300). Berlin, Springer-Verlag

Morgeson, F. V., Van Amburg, D., & Mithas, S. (2011). Misplaced trust? Exploring the structure of the egovernment-citizen trust relationship. *Journal of Public Administration Research and Theory*, 21(2), 257-283

Moss, G., Colman, A. M. (2001). Choices and Preferences: Experiments on Gender Differences. *Brand Management*, 9(2), 89-98

Moss, G., Gunn, R., & Heller, J. (2006). Some Men Like It Black, Some Women Like It Pink: Consumer Implications of Differences in Male and Female Website Design. *Journal of Consumer Behavior*, 5(4), 328-341

Mphidi, H. (2008). Digital divide and e-governance in South Africa. Retrieved from: http://www.ais.up.ac.za/digi/docs/mphidi_paper.pdf

Mpinganjira, M (2014). Delivering citizen-centric m-government services in Africa – critical success factor. *Africa Insight*, 44(3), 129-144

Mpinganjira, M. (2012). Factors affecting adoption of e-government services: A conceptual model. *African Journal of Business Management*, 6(11), 4245-4249. DOI: 10.5897/AJBM11.2579

Mukhongo, L. (2015). Online Political Activism among Young People in Sub-Saharan Africa. In M. Khosrows-Pour (Eds.), *Encyclopedia of Information Science and Technology (3rd Ed)* (pp. 6419 – 6426). New York, NY: Information Science Reference

Munyoka, W. & Manzira, F.M. (2013). Alignment of e- Government Policy Formulation with Practical Implementation: The Case of Sub-Saharan. *World Academy of Science, Engineering and Technology International Journal of Social, Human Science and Engineering*, 7(12), 368-373

Munyoka, W. & Manzira, F.M. (2014,). From E-Government to M-Government – Challenges Faced by Sub-Saharan Africa. *Proceedings of the International conference on Computing Technology and Information Management,* 86-99. Dubai, UAE

Muraya, B.M. (2015). Factors Affecting Successful Adoption of E-government In Kenya’s Public Sector (Masters dissertation, United States International University Africa, Nairobi, Kenya)

Mutula M. S. (2008). Comparison of sub-Saharan Africa’s e-government status with developed and transitional nations. *Information Management & Computer Security*, 16(3), 235-250

Mutula, S.M. (2013). E-Government Divide: Implications for sub-Saharan Africa. In Information Ethics for Africa: Cross-cutting Themes. Pretoria: ACEIE, 59-69

Nabafu, R., & Maiga, G. (2012). A Model of Success Factors for Implementing Local eGovernment in Uganda. *Electronic Journal of E-government*, 10(1), 31 – 46

Nabafu, R., & Maiga, G. (2012). A Model of Success Factors for Implementing Local E-government in Uganda. *Electronic Journal of E-government,* 10(1), 34-46

Nantel, J., & Glaser, E. (2008). The impact of language and culture on perceived website usability. *Journal of Engineering and Technology Management*, *25*(1-2), 112-122. Doi:10.1016/j.jengtecman.2008.01.005

Nasri, W., & Charfeddine, L. (2012). Factors affecting the adoption of Internet banking in Tunisia: An integration theory of acceptance model and theory of planned behaviour. The *Journal of High Technology Management Research, 23(1),1-14*

Nawafleh, S. A., Obiedat, R. F., & Harfoushi, O. K. (2012). E-Government between Developed and Developing Countries. International Journal of Advanced Corporate Learning, 5(1), 8-13. Doi:10.3991/ijac.v5i1.1887

Ndonga, D. D. (2012). E-Commerce in Africa: Challenges and Solutions. African Journal Of Legal Studies, 5(3), 243-268

Ndou, V. (2004). E-government for Developing Countries: Opportunities and Challenges. *The Electronic Journal of Information Systems in Developing Countries*, 18(1), 1-24

Ngulube, P. (2007). The Nature and Accessibility of E-Government in Sub Saharan Africa. *International Review of Information Ethics*, 7(9), 1-13

Nguyen, A. (2016). A Cross-Cultural Study on E-government Services Delivery. *The Electronic Journal Information Systems Evaluation*, 19(2), 121-134

Ngwenya, B. (2014).Ontology Development and the Role of Knowledge in e-Government Project Management: A lesson from Developing Countries. In KJ. Bwalya (Ed.), *Technology Development and Platform Enhancements for Successful Global E-government Design*. New York: Information Science Reference

Nicolai, A.T., & Seidl, D. (2010). That's Relevant: Different forms of practical relevance in management sciences. *Organization studies*, 31(19/10), 1257-1285.

Nielsen, J. (2003). Usability 101: Introduction to usability. Retrieved from: http://www.useit.com/alertbox/20030825.html

Nielsen, J. (1994). Heuristic evaluation. In J. Nielsen and R.L. Mack, (Eds.), *Usability Inspection Methods* (pp. 25-62). New York, NY: John Wiley & Sons

Nielsen, J. (1994). *Usability Engineering.* New York, NY: Academic Press Inc

Nielsen, J. (2010). Mental Models. Retrieved from: https://www.nngroup.com/articles/mental-models/

Nielsen, J. (2012). Usability 101: Introduction to Usability. Retrieved from: https://www.nngroup.com/articles/usability-101-introduction-to-usability/

Nielsen, J., & Molich, R. (1990). Heuristic evaluation of user interfaces. In J.C. Chew & J. Whiteside (Eds.), *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '90)* (pp. 249–256), New York, NY: ACM

Nielsen, J., & Pernice, K. (2010). Eyetracking Web Usability. Berkeley, CA: New Riders.

Niemoller, C., Ozcan, D., Metzger, D., & Thomas, O. (2014). Towards a Design Science-Driven Product-Services System Engineering Methodology. *Lecture Notes in Computer Science*, *8463*, *180-193. DOI:10.1007/978-3-319-06701-8_12*

Nilsen, P. (2015). Making sense of implementation theories, models and frameworks. *Implementation Science*, 10(51), 1-13. DOI: 10.1186/s13012-015-0242-0

Nor, K., Shanab, E., & Pearson, M. (2008). Internet banking acceptance in Malaysia based on the theory of reasoned action. *Journal of Information Systems and Technology Management*, 5(1), 3-14. DOI: http://dx.doi.org/10.4301/S1807-17752008000100 001

Nordby, K. (2003). Design for all, shaping the end-users' tel-eeurope. ETSI's involvement in laying the foundation for an all-inclusive eeurope [Powerpoint presentation]. URL: http://www.telenor.com/wp-content/uploads/2012/05/T04_1.pdf

Nurdin, N., Stockdale, R., & Scheepers, H. (2012). Organizational Adaptation to Sustain Information Technology: The Case of E-Government in Developing Countries. *Electronic Journal of E-Government*, 10(1), 70-83

Nyirenda, J., & Cropf, R. (2010). The Prospects for eGovernment and eGovernance in Sub-Saharan Africa: A Case Study of Zambia. *International Journal of Electronic Government Research, 6(1), 23-45*

O'brien, A., Scott, M., & Golden, W. (2016). The Public Value of Sense of Community in e-Participation. In H.J. Scholl, O. Glassey & M. Janssen (Eds.), *Electronic Government and Electronic Participation* (pp. 39-50). Netherlands: IOS Press BV

Ochara, N. (2014). Towards Regional Ontology for E-participation: An Ecological View. In P.M Sebina, K.H. Moahi & K.J. Bwalya (Eds.), *Digital Access and E-Government: Perspectives from Developing and Emerging Countries*. New York, NY: Information Science Reference

Ojha, A., Sahu, G. P., & Gupta, M. P. (2009). Antecedents of Paperless Income Tax Filing by Young Professionals in India: An Exploratory Study. *Transforming Government: People, Process and Policy, 3*(1), 65-90

Ojha, A., Tripathi, R., & Gupta, M. (2011). E-government Adoption and Proliferation across Different Stages of Evolution. In M.A. Shareef, V. Kumar, U. Kumar & Y.K. Dwivedi (Eds.), *Stakeholder Adoption of E-Government Services: Driving and Resisting Factors* (pp. 137-150). Hershey, PA: Information Science Reference

Okunola, O. M., & Rowley, J. (2013). Dimensions of the User Experience of e-Government Services: The Nigeria Immigration Service Website. *Proceedings Of The European Conference On E-Government*, 380-388

Olalere, A., & Lazar, J. (2011). Accessibility of U.S. federal government home pages: Section 508 compliance and site accessibility statements. *Government Information Quarterly, 28*(3), 303- 309

Olatunji, L.A. (2015). Essays on Foreign Direct Investment Institutions Output Efficiency and Economic Growth in Sub-Saharan Africa Countries (SSA) (Doctoral thesis Middlesex University, London). Retrieved from: http://eprints.mdx.ac.uk/18500/ 1/LOlatunjiThesis.pdf

Oreku, G.S., & Menzi, F.J. (2012). A review of e-government initiatives in Tanzania: Challenges and Opportunities. In K.J. Bwalya & S. Zulu (Eds.), *Handbook of Research on E-Government in Emerging Economies: Adoption, E-Participation, and Legal Frameworks* (pp. 37-70). New York, NY: Information Science Reference

Organization for Economic Co-operation and, Development (OECD). (2010). *Denmark: Efficient E-government for Smarter Public service delivery*. Paris: OECD Publishing. DOI:10.1787/9789264087118-en

Organization for Economic Co-operation and, Development (OECD). (2013). *OECD e-Government Studies: Egypt 2013*. Paris: OECD Publishing

Organization for Economic Co-operation and, Development (OECD). (2010). Progress in Public Management in the Middle East and North Africa: Case Studies on Policy Reform. Retrieved from: http://www.oecd.org/mena/governance/48634338.pdf

Organization for Economic Co-operation and, Development (OECD). (2011). M-Government Mobile Technologies for Responsive Governments and Connected Societies. Paris: OECD Publishing. DOI:http://dx.doi.org/10.1787/9789264118 706-en

Ortega, J.L., Aguillo, I.F., & Prieto, J.A. (2006). Longitudinal study of content and elements in the scientific web environment. *Journal of Information Science 32*(4), 344-351

Owen, S., & Rabin, J. (2008). W3C mobileOK Basic Tests 1.0. Retrieved from: https://www.w3.org/TR/mobileOK-basic10-tests/

Owoye, O., & Bissessar, N. (2013). Corruption in African Countries: A Symptom of Leadership and Institutional Failure. In G. Mudacumura & G. Morcol (Eds.), *Challenges to Democratic Governance in Developing Countries* (pp. 227-225). Switzerland: Springer International Publishing

Ozkan, S., & Kanat, I. (2011). E-government adoption model based on theory of planned behavior: Empirical validation. *Government Information Quarterly*, 28(4), 503-512

Padmapriya, A. (2013). E-Governance: A move towards paperless Administration in India. *International Journal of Computer Trends and Technology*, 4(3), 404-411

Palani, N. (2014). *Mobile Software Testing*. Mumbai: Wordit Content & Editing Services Pvt Ltd

Palanisamy, R., & Mukerji, B. (2014). Security and Privacy issues in E-government. In Information Resources Management Association (Ed.), *Cyber Behavior: Concepts, Methodologies, Tools, and Applications* (pp. 880-891). Hershey, PA: Information Science Reference

Panagiotopoulos, P., Barnett, J., & Brooks, L. (2013). Social Media and Government Responsiveness: The Case of the UK Food Standards Agency. *Lecture Notes in Computer Science,* 8074, 310-321. DOI: 10.1007/978-3-642-40358-3_26

Panhale, M. (2016). *Beginning Hybrid Mobile Application Development*. New York, NY: Apress

Park, N., & Yang, A. (2012). Online environmental community members' intention to participate in environmental activities: An application of the theory of planned behavior in the Chinese context. *Computers in Human Behavior*, 28(4), 1298-1306

Patel, H.; Jacobson, D. (2008, June 9-11). Factors Influencing Citizen Adoption of E-Government: A Review and Critical Assessment. 16th European Conference on Information Systems, Galway, Ireland.

Pavlou, P., & Fygenson, M. (2006). Understanding and predicting electronic commerce adoption: An extension of the theory of planned behaviour. *MIS Quarterly*, 30(1), 115-143

Payne, S.J. (2009). Mental Models in Human–Computer Interaction. In A. Sears & J.A. Jacko (Eds.), *Human-Computer Interaction Fundamentals* (pp. 39-52). New York, NY: CRC Press

Pearrow, M. (2000). W*eb site usability handbook*. Rockland, MA: Charles River Media, Inc

Peffers, K., Tuunanen, T., Rothenberger, M.A., & Chatterjee, S. *(2008*). A design science research methodology for information systems research. *Journal of Management Infomation Systems, 24 (3), 45–77*

Peppa, V. Poutoka A. & Metaxas, G. (2012) E-government adoption and the impact of Greek farmers' cultural issues on trust towards agricultural e-government services. *World Transactions on Engineering and Technology Education*, 10(1)

Pereira, G. V., Macadar, M. A., & Testa, M. G. (2016). A Sociotechnical Approach of eGovernment in Developing Countries: An Analysis of Human Development Outcomes. *International Journal of Systems and Society (IJSS*), 3(1), 67-79. Doi:10.4018/IJSS.2016010105

Peris, A., Domingo, M., & Casacuberta, F. (2016). Interactive neural machine translation. *Computer Speech & Language*. In Press. DOI: http://dx.doi.org/10.1016/j.csl.2016 .12.003

Perry, J., & Christensen, R. (2015). *Handbook of Public Administration*. San Francisco, CA: Jossey-Bass

Prat, N., Comyn-Wattiau, I., & Akoka, J. (2014). Artifact Evaluation in Information Systems Design-Science Research – A Holistic View. *PACIS 2014 Proceedings*. Paper 23. Retrieved from: http://aisel.aisnet.org/pacis2014/23

Preece, J., Rogers, Y., & Sharp, H. (2015). *Interaction Design: Beyond Human-Computer Interaction (4th Ed)*. West Sussex: John Wiley & Sons Ltd

Pretorius, M.C. (2012). A Methodology to Institutionalise User Experience in a South African Provincial Government (Doctoral thesis, Nelson Mandela Metropolitan University, South Africa). Retrieved from: http://uxstrategy.co.za/wp-content/ uploads/2013/03/Marco-Pretorius-PhD-Thesis.pdf

Pretorius, M.C., & Calitz, A.P. (2014). A methodology to institutionalise user experience in provincial government. *South African Computer Journal, 55, 25-39*

Pribeanu, C. (2014). Extending and Refining Usability Heuristics to Better Address User Centered Design Issues in the Development and Evaluation of Municipal Websites. *Informatica Economica*, 18(1), 83-91. Doi:10.12948/issn14531305/ 18.1 .2014.07

Price, P. (2013). *Psychology Research Methods: Core Skills and Concepts*. California, CA: Creative Commons

Pugsley, T., & Hovey, A. (n.d). What is Responsinator? Retrieved from: https://www.responsinator.com/about/

Quesenbery, W., (2005), *Usability Standards: Connecting Practice around the World, 2005, connecting people with technology; issues in professional communication issue*. Amityville, N.Y: Baywood Pub

Rahim, M., & Alharbi, I. (2014, December 22-23). User satisfaction with e-government websites: An Australian experience. 17th International Conference on Computer and Information Technology (ICCIT). DOI: 10.1109/ICCITechn. 2014.7073158

Ralins, B. (2016). *Mobile Technologies in Libraries: A LITA Guide*. Maryland, MA: The Rowman & Littlefield Publishing Group Inc

Rana, N., & Dwivedi, Y. (2015). Citizen's adoption of an e-government system: Validating extended social cognitive theory (SCT). *Government Information Quarterly*, 32(2), 172-181

Randtke, W., & Burrell, M.D. (2012). Tools for Reducing and Managing Link Rot in LibGuides. *Code4Lib Journal*, 17, Article 7019. Retrieved from: http://journal.code4lib.org/articles/7019

Rawlins, B. (2016). *Mobile Technologies in Libraries: A LITA Guide*. London: Rawman & Littlefield

Ray, S., (2011), Identifying Barriers to E-Government Services for Citizens in Developing Countries: An Exploratory Study. *International Journal of Electronic Government Research*, 7(3), 79-91

Recker, J. (2013). *Scientific Research in Information Systems: A Beginner's Guide.* Heidelberg: Springer-Verlag

Reddick, G.C. (2010). *Comparative E-Government*. New York, NY: Springer Science and Business Media

Refsdal, A., Solhaug, B., & Stolen, K. (2015). *Cyber-risk Management*. Switzerland: Springer International Publishing

Rehman et al., (2007). Identifying and understanding factors influencing the uptake of new technologies on dairy farms in SW England using the theory of reasoned action. *Agricultural Systems*, 94(2), 281-293

Rehman, M., Esichaikul, V., & Kamal, M. (2012). Factors influencing e-government adoption in Pakistan. *Transforming Government: People, Process and Policy*, 6(3), 258 – 282

Reis, A., Barroso, J., & Goncalves, R. (2013). Supporting Accessibility in Higher Education Information Systems. In C. Stephanidis & M. Antona (Eds.), *Uniersal Access in Human-Computer Interaction: Applications and Services for Quality of Life* (pp. 250-255). Heidelberg: Springer-Verlag

Rensel, A.D., Abbas, J.M., and Rao, H.R. (2006). Private transactions in public places: An exploration of the impact of the computer environment on public transactional web site use. *Journal of the Association for Information Systems*, 7(1), 19-51

Roach, C., & Cayer, J. (2010). Bridging the Other Divide: An assessment of the usability of Trnidad and Tobago Government Ministry Website. In C. Reddick (Ed.), *Comparative E-government* (pp. 483-504). New York, NY: Springer Science+Business Media

Rodrigues, G., Sarabdeen, J., & Balasubramanian, S. (2016). Factors that Influence Consumer Adoption of E-government Services in the UAE: A UTAUT Model Perspective. *Journal Of Internet Commerce*, 15(1), 18-39. Doi:10.1080/ 15332861.2015.1121460

Rogers, E.M. (1983). *Diffusion of Innovations (3rd edition)*. New York, NY: Free Press

Rogers, E.M. (2003). *Diffusion of Innovations(5th edition*). New York, NY: Free Press

Rogers, M. (2016). Government accessibility standards and WCAG 2. Retrieved from: http://www.powermapper.com/blog/government-accessibility-standards/

Romanenko, A. (2012*). Cultural Diversity Management in Organizations: Psychological Variables - Diversity Training*. Hamburg: Diplomica Verlag, GmbH

Rorissa, A., & Demissie, D. (2010). An analysis of African E-government service websites. *Government information quarterly*, 27(2), 161-169

Rorissa, A., Potnis, D., & Demissie, D. (2010). A Comparative Study of Contents of E-government Service Websites of Middle East and North African (MENA). In C.G Reddick (Ed.), *Comparative E-Government: Integrated Series in Information Systems Volume* (pp. 45-69). New York, NY: Springer New York

Rosenfeld, L., Morville, P., & Arango, J. (2015). *Information Architecture: For the Web and Beyond*. Sebastopol, CA: O'Reilly Media, Inc

Rosenzweig, E. (2015). *Successful User Experience: Strategies and Roadmaps*. Waltham, MA: Morgan Kauffmann

Rozis, R., Vasiļjevs, A., & Skadiņš, R. (2012). Collecting Language Resources for the Latvian E-government Machine Translation Platform. Retrieved from: http://www.lrec-conf.org/proceedings/lrec2016/pdf/1224_Paper.pdf

Rukiza, V., Karokola, G., Mwakalinga, J., & Kowalski, S. (2011, June 13-14). Secure e-Government Adoption: A Case Study of Tanzania. European Security Conference (ESC 2011), Örebro, Sweden

Ruuska, I., & Teigland, R. (2009). Ensuring project success through collective competence and creative conflict in public–private partnerships – A case study of Bygga Villa, a Swedish triple helix e-government initiative. *International Journal Of Project Management*, 27(4), 323-334. Doi:10.1016/j.ijproman .2008.02.007

Sabatier, P.A. (2007). *Theories of the Policy Process (2nd ed)*. Boulder, CO: Westview Press

Sabin-Wilson, L. (2016). *WordPress Web Design for Dummies (Third Edition)*. Hoboken, NJ: John Wiley & Sons, Inc

Sahu, P.K. (2013). *Research Methodology: A Guide for Researchers In Agricultural Science, Social Science and Other Related Fields*. India: Springer India

Salgado, A., & Fortes, P. (2016). Heuristic evaluation for novice evaluators. In A. Marcus

(Ed.), *Design, User Experience, and Usability: Design Thinking and Methods* (pp. 387-398). Switzerland: Springer International Publishing

Samuel, O. (2014). Human Factor Issues In The Use Of E-Government Services Among Ghanaian Middle Age Population: Improving Usability Of Existing And Future Government Virtual Interactive Systems Design. *Journal of Information Engineering and Applications*, 4(4), 85-106

San Martín, H., Herrero, A. (2012). Influence of the user's psychological factor son the online purchase intention in rural tourism: integrating innovativeness to the UTAUT framework. *Tourism Management*, *33*, (2), 341–350

Sang, S., Lee, J.D., & Lee, J. (2009) E-government adoption in ASEAN: the case of Cambodia. *Internet Research*, 19, 517–534

Sapio, B., Turk, T., Cornacchia, M., Papa, F., Nicolo, E., & Livi, S. (2010). Building scenarios of digital television adoption: a pilot study. *Technology Analysis and Strategic Management*, *22* (1), 43–63

Sarabdeen, J., Rodrigues, G. & Balasubramanian, S. (2014). E-Government users' privacy and security concerns and availability of laws in Dubai. *International Review of Law, Computers and Technology*, 28(3), 261-276

Sarosa, S., & Lestari, J. (2009). The Level and Impact of Web Based E-government Adoption: The Case of Jogjakarta's Local Government. In C.G. Reddick (Eds.), *Handbook of Research on Strategies for Local E-Government Adoption and Implementation: Comparative Studies* (pp. 794-811). New York, NY: Information Science Reference

Saunders, M., Lewis, P., & Thornhill, A. (2009). *Research methods for business students (5th Edition).* Upper Saddle River, N.J: Prentice Hall

Schaffer, E. (2004). *Institutionalization of Usability: A Step-by-step Guide*. Boston, MA: Addison-Wesley

Schaupp, L.C. & Carter, L. (2005). E-voting: from apathy to adoption. *The Journal of Enterprise Information Management Science, 18*(5), 586-601

Schaupp, L.C., Carter, L., & McBride, M.E. (2010). E-file adoption: a study of US taxpayers' intentions. *Computers in Human Behavior, 26* (4), 636–644

Scheffler, I. (2007). *Science and Subjectivity*. Indainapolis: Bobbs-Merril

Schuppan, T. (2009). E-Government in developing countries: Experiences from sub-Saharan Africa. *Government Information Quarterly, 26*(1), 118-127. Doi:10. 1016/j.giq.2 008.01.006

Schwab, K., & Sala-i-Martin, X. (2015). The Global Competitiveness Report 2015–2016. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/gcr/2015-2016/Global_Competitiveness_Report_2015-2016.pdf

Schweitzer, E.J. (2009). Europeanisation on the Internet? The Role of German Party Websites in the 2004 European Parliamentary Elections. *Observatorio Journal*, 10, 20-40

Scott, J.K. (2005). Assessing the quality of municipal government web sites. *State and Local Government Review*, *37*(2), 151–165

Segbefia, L. (2016). Sub-Saharan Africa to see slow growth-World Bank. Retrieved from: http://citibusinessnews.com/index.php/2016/06/14/sub-saharan-africa-to-see-slow-growth-world-bank/

Seifert, J.W., & Chung, J. (2009). Using e-government to reinforce government-citizen relationships: Comparing government reform in the United States and China. Social Science Computer Review, 27(3), 3–23

Sein, M.K., Henfridsson, O., Purao, S., Rossi, M., Lindgren, R. (2011). Action Design Research. *MIS Quarterly*, 35(1), 37-56

Selden, S., & Orenstein, J. (2011). Government E-Recruiting Web Sites: The influence of e-recruitment content and usability on recruiting and hiring outcomes in US state governments. *International journal of selection and assessment*, 19(1), 31-40. DOI: 10.1111/j.1468-2389.2011.00532.x

Selden, S.J. & Orenstein, J. (2011). Government E-Recruiting Web Sites: The Influence of E-Recruitment Content and Usability on Recruiting and Hiring Outcomes in US State Governments. *International Journal of Selection and Assessment*, 19(1), 32-40

Seng, W. M., Jackson, S., & Philip, G. (2010). Cultural issues in developing E-Government in Malaysia. *Behaviour & Information Technology*, 29(4), 423-432. Doi:10.1080/01449290903300931

Seo, D., & Benson, M. (2016). Comparing attitudes toward e-government of non-users versus users in a rural and urban municipality. *Government Information Quarterly,33(2),270-282.*Doi: http://dx.doi.org/10.1016/j.giq.2016.02.002

Serenko, A., & Bontis, N. (2004). A model of user adoption of mobile portal. *Quarterly Journal of Electronic Commerce*, 4, 69–98

Shajari, M., & Ismail, Z. (2013, September 4-6). Testing an Adoption Model for E-Government Services Using Structure Equation Modeling. *International Conference on Informatics and Creative Multimedia (ICICM)*, University of Technology, Malaysia. DOI: http://doi.ieeecomputersociety.org/10.1109/ICICM.2013.56

Shambour, Q., & Lu, J. (2011). Government-to-Business Personalized e-Services Using Semantic-Enhanced Recommender System. *Lecture Notes in Computer Science*, 6866, 197 – 211

Shareef, M., Kumar, V., Kumar, U., & Dwivedi, Y. (2011). E-government Adoption Model (GAM): Differing service maturity levels. *Government Information Quarterly, 28, 17-35*

Shehadi, R. & Khoury, R. (2009). Customer-Centric E-Government Modernizing the MENA Region's Public Sector. Retrieved from: http://www.strategyandpwc.com/media /file/Customer-Centric_E-Government.pdf

Shelly, G., Napier, A., & Rivers, O. (2009). *Web Design: Introductory Concepts and Techniques.* Boston, MA: Course Technology, Cengage Learning.

Shi, Y. (2007). The accessibility of Chinese local government Web sites: An exploratory study. *Government Information Quarterly, 24*(2), 377- 403

Shih, H.P. (2004). Extended technology acceptance model of Internet utilization behavior. Information & Management, 41(6), 719–729

Shivakumar, S.K. (2016). *A Complete Guide to Portals and User Experience Platforms*. Broken Sound Parkway, NW: CRC Press

Siegel, D., & Dray, S. (2005). Avoiding the next schism: ethnography and usability. *Interactions*, 12(2), 58-61

Sim, G., & Read, J.C. (2015). Using computer-assisted assessment heuristics for usability evaluations. *British Journal of Educational Technology*, 47(4), 694-709. DOI: 10.1111/bjet.12255

Sivaji, A., Addullah, A., & Downe, A.G. (2011, May 24-26). Usability Testing Methodology: Effectiveness of Heuristic Evaluation in E-Government Website Development. Modelling Symposium (AMS), Kuala Lampur, Malaysia

Smith, B.C. (1996). Limit of correctness in computers. In R. Kling (Ed.), *Computerization and Controversy: Value Conflicts and Social Choices*. San Diego, CA: Academic Press

Sonderegger, A., & Sauer, J. (2013). The influence of socio-cultural background and product value in usability testing. *Applied Ergonomics*, 44(3), 341-349. Doi:10.1016/ j.apergo.2012.09.004

Sonderegger, A., Sauer, J., & Eichenberger, J. (2014). Expressive and classical aesthetics: two distinct concepts with highly similar effect patterns in user-artefact interaction. *Behaviour & Information Technology, 33*(11), 1180–1191

Sonderegger, S., Schmutz, S., & Sauer, J. (2016). The influence of age in usability testing. *Applied Ergonomics, 52,* 291-300. Doi:10.1016/j.apergo.2015.06.012

Sonnenberg, C., & Brocke, J. (2012). Evaluation Patterns for Design Science Research Artefacts. In M. Helfert & B. Donnellan (Eds.), *Practical Aspects of Design Science* (pp. 71 -83). Berlin: Springer Berlin Heidelberg

Sorrentino, M., & De Marco, M. (2013). Implementing e-government in hard times: When the past is wildly at variance with the future. Information Polity: *The International Journal Of Government & Democracy In The Information Age*, 18(4), 331-342. Doi:10.3233/IP-130319

Souter, D., Adam, L., Butcher, N., Sibthorpe, C., & Tusubira, T. (2013). Chapter 4: Education. In E. Yonazi, T. Kelly, N. Halewood, & C. Blackman (Eds.), *The transformational use of information and communication technologies in Africa* (pp. 72-75). New York: The World Bank

Spiliotopoulou, L., & Charalabidis, Y. (2014). Web 2.0 in Governance: A Framework for Utilizing Social Media and Opinion Mining Methods and Tools in Policy Deliberation. In K. Bwalya (Ed.), *Technology Development and Platform Enhancements for Successful Global E-Government Design* (pp. 32-54). Hershey, PA: Information Science Reference. Doi:10.4018/978-1-4666-4900-2.ch003

Stenstrom, E., Stenstrom, P., Saad, G., & Cheikhrouhou, S. (2008). Online hunting and gathering: An evolutionary perspective on sex differences in website preferences and navigation. *IEEE Transactions on Professional Communication, 51*(2), 155- 168

Stephanidis, C. (2009). *The Universal Access Handbook*. Sound Parkway, NW: CRC Press

Steward, A. (2010). Web Accessibility National Transition Strategy. Retrieved from: https://www.finance.gov.au/publications/wcag-2-implementation/

Stier, S. (2015). Political determinants of e-government performance revisited: Comparing democracies and autocracies. *Government Information Quarterly*, 32(3), 270-278

Stoiciu, A., & Popa, A. (2012). E-government - a gateway to the future. *Revista De Stiinte Politice*, (35), 372-380

Stowers, G. N. L. (2002). *The state of federal websites: The pursuit of excellence*. Arlington, VA: The PricewaterhouseCoopers Endowment for the Business of Government

Sufna, N., & Fernando, R. L. (2016). Public Value of E-Government: The Case of Ministry of Public Administration and Home Affairs in Sri Lanka. In I. Sodhi (Ed.), *Trends, Prospects, and Challenges in Asian E-Governance* (pp. 139-159). Hershey, PA: Information Science Reference. Doi:10.4018/978-1-4666-9536-8.ch008

Sun, H. (2001, October 21-24). Building a culturally-competent corporate web site: an exploratory study of cultural markers in multilingual web design. The 19th Annual International Conference on Computer Documentation, Santa Fe, New Mexico, USA

Susanto, T.D. (2013, November 12-14). Individual Acceptance of E-government: A Literature Review. The Second International Conference on Informatics Engineering & Information Science (ICIEIS2013), Kuala Lumpur, Malaysia.

Taher, M.. Yang, Z., & Kankanhalli, A. (2012). Public-Private Partnerships In E-Government: Insights from Singapore Cases. PACIS 2012 Proceedings. Paper 116. http://aisel.aisnet.org/pacis2012/116

Tan, W., Liu, D., & Bishu, R. (2009). Web evaluation: Heuristic evaluation vs. user testing. *International Journal of Industrial Ergonomics*, *39*(4), 621-627. Doi:10.1016/j.er gon.2008.02.012

Tan, W., Liu, D., & Bishu, R. (2009). Web evaluation: Heuristic evaluation vs. user testing. International Journal Of Industrial Ergonomics, 39(4), 621-627. Doi:10.1016/ j.ergon.2008.02.012

Tannen, R. (2013). Usability of healthcare.gov - performance problems trump effective-design. Retrieved from: http://intuitivecompany.com/we-see/blog-post/usability-of-healthcare-gov-performance-problems-trump-effective-design/

Tariq, A. (2010). Making usability affordable in the design of e-government services: User-Centred Design for public sector websites. *International Journal of Electronic Governance*, 3(3), 254-272. Doi:10.1504/IJEG.2010.036901

Tashakkori, A., & Creswell, J. (2007). Exploring the nature of research questions in mixed methods research. *Journal of Mixed Methods Research*, 1 (3), 207-211

Tashakkori, A., & Teddlie, C. (2003). Issues and Dilemmas in Teaching Research Methods. *Research Methodology*, 6 (1), 61-77

Tashakkori, A., & Teddlie, Ch. (2008). Quality of inferences in mixed methods research. In Bergman, M. (Ed.), *Advances in mixed methods research: Theories and applications*. London, UK: Sage

Tedesco, D., Chadwick-Dias, A., and Tullis, T. (2004). Demographic Differences in Preferred Web Site Content. Aging by Design. Presentation at Bentley College, Waltham, Massachusetts

Teo, T.H., Srivastava, S.C., & Jiang, L. (2008). Trust and electronic government success: An empirical study. *Journal of Management Information Systems*, 25(3), 99–132

Thompson, D. (2006). Directory of Free Public Internet Access Points in the Western Cape. Retrieved from: https://www.westerncape.gov.za/text/2006/2/directory_of_public_access_facilities_jan06.pdf

Thyvalikakath, T. P., Monaco, V., Thambuganipalle, H., & Schleyer, T. (2009). Comparative study of heuristic evaluation and usability testing methods. *Studies In Health Technology And Informatics*, 143,322-327

Tiago, T., Faria, S., Couto, J.P., & Tiago, F. (2015). Fostering Innovation by Promoting Entrepreneurship: From Education to Intention. *Procedia - Social and Behavioral Sciences, 175*, 154-161. Doi:10.1016/j.sbspro.2015.01.1186

Tolbert, C. J., & Mossberger, K. (2006). The effects of e-government on trust and confidence in government. *Public Administration Review*, 66(3), 354–369

Tomlin, C. (2013). Top 7 HealthCare.gov UX Failures. Retrieved from: http://www.usefulusability.com/top-7-healthcare-gov-ux-failures/

Tractenberg, R.E., Yumoto, F., Aisen, P.S., Kaye, J.A., & Mislevy, R.J. (2012). Using the Guttman Scale to Define and Estimate Measurement Error in Items over Time: The Case of Cognitive Decline and the Meaning of “Points Lost”. *PLoS ONE 7(2): e30019. Doi:10.1371/journal.pone.0030019*

Travica, B. (2014). *Examining the Informing View of Organization: Applying Theoretical and Managerial Approaches*. Hershey, PA: IGI Global

Tullis, T., & Albert, W., (2013). Measuring The User Experience: Collecting, Analysing, And Presenting Usability Metrics (2nd Ed.). Waltham, MA: Morgan Kauffman

Tyler, Z.C., & Gopal, S. (2010). Sub-Saharan Africa at a Crossroads: A Quantitative Analysis of Regional Development. Paper N0. 10, Africa 2060 Project. Boston University. Retrieved from: http://www.bu.edu/pardee/files/2010/04/Pardee-Paper-10-Regional-Development-in-SSA.pdf

U.S. Department of Health and Human Services. (2012). Research-Based Web Design & Usability Guidelines. Retrieved from: https://www.usability.gov/sites/default/files /documents/guidelines_book.pdf

UNDESA. (2012). United Nations E-government Survey 2012: E-government for the people. Retrieved from: https://publicadministration.un.org/egovkb/Portals/egovkb/Docu ments/ un/2012-Survey/Complete-Survey.pdf

UNDESA. (2014). United Nations E-government Survey 2014: E-government for the future we want. Retrieved from: http://unpan3.un.org/egovkb/Portals/ego vkb/Docum ents/un/2014-Survey/E-Gov_Complete_Survey-2014.pdf

UNDESA. (2016). The United Nations E-Government Survey 2016: E-Government in Support of Sustainable Development. Retrieved from:http://workspace.unpan .org/sites/Internet/Documents/UNPAN96407.pdf

UNESCO. (2016). Uganda government officials trained on web accessibility for persons with disabilities. Retrieved from: http://www.unesco.org/new/en/media-servic es/single-view/news/uganda_government_officials_trained_on_web_accessibi lity_for/#.V-uUXPB95hE

United Nations Development Programme (UNDP). (2016). Gender gap costs sub-Saharan Africa $US95 billion a year: New UNDP report. Retrieved from: http://www.undp.org/content/undp/en/home/presscenter/pressreleases/2016/ 08/28/les-disparit-s-entre-les-genres-co-tent-l-afrique-subsaharienne-95-milliards-de-par-an.html

Vaishnavi, V.K., & Kuechler, W. (2015). *Design Science Research Methods and Patterns: Innovating Information and Communication Technology (2nd ed).* Broken Sound Parkway, NW: CRC Press

Van Dam, N., Evers, V., & Arts, F.A. (2005). Cultural User Experience Issues in E-government: Designing for a Multi-cultural Society. *Lecture Notes in Computer Science, 3081, 310-324*

Van Dijk, J., Pieterson, W., Van Deursen, A., & Ebbers, W. (2007). E-services for citizens: The Dutch usage case. *Lecture Notes in Computer Science, 4656,* 155–166

Veljković, N., Dinić, S., B., & Stoimenov, L. (2012). Building EGovernment 2.0 - A Step Forward in Bringing Government Closer to Citizens. *Journal of E-government Studies and Best Practices*. DOI:10.5171/2012.770164

Venable, J., Pries-Heje, J., & Baskerville, R. (2016). FEDS: a Framework for Evaluation in Design Science Research. *European Journal of Information Systems*, 25(1), 77–89

Venkatesh, V., Brown, S.A., & Bala, H. (2013). Bridging the Qualitative–Quantitative Divide: Guidelines for Conducting Mixed Methods Research in Information Systems. *MIS Quarterly*, 37(1), 21-54

Venkatesh, V., Hoehle, H., & Aljafari, R. (2014). A usability evaluation of the Obamacare website. *Government Information Quarterly*, 31(4), 669-680. Doi:10.1016/j.giq. 2014.07.003

Venkatesh, V., L. Thong, J. Y., & Xu, X. (2012). Consumer Acceptance and Use Of Information Technology: Extending The Unified Theory Of Acceptance And Use Of Technology. *MIS Quarterly*, 36(1), 157-178

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly*, 27(3), 425-478

Vermaat, M., Sebok, S., Freund, S., Campbell, J., & Frydenberg, M. (2015). *Enhanced Discovering Computers, Essentials*. Boston, MA: Cengage Learning

Vigo. M.,Abascal, J., Aizpurua, A. andArrue, M. (2009).Tool Independence for the Web Accessibility Quantitative Metric. *Disability and Rehabilitation: Assistive Technology, 4*(4), 248-263

Viitanen, J., & Nieminen, M. (2011). Usability evaluation of digital dictation procedure – An interaction analysis approach. *Lecture Notes in Computer Science*, 7058, 133-150

W3C. (2010). Involving Users in Evaluating Web Accessibility. Retrieved from: https://www.w3.org/WAI/eval/users.html

W3C. (2016). Understanding WCAG 2.0: A guide to understanding and implementing Web Content Accessibility Guidelines 2.0. Retrieved from: https://www.w3.org/tr /understanding-wcag20/Overview.html

Wagner, N., Hassanein, K., & Head, M. (2014). The impact of age on website usability. *Computers in Human Behavior, 37,* 270-282. Doi:10.1016/j.chb.2014.05.003

Wallace, S., & Yu, H. (2009). The Effect of Culture on Usability: Comparing the Perceptions and Performance of Taiwanese and North American MP3 Player Users. *Journal of Usability Studies, 4*(3), 136-146

Walls, J., Widmeyer, G., and El Sawy, O. *(2004). Assessing Information System Design Theory in Perspective: How Useful was our 1992 Initial Rendition? Journal of Information Technology Theory & Application (JITTA), 6, 2, 43-58*

Wang, Y.S., & Shih, Y.W. (2009). Why do people use information kiosks? A validation of the unified theory of acceptance and use of technology. *Government Information Quarterly, 26* (1), 158–165

Wechsung, I. (2013). *An Evaluation Framework for Multimodal Interaction: Determining Quality Aspects and Modality Choice*. Switzerland: Springer International Publishing

Weerakkody, V., El-Haddadeh, R., Al-Sobhi, F., Shareef, M., & Dwivedi, Y. (2013). Examining the influence of intermediaries in facilitating e-government adoption: An empirical investigation. *International Journal of Information Management, 33,*716-725

Weick, K. (1990). Technology as Equivoque: Sensemaking in New Technologies. In P. Goodman (Ed.), T*echnology and organizations* (pp. 1-44). San Francisco: Jossey-Bass.

West, D. M. (2004). E-government and the transformation of service delivery and citizen attitudes. *Public Administration Review*, 64(1), 15−27

Western Cape Government. (2014). Western Cape Government (WCG) Usability Laboratory. Retrieved from: https://www.westerncape.gov.za/facility/western-cape-government-wcg-usability-laboratory

Wilson, *C.* (2014). *User Interface Inspection Methods*. Waltham, MA: Morgan Kaufmann

Witoń, A. (2015). Spatial Diversity in the Socio-Economic Development in Sub-Saharan Africa as Measured by a Composite Index. *Entrepreneurial Business & Economics Review*, 3(1), 75-85. Doi:10.15678/EBER.2015.030106

Witt, N., & McDermott, A. (2004). Web site accessibility: What logo will we use today? *British Journal of Educational Technology, 35* (1), 45–56

Whitmore, A. (2012). A statistical analysis of the construction of the United Nations E-Government Development Index. *Government Information Quarterly*, 29(1), 68-78.

Yaacob, H., & Yusoff, M. (2014). Comparing the Relationship between Perceived Characteristics of Innovation (PCI) and Adoption of Computer Based Training among Trainer and Trainees. *Procedia - Social and Behavioral Sciences*, 155, 69 – 74

Yang, K., & Rho, S.-Y. (2007). E-government for better performance: Promises, realities, and challenges. *International Journal of Public Administration*, 30(11), 1197–1217

Yeasmin, S., & Rahman, K.F. (2012). Triangulation Research Method as the Tool of Social Science Research, *Bup Journal, 1*(1), 154-163

Yi, M., Jackson, J., Park, J., & Probst, C. (2006). Understanding information technology acceptance by individual professionals: toward an integrative view. *Information & Management*, 43(3), 350-365

Yildiz, M., & Saylam, A. (2013). E-government discourses: An inductive analysis. *Government Information Quarterly*, 30, 141-153

Youngblood, N. E. (2014). Revisiting Alabama state website accessibility. *Government Information Quarterly*, 31(3), 476-487. Doi:10.1016/j.giq.2014.02.007

Youngblood, N. E., & Mackiewicz, J. (2012). A usability analysis of municipal government website home pages in Alabama. *Government Information Quarterly*, 29(4), 582-588. Doi:10.1016/j.giq.2011.12.010

Youngblood, N.E., & Youngblood, S.A. (2013) - User experience and accessibility: An analysis of county web portals. *Journal of Usability Studies*, 9(1), 25-41.

Zafiropoulos, K., Karavasilis, I., & Vrana, V. (2012). Assessing the Adoption of e-Government Services by Teachers in Greece. *Future Internet*, 4, 528-544. DOI:10.3390/fi4020528

Zaphiris, P., Kurniawan, S., Ghiawadwala, M. (2007). A systematic approach to the development of research-based web design guidelines for older people. *Universal Access in the Information Society, 6* (1), 59–75

Zarzuela, P., & Anton, C. (2015). Determinants of social commitment in the young. Applying the Theory of Reasoned Action. *Revista Española de Investigación en Marketing ESIC,* 19(2), 83-94

Zhao, F., & Khan, M.S. (2013). An Empirical Study of E-Government Service Adoption: Culture and Behavioral Intention. *International Journal of Public Administration*, 36(10), 710-722

Zhao, F., Shen, K. N., & Collier, A. (2014). Effects of National Culture on E-Government Diffusion - A Global Study of 55 countries. *Information & Management,* 51(8), 1005-1016. Doi:10.1016/j.im.2014.06.004

Zhao, H., & Benyoucef, M. (2014). Usability and credibility of e-government websites. *Government Information Quarterly,* 31(4), 584-595. Doi:10.1016/j.giq.2014.07.002

Zhao, J.J., & Zhao, S.Y. (2010). Opportunities and threats: A security assessment of state e-government websites. *Government Information Quarterly,* 27, 49-56

Zhou, T. (2011). Understanding mobile internet continuance usage from the perspectives of UTAUT and flow. *Information Development, 27* (3), 207–218

Zhou, T., Lu, Y., & Wang, B. (2010). Integrating TTF and UTAUT to explain mobile banking user adoption. *Computers in Human Behavior, 26* (4), 760–767

Zuiderwijk, A., Janssen, M., & Dwiedi, Y. (2015). Acceptance and use predictors of open data technologies: Drawing upon the unified theory of acceptance and use of technology. *Government Information Quarterly, 32(4), 429-440.* Doi:10.1016/j.giq.2015.09.005

APPENDICES

Appendix A: Quick Evaluation Checklist for SSA E-government Websites

Basic Information	
Title of Website	
URL	
Name of Evaluator	
Date	

Instructions to Evaluators

N.B. Model here refers to the policy-ingrained model developed in this thesis (Figure 7.1) and the associated content in Chapter 7.

- This e-government website evaluation tool provides quick and easy to use evaluation criteria for IT staff of government agencies and ministries in SSA to use and evaluate their websites.
- The questions are grouped into six dimensions namely online services, user-help & feedback, navigation, legitimacy, information architecture, and accessibility accommodation.
- There are a total of 27 questions, and all should be answered for the evaluation.
- The questions have been implied to have only a Yes or No answer. The dichotomous responses can either take the value or 1 or 0 depending on the question. Answers containing "1" indicate areas with usability issues while answers with "0" have no usability issues.
- It is advisable to address each of the usability issues identified.
- Depending on the dimension for which a given usability issue is identified, the evaluators should refer to the specific dimension for each of the four mental model (government, designer, evaluator and user) proposed in model to provide guidelines on how to address the given issue (Chapter 7, Section 7.2.2.).
- If the total number of usability issues identified in the course of the evaluation is more than 10, it is imperative to recommend to the specific government agency to not only address the issues, but also apply the general strategies outlined in the model (Section 7.2.1).

A. **Online Services**		**Yes**	**No**
1.	Does the website have any downloadable forms?	0	1
	If yes*, can you think of any information disseminated by the government agency that can be effectively distributed through downloadable forms, but has not been done so?*	1	0
	If no*, does the agency have any information that can be best disseminated via downloadable forms?*	1	0
2.	Does the website have any interactive databases?	0	1
3.	Have any e-commerce applications been included on the website?	0	1
	If yes*, are there any other manual transactional services offered by the agency that can be offered as e-commerce solutions?*	1	0
	If no*, does the agency offer any transactional services to any e-government stakeholder group (e.g. citizens, businesses, and other government agencies?*	1	0
4.	Does the website present information about tenders or job opportunities offered by the government agency?	0	1
5.	Does the website have any chat areas or message boards?	0	1
6.	Does the website have an email subscription tool?	0	1
7.	Does the website have multimedia applications?	0	1
	If yes*, can you think of any information disseminated by the government agency that can be effectively distributed multimedia applications, but has not been done so?*	1	0
	If no*, does the agency have any information that can be best disseminated via multimedia applications?*	1	0

8.	Does the government agency have associated social media accounts for official communication?	0	1
	If yes*, are these accounts linked to the website?*	0	1
9.	Does the website include all governance and civic-oriented documents and publications produced by the government agency?	0	1
B. User-help & Feedback		**Yes**	**No**
10.	Is the website responsive on mobile devices? ***Note:*** *Use Responsinator or any other freely available tool to evaluate the responsiveness of the website.*	0	1
11.	Does the website have an index?	0	1
	If yes*, are all important sections of the website covered in the index?*	0	1
12.	Does the website have a search feature?	0	1
	If yes*, does it return appropriate queries and sort the results according to importance?*	0	1
13.	Does the website have feedback tools (e.g. citizen satisfaction questionnaires, feedback forms, forms for submitting proposals and complaint forms)?	0	1
	If yes*, are there any feedback tools that would be important for this specific government agency that are not included on the website*?	1	0
14.	Does the website have any non-native language translations?	0	1
C. Navigation		**Yes**	**No**
15.	Are all services offered by the government agency listed on the website?	0	1
16.	Does the website have a sitemap?	0	1

	***If yes,** does the sitemap cover all vital areas of the website?*	0	1
17.	Does the website have any broken links? ***Note***: use any freely available tool such as Xenu's Link Sleuth to evaluate the website for broken links).	0	1
D. Legitimacy		**Yes**	**No**
18.	Does the website have disclaimer statements?	0	1
19.	Does the website have a privacy policy?	0	1
	If yes, is the privacy policy clearly presented and periodically repeated throughout the website?	0	1
20.	Does the website have a security policy? ***Note**: the security policy can be embedded in the privacy policy, nonetheless, it has to still stand out as a section on its own.*	0	1
	If yes, is the security policy clearly presented and periodically repeated throughout the website?	0	1
21.	Does the website have any security issues? ***Note:*** use a freely available tool such as SUCURI SITECHECK to evaluate the website for security vulnerabilities. Commercial security tools can also be used if the government agency has access to any.	0	1
22.	If the website requires user details, does it have any authentication mechanisms or a digital signature?	0	1
E. Information Architecture		**Yes**	**No**
23.	Does the website have clearly delineated audience-focused areas?	0	1
	***If yes**, can you think of any other audience-focused area not already available on the website, which can be created to group the information in*	1	0

	the website for effective dissemination?		
	If no, does the website contain information that can be best presented in specific audience-focused areas?	1	0
24.	Does the website contain any personalised or customisable features?	0	1
	If yes, can you think of any other personalised or customisable features that are not yet included on the website, but that can enhance the delivery of specialised services to users? ***Note:*** *the focus should be on services offered by the specific government agency.*	1	0
F.	**Accessibility Accommodation**	**Yes**	**No**
Note: conduct a quick accessibility scan of the website using a freely available WCAG 2.0 evaluation tool.			
25.	Does the website have any level A or AA accessibility errors?	0	1
26.	Does the website have any level AAA accessibility errors?	0	1
27.	Randomly check the first 10-20 non-text elements on the website and determine if the alternative text provided in the description is an appropriate narrative of the element. Did all the evaluated elements have an appropriate narrative in the alt-text?	0	1

Appendix B: Ethical Clearance

UNIVERSITY OF THE FREE STATE
UNIVERSITEIT VAN DIE VRYSTAAT
YUNIVESITHI YA FREISTATA

UFS·UV
NATURAL AND AGRICULTURAL SCIENCES
NATUUR- EN LANDBOUWETENSKAPPE

Faculty of Natural and Agricultural Sciences

21-Jul-2016

Dear **Mr Silas Verkijika**

Ethics Clearance: **Evaluating and Improving the Usability of E-government Websites in Sub-Saharan Africa for enhancing citizen Adoption and Usage**

Principal Investigator: **Mr Silas Verkijika**

Department: **Computer Science and Informatics (Bloemfontein Campus)**

APPLICATION APPROVED

This letter confirms that a research proposal with tracking number: **UFS-HSD2016/0516** and title: **'Evaluating and Improving the Usability of E-government Websites in Sub-Saharan Africa for enhancing citizen Adoption and Usage'** was given ethical clearance by the Ethics Committee.

Your ethical clearance number, to be used in all correspondence is: **UFS-HSD2016/0516**

Please ensure that the Ethics Committee is notified should any substantive change(s) be made, for whatever reason, during the research process. This includes changes in investigators. Please also ensure that a brief report is submitted to the Ethics Committee on completion of the research.
The purpose of this report is to indicate whether or not the research was conducted successfully, if any aspects could not be completed, or if any problems arose that the Ethics Committee should be aware of.

Note:

1. This clearance is valid from the date on this letter to the time of completion of data collection.
2. Progress reports should be submitted annually unless otherwise specified.

Yours Sincerely

Prof. PD (Danie) Vermeulen
Chairperson: Ethics Committee
Faculty of Natural and Agricultural Sciences

Natural and Agricultural Sciences Research Ethics Committee
Office of the Dean: Natural and Agricultural Sciences
T: +27 (0)51 401 2322 | F: +27 (0)51 401 3728 | E: heidemannj@ufs.ac.za
Biology Building, Ground Floor, Room 9 | P.O. Box/Posbus 339 (Internal Post Box G44) | Bloemfontein 9300 | South Africa
www.ufs.ac.za

Appendix C: Consent Form

Evaluator Consent to Participate in the Study

Title: Evaluating and Improving the Usability of E-government Websites in Sub-Saharan Africa for enhancing citizen Adoption and Usage

Student Name: SF Verkijika

Supervisor: Dr Lizette De Wet

General Information:

This consent form is intended for persons who intend to participate in the above-mentioned study as heuristic evaluators.

Purpose of the study:

This evaluation is part of my PhD thesis which aims to evaluate the current usability state of e-government websites in sub-Saharan Africa (SSA) and provide a guiding model for advancing the usability of these websites in order to increase their adoption and usage.

Your Participation:

Your role in this study will involve conducting heuristic evaluations of selected e-government websites using a set of usability guidelines. Prior to conducting the evaluations, you will undergo training with the principal researcher on the different heuristics to be evaluated so as to have an adequate understanding of the heuristic guidelines and rating mechanisms to facilitate agile and quality evaluations. You will conduct heuristic evaluations on a total of 279 e-government websites from 31 countries in SSA. You are likely to take between 60 to 120 minutes to complete the evaluation of each e-government website. As such, you will take as much as 3 months to complete the evaluations to ensure that you have no time factor pressure during the evaluation. Additionally, you will be provided with internet access to facilitate the evaluations so you will not need to personally incur the cost of internet used for the evaluation.

Confidentiality:

All information collected from you will be treated with utmost confidentiality. Only authorised persons will be allowed access to the information and at no time will your personal identification details be disclosed outside of this study.

Right to Withdraw:

Your participation in this study is totally voluntary and you are free to withdraw from the study at any time without prejudice.

Contact Details:

For more information, or if you encounter any problems, contact Verkijika Silas (PhD Student) at: vekasif@gmail.com or Dr Lizette De Wet (Supervisor) at: Ldwet@ufs.ac.za

Consent Agreement:

I ____ confirm that I have read and understood the information on this form. I have had the chance to carefully consider the information, ask questions and had all of my questions answered to my satisfaction. I understand that my participation is voluntary and I can withdraw at any time without prejudice and will not be penalised in away way.

I agree to record the heuristics evaluation data exactly as stated in the ratings criteria provided to me during training.

I hereby give my consent to participate in the study described above.

Full Name of Participant: ____

Signature of Participant: __________________________________ Date: ________________

Full Name of Researcher: ____

Signature of Researcher: __________________________________ Date: ________________

Appendix D: Usability Heuristics of the Six-dimensional Framework

Heuristic Evaluation

E-Government Usability Variables and Ratings Criteria

Table 1: E-government usability variables and operational definitions

Dimension/Variable	**Operational Definition***
Online Services	
Dichotomous Variables	
Basic information	Elementary data identifying website and host agency
Interactive forms	Online form completion and submittal on demand
Interactive databases	Online access to public databases on demand
Multimedia applications	Online access to videos, or audio clips on demand
Chat areas or message boards	Users' forum for live discussions/communications and or messaging - Including social media communication platforms.
E-mail updates/listserv	Registration for e-mail update service for user interest items
Scale variables	
Documents/publications	Official printable material from host agency
Communications with officials	Contact information for elected and management individuals responsible for agency
Downloadable forms	Printable on user demand for official business
E-commerce applications	Individual commerce and citizen transactional
Employment information	Online access to public job information on demand
User-help & Feedback	
Dichotomous Variables	
About the site	Basic data link about the site, targeted for new users or those with little knowledge of ICTs
E-mail us	Customized e-mail template for site assistance
PDA/wireless	Internet portable or wireless mechanism that allows access to any site (Evaluated using http://www.responsinator.com/)
Index	Alphabetized information that permits new users to display site

	facts and other material
Feedback	Link for comments about how site works and impressions
Scale variables	
Foreign language	Translation site version(s) for non-native users
Search	Tool to search content of the site
Navigation	
Dichotomous Variables	
E-Government services	E-Government services enabled through direct links to execute various online functions or transactions
Link to contact information	Direct links readily available to e-mail host agency
Site map	Site map available on the e-government website
Scale variables	
Link to other agencies	Ability to directly make contacts through links with other government agencies
Broken Links	The number of broken links found in the website.
Legitimacy	
Dichotomous Variables	
Contact information	Contact information for users to address questions to and to be assured that it is a credible and official government agency
Disclaimer statements	Disclosure data about the site informing users or visitors of what it is about or not about
Security policy	Statements about the extent to which security is honoured or maintained
Authentication password/digital sign	Visible mechanisms to determine site identity or affiliation
Scale variables	
Privacy policy	Statements about the extent to which privacy is honoured or maintained
Website Security (Sucuri Sitecheck)	Security state of website based on four categories namely: malware, blacklisting status, known errors and outdated software.
Information architecture	
Dichotomous Variables	

Agencies/departments	Agency or government ministry listing
Services	Agency or government ministry's functions noted for novice users
Branch of government	Identification of type or kind of government represented - e.g. ministry
Branding/structure/metaphor	Publicly recognizable identity or image or symbol communicated - e.g. national coat of arms, national flag, logo
Scale variables	
Audience-focused/ centric	User centric approach and outlook on the site especially targeted for new users and those with little knowledge about ICTs and government agencies
Personalized/ customizable	Features customized to satisfy users' preferences within reason
Accessibility Accommodations	
Scale variables	
Manual Check – Alt Text	Manually Check Alt text to determine if the alt text is an appropriate description of the media. Randomly check any 20 media files fir alt text etc.
FAE compliance	Accessibility test to ascertain if there are design errors that hinder disabled accessibility. FAE accessibility tool provides a description of the accessibility implementation status from incomplete to complete.
**Indicates all the dichotomous variables. The ratings of dichotomous variables take only two values (zero or one). To rate a dichotomous variable, enter one (1) if the given variable is true for the e-government website and zero (0) otherwise. The ratings for scale variable are presented in Table 2 below.*	

Table 2: Scale ratings of E-government usability variables

Scale Ratings – Six Dimensional Model of E-government Usability		
Variable	**Rating**	**Rating Description**
Communications with Officials	0	Absence of contact information
	1	Address or phone number
	2	E-mail address (provides access to address or phone number)

	3	Availability of social media communication platform
	4	Responds frequently on user social media post and queries or responds to email within 24 hours.
Documents and Publications	0	Absence of documents and publications
	1	Routine information
	2	Organizational service descriptions
	3	Civic engagement oriented (e.g., policy-maker meeting agendas and minutes)
	4	Governance oriented (e.g., ordinance and budget information)
Downloadable Forms	0	Absence of downloadable forms
	1	One to three downloadable forms
	2	Four to six downloadable forms
	3	Seven to nine downloadable forms
	4	More than nine downloadable forms
E-Commerce Applications	0	No capability
	1	One to three distinct business transactions with one or more online payment mechanisms
	2	Four to six distinct business transactions with one or more online payment mechanisms
	3	Seven to nine distinct business transactions with one or more online payment mechanisms
	4	More than nine distinct business transactions with one or more online payment mechanisms
Employment Information	0	No employment information
	1	Explanation of application process
	2	Full job description
	3	Downloadable application form
	4	Interactive application completion and submittal online
Foreign Language	0	Absence of non-native language translation
	1	One non-native language translation
	2	Two non-native language translations
	3	Three non-native language translations
	4	More than three non-native language translations

Search	0	Absence of search mechanism
	1	FAQ (frequently asked questions)
	2	Site map
	3	Search help features
	4	Sort search relevance feature
Links to Other Agencies	0	Absence of link to other non-host, public agencies or community based organizations
	1	Link to one to four other non-host, public agencies or community based organizations
	2	Link to five to eight other non-host, public agencies or community based organizations
	3	Link to nine to twelve other non-host, public agencies or community based organizations
	4	Link to more than twelve other non-host, public agencies or community based organizations
Broken links	0	Broken links greater than five percent
	1	Broken links greater than three percent but less than or equal to five percent
	2	Broken links greater than one percent but less than or equal to three percent
	3	Broken links greater than zero percent but less than or equal to one percent
	4	Zero percent broken links
Privacy Policy	0	Absence of privacy policy
	1	Unclear privacy policy
	2	Unclear privacy policy with link periodically repeated throughout the website
	3	Clear privacy policy
	4	Clear privacy policy with periodically repeated throughout the website
Website Security (Sucuri Sitecheck)	0	Four or more security issues
	1	Three security issues
	2	Two security issues

	3	One security issues
	4	No security issues
Audience-Focused	0	Absence of apparent audience-focused areas
	1	One distinct audience-focused area
	2	Two distinct audience-focused areas
	3	Three distinct audience-focused areas
	4	More than three distinct audience-focused areas
Personalized or Customizable	0	Absence of personalized/customizable variable
	1	One personalized/customizable feature
	2	Two personalized/customizable features
	3	Three personalized/customizable features
	4	More than three personalized/customizable features
FAE Compliance	0	Incomplete implementation Status (Score < 50%)
	1	Partial Implementation status (Score < 75%)
	2	Partial Implementation status (Score 75-<95)
	3	Almost complete implementation status
	4	Complete Implementation Status
Manual Check Alt Text	0	Four or more errors
	1	Three errors
	2	Two errors
	3	One error
	4	No error

Appendix E: UsabAIPO Heuristics

Design Interface	
1	The interface includes the title of the site, the section or the page in a visible way
2	You know at all times where you are positioned
3	The links are clearly differentiated
4	The scroll is less than two screens
5	There is a link that allows user to return to the home page
6	The interface is perfectly visualized in different resolutions
7	It is easy to locate information previously found
8	The information is organized according to a recognized and familiar logic for users
9	Icons related to and associated with the contents are used
10	The structure, order and logic are familiar and intuitive for users
Navigation	
11	The same actions take to the same results
12	The same information (text) is expressed in the same way in the entire page
13	The information is organized and is similar in each page
14	The standard colors are used for visited links and for ones not visited
15	It is possible to repeat an action already carried out in a simple way
16	There is not redundancy of information on the page
17	The information is short, concise and precise
18	The text is easy to read, it is well organized and the sentences are not very long
19	The fonts are readable and have a suitable size
20	The fonts color has sufficient contrasts with the background
Content Organization	
21	The presentation of the content is familiar or understandable for the user
22	When options exist, they are organized in the user's logical way of thinking
23	The symbols and icons used are easy to understand
24	The information is structured in titles, bold text, and frames
Functionality diverse	
25	If there is help, it is visible and easy to find
26	The page has a section of frequently asked questions

27	Home page has a text box to introduce words to search for in the web site
28	The news headlines contain a link to read the full story
29	The search's area is identified with a headline that titles the search action
30	It shows the date of the last update

Appendix F: List of Evaluated E-Government Websites

SSA Countries	Websites		
	Presidency	Ministry of Tourism	Ministry of Education
Benin	http://www.gouv.bj/	http://tourismebenin.bj/	http://mesrs-bj.org/
Botswana	http://www.gov.bw/en/	http://www.mewt.gov.bw/	http://www.mti.gov.bw/
Burkina Faso	http://www.presidence.bf/	http://www.culture.gov.bf/	http://www.mrsi.gov.bf/
Burundi	http://presidence.gov.bi/	http://www.burundi-tourism.com/	http://www.enseignementsuperieur.gov.bi/
Cameroon	https://www.prc.cm/en/	http://www.mintour.gov.cm/en/	http://www.minesup.gov.cm/
Chad	https://www.presidence.td/fr.html	http://www.ott.td/site/?l=en	http://mestchad.blogspot.co.za/
Côte d'Ivoire	http://www.presidence.ci/	http://www.tourisme.gouv.ci/	http://www.education-ci.org/portail/
Democratic Republic of the Congo	http://www.presidentrdc.cd/	http://www.mintourisme.cd/	http://www.eduquepsp.cd/
Djibouti	http://www.presidence.dj/	http://www.visitdjibouti.dj/	http://www.education.gov.dj/
Ethiopia	http://www.thepresidency.gov.et/eng/	http://www.moct.gov.et/index.php/en/	http://www.moe.gov.et/English/Pages/index.aspx
Gabon	http://presidence-gabon.ga/	http://www.culture.gouv.ga/	http://www.education-nationale.gouv.ga/
Gambia	http://www.statehouse.gm/	http://www.motc.gov.gm/	http://moherst.gov.gm/
Ghana	http://www.presidency.gov.gh/	http://www.motcca.gov.gh/	http://www.moe.gov.gh/
Kenya	http://www.presid	http://www.tourism.go.k	http://www.education.go.ke/h

	ent.go.ke/	e/	ome/
Lesotho	http://www.gov.ls/pm/	http://www.gov.ls/mtec1/	http://education.org.ls/
Liberia	http://www.emansion.gov.lr/	http://www.micatliberia.com/	http://moe.gov.lr/site/
Madagascar	http://www.presidence.gov.mg/	http://www.tourisme.gov.mg/	http://www.education.gov.mg/
Malawi	http://www.statehouse.mw/	http://www.visitmalawi.mw/	http://www.justice.gov.mw/
Mali	http://www.koulouba.ml/	http://www.culture.gouv.ml/	http://www.education.gouv.ml/
Mauritius	http://president.govmu.org/	http://tourism.govmu.org/English/Pages/default.aspx	http://ministry-education.govmu.org/English/Pages/default.aspx
Namibia	http://www.op.gov.na/	http://www.met.gov.na/Pages/DefaultNew.aspx	http://www.moe.gov.na/
Nigeria	http://www.statehouse.gov.ng/	http://www.fmtc.gov.ng/	http://www.education.gov.ng/
Rwanda	http://www.paulkagame.com/	http://www.minicom.gov.rw/	http://www.mineduc.gov.rw/home/
Senegal	http://www.presidence.sn/	http://www.tourisme.gouv.sn/	http://www.education.gouv.sn/
Seychelles	http://www.statehouse.gov.sc/	http://pfsr.org/	http://www.education.gov.sc/
Sierra Leone	http://www.statehouse.gov.sl/	http://www.ntb.sl/	http://education.gov.sl/
South Africa	http://www.thepresidency.gov.za/	http://www.tourism.gov.za/Pages/Home.aspx	http://www.dhet.gov.za/
Uganda	http://www.statehouse.go.ug/	http://tourism.go.ug/	http://www.education.go.ug/
United Republic of Tanzania	http://www.ikulu.go.tz/	http://www.mnrt.go.tz/	http://www.moe.go.tz/
Zambia	http://www.statehouse.gov.zm/	http://www.mota.gov.zm/	http://www.moe.gov.zm/

Zimbabwe	http://www.opc.gov.zw/	http://www.tourism.gov.zw/	http://www.mhtestd.gov.zw/

SSA Countries	**Websites**		
	Ministry of health	**Finance**	**Labour**
Benin	http://www.sante.gouv.bj/	http://www.finances.bj/accueil/	http://www.travail.gouv.bj/
Botswana	http://www.moh.gov.bw/	http://www.finance.gov.bw/	http://www.gov.bw/en/Ministries--Authorities/Ministries/Ministry-of-Labour--Home-Affairs-MLHA/
Burkina Faso	www.sante.gov.bf	http://www.finances.gov.bf/	http://www.fonction-publique.gov.bf/
Burundi	https://www.minisante.bi/	http://www.finances.gov.bi/	http://www.ministerefptss.gov.bi/
Cameroon	http://www.minsante.cm/	http://www.minfi.gov.cm/index.php/en/ministry	http://www.mintss.gov.cm/index.php?lang=en
Chad	http://www.sante-tchad.org/	http://finances.gouv.td/	http://www.mpntic.gouv.td/
Côte d'Ivoire	http://www.sante.gouv.ci/	http://www.finances.gouv.ci/	http://www.formation.gouv.ci/
Democratic Republic of the Congo	http://www.minisanterdc.cd/new/index.php	http://minfinrdc.com/minfin/	http://fonctionpublique.gouv.cd/
Djibouti	http://www.sante.gouv.dj/	http://www.ministere-finances.dj/	http://www.mern-gouv.com/
Ethiopia	http://www.moh.gov.et/	http://www.mofed.gov.et/English/Pages/Home.aspx	http://www.molsa.gov.et/English/Pages/index.aspx
Gabon	http://www.sante.gouv.ga/	http://www.budget.gouv.ga/	http://www.travail.gouv.ga/
Gambia	http://www.moh.gov.gm/	http://www.dosfea.gm/	http://www.moici.gov.gm/

Ghana	http://www.moh-ghana.org/	http://www.mofep.gov.gh/	http://melr.gov.gh/
Kenya	http://www.health.go.ke/	http://www.treasury.go.ke/	http://www.labour.go.ke/
Lesotho	http://www.health.gov.ls/	http://finance.gov.ls/about/default.php	http://www.labour.gov.ls/
Liberia	http://www.mohsw.gov.lr/	http://www.mfdp.gov.lr/	http://www.moys.gov.lr/
Madagascar	http://www.sante.gov.mg/extranet/home/webresponsive	http://www.mefb.gov.mg/	http://www.mfptls.gov.mg/
Malawi	http://www.hiv.health.gov.mw/	http://www.finance.gov.mw/	http://www.moit.gov.mw/
Mali	http://www.sante.gov.ml/	http://www.finances.gouv.ml/	http://www.fonctionpublique.gouv.ml/
Mauritius	http://health.govmu.org/English/Pages/default.aspx	http://mof.govmu.org/English/Pages/default.aspx	http://labour.govmu.org/English/Pages/default.aspx
Namibia	http://www.mhss.gov.na/	http://www.mof.gov.na/	http://www.mol.gov.na/
Nigeria	http://www.health.gov.ng/	http://www.finance.gov.ng/	http://www.labour.gov.ng/
Rwanda	http://www.moh.gov.rw/index.php?id=2	http://www.minecofin.gov.rw/index.php?id=2	http://www.mifotra.gov.rw/
Senegal	http://www.sante.gouv.sn/	http://www.finances.gouv.sn/en/	http://www.travail.gouv.sn/
Seychelles	http://www.health.gov.sc/	http://www.finance.gov.sc/	http://www.employment.gov.sc/
Sierra Leone	http://health.gov.sl/	http://labour.gov.sl	http://mofed.gov.sl/
South Africa	http://www.health.gov.za/	http://www.treasury.gov.za/ministry/	http://www.labour.gov.za/DOL/
Uganda	http://www.health.go.ug/	http://www.finance.go.ug/	http://www.mglsd.go.ug/
United	http://www.moh.go.tz	http://www.mof.go.tz/	http://www.kazi.go.tz/

Republic of Tanzania	/		
Zambia	http://www.moh.gov.zm/	http://www.mofnp.gov.zm/	http://www.mlss.gov.zm/
Zimbabwe	http://www.mohcc.gov.zw/	http://www.zimtreasury.gov.zw/	http://www.mpslsw.gov.zw/

	Websites		
SSA Countries	**Ministry of International Affairs**	**Local Government 1**	**Local Government 2**
Benin	http://www.diplomatie.gouv.bj/	http://mairiecotonou.org/	http://www.villedeportonovo.com/
Botswana	http://www.mofaic.gov.bw/	http://www.cdc.gov.bw/	http://www.kgatlengdc.gov.bw/
Burkina Faso	http://www.mae.gov.bf/	http://www.mairie-koudougou.bf/	http://www.ouahigouya.org/
Burundi	http://www.diplobdi.org/	www.villedebujumbura.org	www.villedebujumbura.org
Cameroon	http://www.diplocam.cm/Cameroon-diplomaty/	http://bueacouncil.com/	http://douala-city.org/fr/?e1=84&kid=1&bnid=84
Chad	http://www.tchad-diplomatie.com/	http://www.villedemoundou.org/	http://www.mairiedendjamena.org/home.html
Côte d'Ivoire	http://www.diplomatie.gouv.ci/	http://tiapoum.ahibo.com/	http://marcory.org/
Democratic Republic of the Congo	http://minjsl.gouv.cd/	http://www.kinshasa.cd/	http://www.mairiedelubumbashi.com/
Djibouti	http://www.djibdiplomatie.dj/	http://www.region-dikhil.dj/	http://www.region-tadjourah.dj/
Ethiopia	http://www.mfa.gov.et/	http://www.aacc.gov.et/	http://www.dire-dawa.gov.et/index.php?la

			ng=en
Gabon	http://www.affaires-etrangeres.gouv.ga/	http://www.libreville.ga/	http://lambarene.ga/
Gambia	http://www.mofa.gov.gm/	http://banjulcitycouncil.blogspot.co.za/	
Ghana	http://www.mfa.gov.gh/	http://ama.ghanadistricts.gov.gh/	http://kwahueast.ghanadistricts.gov.gh/
Kenya	http://www.mfa.go.ke/	http://www.nairobi.go.ke/	http://www.mombasa.go.ke/
Lesotho	http://www.foreign.gov.ls/home/	http://www.mcc.org.ls/	http://www.mcc.org.ls/
Liberia	http://www.mofa.gov.lr/public2/index.php	http://www.bongcounty.info/	http://www.paynesvilleliberia.com/
Madagascar	http://www.diplomatie.gov.mg/	www.commune-urbaine-mahajanga.mg	http://www.toliara.org/
Malawi	http://www.foreignaffairs.gov.mw/	http://www.bccmw.com/	http://www.llcitycouncil.org/
Mali	http://www.diplomatie.gouv.ml/	http://mairiesikasso.blogspot.co.za/	http://marena.tringa.free.fr/
Mauritius	http://foreign.govmu.org/English/Pages/default.aspx	http://www.bbrh.org/index.php	http://mpl.intnet.mu/home.htm
Namibia	http://www.mfa.gov.na/	http://www.keetmanshoopmunicipality.org.na/	http://www.okahandja.org.na/
Nigeria	http://www.foreignaffairs.gov.ng/	http://www.nigerstate.gov.ng/	http://www.lagosstate.gov.ng/
Rwanda	http://www.minaffet.gov.rw/index.php?id=351	http://www.kigalicity.gov.rw/	http://www.huye.gov.rw/
Senegal	http://www.diplomatie.gouv.sn/	http://www.villededakar.org/	http://mairiederufisque.org/index.php
Seychelles	http://www.mfa.gov.sc/	http://www.localgovernment.gov.sc/	
Sierra Leone	http://www.nacesl.org/mofa/index.htm	http://www.fcc.gov.sl/	http://www.moyamba.gov.sl/

South Africa	http://www.dirco.gov.za/	http://www.mangaung.co.za/	https://www.capetown.gov.za/en/Pages/default.aspx
Uganda	http://www.mofa.go.ug/	http://masaka.go.ug/	http://www.kcca.go.ug/
United Republic of Tanzania	http://www.foreign.go.tz/index.php/en	http://www.tmc.go.tz/	http://www.arusha.go.tz/
Zambia	http://www.foreignaffairs.gov.zm/	http://www.lcc.gov.zm/	http://www.mlgh.gov.zm/?page_id=683
Zimbabwe	http://www.zimfa.gov.zw/	http://www.hararecity.co.zw/	http://www.citybyo.co.zw/

E-Government Development in Sub-Saharan Africa (SSA): Relationship with Macro Level Indices and Possible Implications

Silas Formunyuy VERKIJIKA[1], Lizette DE WET[2]

[1]*University of the Free State, 205 Nelson Mandela Drive, Bloemfontein, 9300, South Africa*

Tel: +27 (0) 782208877, Email: vekasif@gmail.com

[2] *University of the Free State, 205 Nelson Mandela Drive, Bloemfontein, 9300, South Africa*

Tel: +27 (0)51 401 3705, Fax: +27 (0)51 4012754, Email: dWetL@ufs.ac.za

Abstract: The remarkable benefits of e-government has enthused many governments around the globe to focus on the development of e-government competencies as a central part of their strategies. However, there are still great disparities in the level of e-government development between the developed and developing worlds, with Sub-Saharan Africa (SSA) lagging behind all other regions. The reason for these disparities has so far been attributed to differences in national income; nonetheless, some resource-poor countries have succeeded to make great strides in e-government development. As such, there has been a call to examine other indicators of e-government development, since national income alone does not paint a detailed picture. In this light, this study examined a total of six indicators (corruption, gender equality, population age, national income, cybersecurity, and innovation) that are believed to influence e-government development using SSA as the case study. Macro-level indices were used to capture country level data from 49 SSA countries. The findings indicated that all the factors significantly influenced e-government development in SSA. The paper culminates with a discussion of the possible implications of the findings.

Keywords: E-government development, Sub-Saharan Africa, e-government indicators, corruption, gender equality, population age, national income, cybersecurity, innovation.

1. Introduction

Over the last two decades, governments around the world have increasingly adopted Information and Communication Technologies (ICTs) into their mainstream activities as a means of enhancing their overall performance. This espousal of ICTs into government activities has been widely referred to as e-government [1], [2]. Evidence from around the world indicates that e-government is an extremely valuable strategy for governments to boost their administrative efficiency, gain the trust of citizens, uproot corruption of government officials, and eventually encourage democratic governance [3], [4]. According to Schuppan [2], the fact that e-government enables the efficient and effective administration of state institutions makes it a vital precondition for a nation's economic and social development. As such, the development of e-government competencies has become a central aspect of most government strategies around the globe [5], [6].

While e-government presents many benefits, most countries in the developing and less developed worlds are yet to enjoy such benefits, as the development of e-government in these regions lags far behind that of the developed world [7]. One such region is Sub-Saharan Africa (SSA). SSA is the geographical area in the African continent that lies south of the Sahara desert and consist of 49 countries. Data from the United Nations' (UN) e-government development index clearly indicates that most SSA countries are being considered as the least developed in terms of e-government. Cloete [8] explicates that the reasons why many countries in SSA stifle in e-government development, are the high deficiency in visionary leadership, corrupt officials, and ambiguous ICT and e-government policies that are insufficient to address the contemporary role of ICTs in government. This is a call for concern as high e-government development can be very pertinent in SSA as a means of addressing the high inefficiencies, limited capacity, and poorly trained personnel that characterise public administration in the region [9].

One way to foster e-government development in SSA is by understanding the different general indicators that can influence national e-government development. One such indicator that has been identified by the UN is the national income of a country, which has been noted to have a strong influence on national e-government development. Nonetheless, it has been argued that national income is not the only factor that constitutes or guarantees e-government development. As such, identifying other national indicators that can influence national e-government development is imperative in order to ensure the development of sound policies and national e-government strategies that can foster e-government growth in SSA.

This study has as objective to examine possible macro level indicators that can explain trends in e-government development in SSA. The factors that will be examined include: corruption index, gender equality, national age distribution, national income, cybersecurity index, and innovation index.

2. Literature Review

2.1.– Corruption and E-government Development

The links between e-government and corruption has been widely discussed in literature. However, the existing discussions have been highly unrepresentative with most researchers only focusing on enhancing knowledge on the potentials of using e-government to eradicate corruption. For example, several researchers ([10], [11]) have provided various models and approaches on how e-government can be effectively used to reduce corruption, while others ([3], [12]) have provided empirical evidence to support the positive impact of e-government on eradicating corruption. Nevertheless, for such benefits to be attained, e-government projects need to be successfully deployed - which is not the case in developing regions such as SSA, where there is a high degree of failure in e-government initiatives [13].

According to Aladwani [14], corruption is a huge factor influencing the failure of e-government projects in developing countries. Similarly, pervasive corruption has been argued to be one of the most vital contextual factors that significantly affect the maturity of e-government initiatives [15]. Additionally, e-government development in Africa is stifled by corrupt officials [8]. While there is little or no empirical evidence indicating the impact of corruption on e-government initiatives, it is widely acknowledged that corruption stifles the development of a nation. For example, studies by Svensson [16] and Blackburn and Forgues-Puccio [17] showed that corruption negatively impacts on economic growth. Bamidele [18] and Lawal [19] also indicated that corruption is a major factor impeding sustainable development in Africa as it prevents the development of effective governance institutions. Furthermore, Adesote and Abimbola [20] emphasised that corruption in Nigeria negatively affects the country's development initiatives. Consequently, some researchers ([14], [21]) have postulated that e-government project failures in the developing world could be influenced by corruption. Similar to other development initiatives, e-government development also requires strong institutional bodies and financial resources for its implementation. As such, it is plausible to hypothesise that, like other development initiates, e-government can also stifle in the midst of corruption.

2.2.– Gender Equality and E-government Development

Gender basically refers to the hierarchical separation between men and women rooted in both social practices and institutions [22]. Existing literature on technology adoption has highlighted the significant gender differences in the adoption and usage of technologies ([23], [24], [25]). There is a high significant gender gap in the adoption and usage of technologies, with women being at the bottom end. In the context of e-government solutions, Al-Shafi and Weerakkody [26] showed that there were significant gender differences in the adoption of e-government in Qatar. Similarly, Ambali [27] showed that gender has a profound moderating effect on the impact of several factors, for example ease of use, perceived usefulness, security, intention to use and facilitating conditions on e-government adoption. According to Sarabdeen and Rodrigues [28], most e-government initiatives have been implemented without taking into consideration the existing gender-based differences in technology usage and behaviour. This could result in poor adoption of e-government solutions and thus account for the subsequent failure of e-government initiatives. However, when there is a high gender balance in terms of skills and competencies, the adoption of e-government becomes consistent for both men and women [29]. As such, this study hypothesises that e-government development will be high in countries that have high gender equality; as such countries will have high e-government adoption and thus more demand for e-government services.

2.3.– Age Differences and E-government Development

Existing evidence ([25], [26]) indicates that age has both a direct and an indirect effect on the adoption and usage of technology. The age group that characterises most of a country's population can highly influence the demand for e-government services and thus its subsequent development. For example, evidence from Alabama indicated that the development of e-government was negatively associated with the age group of people younger than 18 years and those older than 65 years [30]. In Saudi Arabia, Baker, Al-Gahtani and Hubona [31] found that older users were less likely to engage in e-government activities because of resistance to change. This could be supported by the view that older users have several declines that affect their computer usage [32]. Wigand [33] indicated that, while younger citizens (younger than 50 years) preferred the internet, older citizens (older than 65 years) preferred telephone and face-to-face interactions. As such, a nation with a high population of older citizens might have less demand for e-government services. Similarly, children might also have little use for e-government services and so demand will decrease with an increase in the younger generation. However, the middle age group, between 15 and 64 years as classified by the UN, is the age group that prefers the internet and might have high demands for e-government services. This study, therefore, hypothesises that a country with a high percentage of young children (younger than 15 years) and senior citizens (older than 65 years), will have little demand for e-government services and the country will, thus, have poor e-government development. On the other hand, a nation with a high population of active citizens (15 – 64 years) will have a greater demand for and adoption of e-government services, and thus higher e-government development.

2.4.– National Income and E-government Development

The national income of a country plays a vital role in advancing e-government development in the area. After examining the relationship between national income and e-government development across countries, Hafeez and Sher [34] found a clear pattern aligning national income with e-government development, with high income countries having greater e-government progress. National income depicts the economic progress of a nation, which in turn significantly influences its e-government development [35]. Perry and Christensen [36] noted that disparities in income level could possibly explain why European countries improve the most in e-government implementation, while African countries improve the least. Asogwa [37] explicated that investments in financial resources was one of the factors necessary for overcoming the challenges of implementing e-government in Africa. Consequently, poor countries might struggle to effectively implement their e-government initiatives due to constraints in financial resources. As such, this study hypothesises that an increase in the national income of a country in SSA will positively influence e-government development in that country.

2.5.– Cybersecurity and E-government Development

Information security has been noted as an important factor that influences the successful adoption and use of e-government systems [38]. Information security can, in the context of e-government systems, be seen as the necessary measures for protecting the confidentiality, integrity, and availability of sensitive information that is processed, stored and transmitted between e-government systems. E-government systems are faced with several security threats with the denial of service (DOS) attacks being the most common [39]. Existing security threats to privacy, identity, and data systems significantly affect citizens' trust in e-government systems and this plays a vital role in influencing governments' and users' willingness to adopt and use e-government solutions [38], [40]. Cybersecurity incidents are becoming rampant with e-government systems. For example, in June 2015, numerous Canadian government websites and servers were taken down in a cyber-attack. Similarly; early in 2015 there was a wave of cyber-attacks that targeted government-related websites in Ghana, Nigeria, and Senegal [41]. Since perceived security is vital for e-government adoption [40], it remains important to ensure that e-government solutions are highly secure to encourage user adoption and its subsequent development. As such, this study hypothesises that countries that have implemented high levels of cybersecurity measures will have more citizens willing to adopt e-government solutions, and such demand will result in higher e-government development in the nation to meet the user needs.

2.6.– Innovation and E-government Development

Innovation in public administration plays a positive role in enhancing e-government development [42]. Innovation generally refers to the transformation of an invention to usable products or processes for creating superior ways of adding value to for customers [42] Innovation is a vital part of the overall e-government process, as it is necessary for the initiation phase of e-government initiatives, as well as the continuous improvement of e-government systems [43]. Governments with high innovation orientations are more receptive to new approaches and thus have a higher likelihood of adopting novel e-government systems [42]. Cheng *et al*. [44] highlight that public-sector innovations are generally a reflection of the application of technological solutions provided by commercial technology. As such, the general level of innovation in a country will provide public sector organizations with available technological advancements for improving on their e-government offerings. A good example in SSA is the e-tax systems widely adopted by governments in several SSA countries due to the availability of innovative mobile money payment solutions developed by the private sector. Consequently, this study hypothesises that a higher national level of innovation will have a positive relationship to e-government development.

3. Methodology

This study adopted a cross-sectional research design for analysing the macro level factors that influence e-government development in SSA. In a cross-sectional research design the data for the study is collected at one point in time for several variables. In the case of this study, data for 2014 was collected for the different variables used in the study. For addressing the objectives of this study and examining the hypothesised relationships, it was important to obtain available data from all the countries in SSA, aggregated at the national level. A total of 49 countries were included in the sample. The applicable data was collected from several notable secondary sources. Each of the data sources used in this study is discussed below alongside the variable for which it was measured.

3.1.– Dependent variable

The dependent variable in this study was e-government development measured using the e-government development index (EGDI). The 2014 EGDI was used. The 2014 EGDI reflects the state of a country's e-government development based on the UN E-government Survey Report [35]. EGDI is a composite index made up of three indices, namely: the online service index (OSI), the telecommunication infrastructure index (TII), and the human capital index (HDI). EGDI is a reliable index that had been widely adopted in many studies to map a country's level of e-government maturity [45].

3.2.– Explanatory variables

A total of six explanatory variables were used in this study.

- **Corruption**: The 2014 corruption perception index (CPI) data was obtained from Transparency International.
- **Gender Equality**: The gender development index (GDI) obtained from the UN dataset was used as proxy for gender equality. GDI data for 2013 was used as it was the closest dataset for the chosen period for cross-sectional analysis.
- **Age Differences**: The 2014 data on the population age demographics for each country was obtained from the World Bank. The data classified populations into three age groups, namely: 0-14 years, 15-64 years, and 65 years and above. Following from discussions in section 2.3, the age group 0-14 and 65 and above were grouped as a population group with less demand and use of e-government services, while the population group 15-64 years was grouped as the active e-government populace.

- **National Income**: The 2014 gross national income (GNI) per capita obtained from the World Bank dataset was used as the proxy for national income. This is the measure for national income that has been used over the years in the UN e-government surveys to depict the relationship between national income and e-government.
- **Cybersecurity**: The cybersecurity efforts of each country were obtained from the 2014 global cybersecurity index (GCI) by ABI Research and the International Telecommunication Union.
- **Innovation**: National level innovation for each of the countries was determined based on data from the 2014 global innovation index (GII) report. The GII is co-published by the World Intellectual Property Organization (WIPO), Cornell University and INSEAD.

4. Results

The results in Table 1 present a detailed picture of e-government development in SSA as of 2014. The average EGDI for SSA of 0.2474 is far below the world average of 0.4712 and the African average of 0.2661 [35]. Therefore, SSA is the worst developed region in terms of e-government around the world. Within SSA, the Southern Africa sub-region is the most advanced in e-government development, followed by eastern Africa and middle Africa respectably, while western Africa is the worst. Nonetheless, there are isolated cases of countries in eastern and southern Africa where e-government development stands above the world average, as indicated by the maximum e-government scores in these sub-regions. Similar to the EGDI, southern Africa also leads the rest of the regions in all three e-government development sub-dimensions (OSI, TII, and HDI).

Table 1: E-government Development in SSA

E-Government Index		Sub-Regions				Region
		Eastern Africa	Middle Africa	Southern Africa	Western Africa	SSA
EGDI	Mean	0.2597	0.2221	0.3726	0.2079	0.2474
	STD.	0.1293	0.0778	0.0895	0.0819	0.1112
	Min / Max	0.0139 / 0.5338	0.1076 / 0.3294	0.2629 / 0.4869	0.0946 / 0.3735	0.0139 / 0.5338

OSI	Mean	0.2229	0.0962	0.2614	0.1521	0.1805
	STD.	0.1739	0.0945	0.1099	0.1082	0.1431
	Min / Max	0.0000 / 0.5118	0.0079 / 0.2992	0.1339 / 0.3858	0.0000 / 0.3150	0.0000 / 0.5118
TII	Mean	0.1173	0.1075	0.2392	0.1315	0.1326
	STD.	0.13361	0.0742	0.0955	0.0698	0.1063
	Min / Max	0.0000 / 0.4721	0.0280 / 0.2660	0.1179 / 0.3466	0.0385 / 0.2966	0.0000 / 0.4721
HDI	Mean	0.4387	0.4669	0.6173	0.3403	0.4299
	STD.	0.1634	0.1332	0.0819	0.1370	0.1613
	Min / Max	0.0000 / 0.7310	0.2341 / 0.6677	0.5135 / 0.7282	0.1192 / 0.6032	0.0000 / 0.7310

The correlation matrix in Table 2 presents the relationships between the independent variables. Corruption has a strong positive relationship with gender equality, age group (15-64), and innovation. It should be noted that a high CPI reflects a less corrupt country. This shows that less corrupt countries tend to be more balanced in terms of gender equality, are more innovative, and most of the population falls within the 15-64 age group. It is also observed that high gender development tends to be the most innovative. This supports the views that gender equality is a prerequisite for innovation [46]. Likewise, the higher the population group between the ages of 15-64, the more innovative a country is.

Table 2: Correlation Matrix for the Explanatory factors

Factor	Mean	STD	(1)	(2)	(3)	(4)	(5)	(6)	(7)

(1)	32.45	12.30	1							
(2)	0.87	0.07	0.47**	1						
(3)	44.51	6.08	-0.61**	-0.49**	1					
(4)	55.49	5.08	0.62**	0.49**	-1.00**	1				
(5)	4619.79	1.18	0.274	0.13	-0.51**	0.51**	1			
(6)	0.16	6619.15	0.22	0. 27	-0.14	0.14	0.03	1		
(7)	0.22	0.17	0.63**	0.48*	-0.68**	0.68**	0.71**	0.51**	1	

(1) Corruption (CPI), (2) Gender equality (GDI), (3) Age Group (0-14 & 65+), (4) Age group (15-64), (5) National Income (GNI), (6) Cybersecurity (GCI), (7) Innovation (GII).

On the other hand, having many people in the age groups of 0-14 and 65+ years has a significant negative relationship with innovation. This can be deduced from the fact that the age group 15-64 reflects the active population of the country responsible for creating innovations, while the age groups 0-14 and 65+, mostly contain dependents. A higher national income is also significantly associated with high levels of innovation. Countries with higher national incomes have the necessary economic resources to foster innovation, as national income is a key indicator of economic progress. The cybersecurity index only showed a positive relationship with innovation.

The next section presents the regression analysis of the relationship between the explanatory factors and e-government development in SSA. Because of the significant correlations found in table 2 between the explanatory variables, a multiple regression could not be conducted due to possible collinearity problems. Consequently, simple linear regressions were used to establish how each of the explanatory variables influenced e-government development in SSA. However, each of the models was controlled for differences in e-government development across sub-regions, as highlighted in section 3.3 above. Controlling for sub-regional differences in e-government development is consistent with prior studies [45], [47].

Table 3: Regression Analysis for the Relationship between Explanatory factors and E-government development

Explanatory Factors	Beta Coeff.	Regression Parameters		T-Test		Control Effect	
	β	Adjusted R2	F-Value (Sig.)	T-Value	(Sig.)	R^2-Change	F-Change (Sig.)
(1)	0.552	0.431	19.170 (0.000)**	4.737	0.000**	0.049	4.137 (0.048)*
(2)	0.731	0.552	21.342 (0.000)**	4.788	0.000**	0.091	0.091 (0.764)
(3)	-0.599	0.461	21.516 (0.000)**	-5.123	0.000**	0.027	2.389 (0.129)
(4)	0.599	0.461	21.516 (0.000)**	5.123	0.000**	0.027	2.389(0.129)
(5)	0.358	0.327	12.158 (0.000)**	2.935	0.005**	0.187	12.774 (0.001)**
(6)	0.450	0.412	14.989 (0.000)**	3.711	0.001**	0.235	15.949 (0.000)**
(7)	0.724	0.685	36.956 (0.000)**	7.216	0.000**	0.079	8.263(0.007)**

(1) Corruption (CPI), (2) Gender equality (GDI), (3) Age Group (0-14 & 65+), (4) Age group (15-64), (5) National Income (GNI), (6) Cybersecurity (GCI), (7) Innovation (GII).

From Table 3, it is observed that all the examined models were significant with all explanatory variables having a significant influence on e-government development. Except for the age groups 0-14 and 65+, which had a negative influence, all the other factors showed positive relationships with e-government development. The positive influence of corruption on e-government development indicates that the least corrupt countries in SSA tend to have a higher level of e-government development. This supports the view that corruption stifles e-government development in SSA [8]. It was also observed that countries with high levels of gender equality have higher levels of e-government development. This suggests that high gender equality reduces existing gaps in technology adoption and usage, thus increasing demand for e-government services. Additionally, countries with high gender equality are more likely to take into consideration gender-based difference in the implementation of e-government projects ([28], [29]), thus fostering success of such initiatives and possible growth of e-government development.

The results showed that having a higher population in the age groups 0-14 and 65+ was associated with poor e-government development, while the age group 15-64 was associated with high e-government development. This is in line with the findings by Xu and Asencio [30] in Alabama who observed that e-government development was negatively associated with the age group of people younger than 18 years and those older than 65 years. As mentioned before, this could result from the fact that people in these age groups are less likely to engage in e-government activities [31]. Consequently, there will be little demand for e-government services, which will negatively affect its development. On the other hand, the positive influence of the age group 15-64 can result from the high demand of e-government services by this group, as indicated by Wigand [33].

The significant influence of national income on e-government development is expected, following existing evidence from the UN e-government surveys [35]. This is also congruent to the patterns identified by Hafeez and Sher [34]. As such, disparities in national income could explain poor development of e-government in most SSA countries, as highlighted by Perry and Christensen [36].

The positive influence of cybersecurity on e-government development highlights the necessary role of security in e-government adoption and development as posited in prior studies ([38], [40]). Likewise, the positive effect of innovation on e-government development supports the arguments by Anthopoulos *et al.* [42] that innovation in public administration plays a positive role in enhancing e-government development.

Lastly, the results showed that, except for gender equality and age, controlling for regional differences in e-government development had a significant influence on all the other relationships. The highest control effect was seen in the relationship between cybersecurity and e-government development where the control factor accounted for 23.5% of the explained variance (R^2-Change). Unlike age and gender that are demographic factors specific to each country, the other variables could easily have spill-over effects, which possibly explain the significant impact associated with controlling for regional differences.

5. Conclusions and Implications

E-government has been widely acknowledged as an extremely valuable strategy for coasting the administrative efficiency of governments around the globe. As such, advancing e-government development has become a central aspect of most government strategies around the world ([5], [6]). However, there are notable disparities in e-government development across different regions, with SSA being at the bottom of e-government development in the world. To help advance e-government, it is necessary to examine and understand the indicators of e-government in the region.

Prior evidence [35] has shown that national income is a valuable indicator of e-government development, yet it did not account for all the disparities. For instance, even though national income had a significant influence on e-government development, some outliers, like India, Bolivia, Ghana, Honduras, India, Philippines, Vietnam and Uzbekistan, suggest that other factors play a role in the relationship [35]. However, these factors have not been identified before.

This study, therefore, aimed at examining other macro-level factors that could explain the level of e-government development (or lack thereof) in SSA. The results showed that all the examined factors (corruption index, gender equality, national age distribution, national income, cybersecurity index, and innovation index) had a significant influence on e-government development in SSA. This provides a valuable basis for understand existing patterns in e-government development far beyond what has been established in the UN e-government surveys. For example, Sudan has a higher GNI per capita than Ghana and India, yet its level of e-government is comparably lower than that of both Ghana and India (UN, 2014). Based on the findings from this study, a possible explanation could be provided for such scenarios: it can be seen that Sudan is a highly corrupt nation (CPI = 11) compared to Ghana (CPI= 48) and India (CPI = 38). Similarly, the Congo Republic has a higher GNI per capita than Ghana, Honduras, India, Philippines, Vietnam and Uzbekistan; however, the level of e-government development in the Congo is worse than that for all the noted countries. Since the Congo has a higher level of corruption than the above-mentioned countries, there is a possibility that corruption could be a vital indicator to address the unexplained outliers in the relationship between national income and e-government development. Subsequent UN e-government surveys can benefit from these findings and adopt the corruption index as a moderating factor in providing a comprehensive picture of the relationship between national income and e-government development.

Other implications relate to the need for ensuring that gender and age differences are considered when implementing e-government initiatives. Sarabdeen and Rodrigues [28] have noted that most e-government initiatives are implemented without taking gender differences into consideration. As such, these differences should be seriously considered in SSA as gender equality is vital for e-government development and success [48].

Lastly, many e-government initiatives in Africa fail because they try to copy and paste from the developed world without taking local realities into consideration [2]. However, this can be addressed by promoting innovations that can address local challenges. Innovation remains a vital part of e-government development ([42], [43]), and since public-sector innovations are generally a reflection of the application of technological solutions provided by commercial technology [44], it remains imperative for countries in SSA to promote local innovations as a means of developing valuable systems to foster e-government development. Likewise, building local cybersecurity capacity is vital for ensuring secure e-government solutions in SSA.

References

[1]. Buffat, A. (2015). Street-Level Bureaucracy and E-Government. Public Management Review, 17(1), 149-161

[2]. Schuppan, T. (2009). E-Government in developing countries: Experiences from sub-Saharan Africa. Government Information Quarterly, 26(1), 118-127

[3]. Elbahnasawy, N. (2014). E-Government, internet adoption, and corruption: an empirical investigation. World Development, 57, 114–126

[4]. Jun, K., Wang, F., & Wang, D. (2014). E-Government Use and Perceived Government Transparency and Service Capacity. Public Performance & Management Review, 38(1), 125-151.

[5]. Hui, Z., Xiaolin, X., & Jianying, X. (2014). Diffusion of e-government: A literature review and directions for future directions. Government Information Quarterly, 31(4), 631-636.

[6]. Sorrentino, M., & De Marco, M. (2013). Implementing e-government in hard times: When the past is wildly at variance with the future. Information Polity: The International Journal of Government & Democracy In The Information Age, 18(4), 331-342

[7]. Nawafleh, S.A., Obiedat, R.F., & Harfoushi, O.K. (2012). E-Government between Developed and Developing Countries. International Journal Of Advanced Corporate Learning, 5(1), 8-13.

[8]. Cloete, F. (2012). E-Government lessons from South Africa 2001- 2011: Institutions, state of progress and measurement. The African Journal of Information and Communication, 12, 128-142.

[9]. Awotwi, J.A. (2011). The Ghana Community Services LTD (GCNet) Implementation Challenges. In P. Danilo (Ed). Global Strategy and Practice of E-Governance: Examples from Around the World (pp. 209-230). New York, NY: Information Science Reference

[10]. Abu-Shanab, E.A, Harb, Y.A., & Al-Zoubi, S.Y. (2013). E-Government as an anti-corruption tool: citizens perceptions. International Journal of Electronic Governance, 6(3), 232–248

[11]. Ojha, A., Palvia, S., & Gupta, M. (2008). A Model for Impact of E-Government on Corruption: Exploring Theoretical Foundations

[12]. Kim, S., Kim, H., & Lee, H. (2009). An institutional analysis of an e-government system for anti-corruption: The case of OPEN. Government Information Quarterly, 26 (1), 42–50

[13]. Peppa, V. Poutoka A. & Metaxas, G. (2012) E-government adoption and the impact of Greek farmers' cultural issues on trust towards agricultural e-government services World Transactions on Engineering and Technology Education 2012 WIETE Vol.10, No.1, 2012

[14]. Aladwani, A. (2016). Corruption as a source of E-government projects failure in developing countries: A theoretical exposition. International Journal of Information Management, 31(1), 105-112

[15]. Singh, H., Das, A., & Joseph, D. (2007). Country-level determinants of e-government maturity. Communications of the Association for Information Systems, 20, 632–648

[16]. Svensson, J. (2005). Eight questions about corruption. Journal of Economic Perspectives, 19, 19–42.

[17]. K. Blackburn, K., & Forgues-Puccio, G. (2007). Distribution and development in a model of misgovernance. European Economic Review, 51,1534–1563
[18]. Bamidele, O. (2013). Corruption, Conflict and Sustainable Development in African States. The African Symposium: An online journal of the African Educational Research Network, 13(1), 42-54
[19]. Lawal, G. (2007). Corruption and Development in Africa: Challenges for Political and Economic Change. Humanity & Social Sciences Journal, 2 (1), 01-07.
[20]. Adesote, S., & Abimbola, J. (2012). Corruption And National Development in Nigeria's Fourth Republic: A Historical Discourse. Journal of Sustainable Development in Africa, 14(7), 81-98.
[21]. Kim, C.K. (2014). Anti-corruption initiatives and e-government: a cross-national study. Public Organization Review, 14 (3), 385–396
[22]. Jackson, S., and Scott, S. "Gender," 2001, London: Routledge.
[23]. Dwivedi, Y., Papazafeiropoulou, A., and Gharavi, H. (2006). "Socio-Economic Determinants of Adoption of the Government Gateway Initiative in the UK", Electronic Government, (3:4), 2006, pp. 404-419
[24]. Choudrie, J. and Lee, H. (2004). "Broadband development in South Korea: institutional and cultural factor," European Journal of Information Systems, (13:2), 2004. pp. 103-114.
[25]. Venkatesh, V., Morris, M., Davis, G., & Davis, F. (2003). User Acceptance of Information Technology: Toward a Unified View. Management Information Systems Quarterly, 27(3),
[26]. Al-Shafi, S., & Weerakkody, V. (2010). Factors Affecting E-Government Adoption in The State Of Qatar. European and Mediterranean Conference on Information Systems. Retrieved from: http://core.ac.uk/download/pdf/336865.pdf
[27]. Ambali, A.R. (2012). E-Government Policy: A Case study of E-filing System. In C. Reddick (Ed.). Cases on Public Information Management and E-Government Adoption (pp. 295-326). New York, NY: Information Science Reference
[28]. Sarabdeen, J. & Rodrigues, G. (2010). Gender differences in e-government adoption in Dubai', The Business Review, Cambridge, 16(2), 120-126.
[29]. Rufín Moreno, R., Molina, C. M., Figueroa, J. C., & Moreno, M. R. (2013). Gender and E-Government Adoption in Spain. International Journal of Electronic Government Research (IJEGR), 9(3), 23-42.
[30]. Xu, H., & Asencio, H. (2015). E-Government in U.S Local government: Disparities, Obstacles and Development Strategies. In A. Monoharan (Ed.). E-Government and Websites: A Public Solutions Handbook (Chapter 10). New York, NY: Routledge
[31]. Baker, E., Al-Gahtani, S., & Hubona, G. (2007). The effects of gender and age on new technology implementation in a developing country: Testing the theory of Planned Behaviour (TPB). Information Technology and People, 20(4), 352-375
[32]. Hanson, V. (2009). Age and Web Access: The Next Generation. Retrieved from: https://static.aminer.org/pdf/PDF/000/240/762/developing_guidelines_for_designing_usable_web_pages_for_older_chinese.pdf

[33]. Wigand, D.L. (2011). A Framework for Citizen Centric Websites. In E. Downey et al. (Eds). E-Government Website Development: Future Trends and Strategic Models: Future Trends and Strategic Models. New York, NY: Information Science Reference.

[34]. Hafeez, S., & Sher, S. (2006). UN Global E-government Readiness Report 2005: From E-government to E-inclusion. New York, NY: United Nations

[35]. United Nations. (2014). UN Egovernment Survey 2014: E-government for the Future we want. New York : UNPAN.

[36]. Perry, J., & Christensen, R. (2015). Handbook of Public Administration. San Francisco, CA: Jossey-Bass.

[37]. Asogwa, B. (2015). E-Government development in Africa: An assessment of status of Sub-Regional practices. In S. Sohdi (Ed.). Emerging Issues and Prospects in African E-Government. New York, NY: Information Science Reference.

[38]. Khanyaako, E., & Maiga, G. (2013). An information security model for e-government services adoption in Uganda. IST-Africa Conference and Exhibition (IST-Africa),(pp. 1-11).

[39]. Mitrokotsa, A., & Douligeris, C. (2008). E-Government and Denial of Service Attacks. New York: Information Science Reference.

[40]. Jacobi, A., Jensen, M., Kool, L., Munnichs, G. & Weber, A. (2013). Security of E-goernment Systems. European Parliament. Retrieved from: http://www.europarl.europa.eu/RegData/ etudes/etudes /join/2013/513510/IPOL-JOIN_ET(2013)513510(ANN02)_EN.pdf

[41]. Cordell, D. (2015, February 28). Cyber Attacks In West Africa Spark It Debates. Retrieved from: https://hacked.com/cyber-attacks-west-africa-spark-debates/

[42]. Anthopoulos, L., Reddick, C., Giannakidou, I., & Mavridis, N. (2015). E-Government as an Innovative product: Theories and Case Study. In C. Reddick & L. Anthopoulos (Eds). Information and Communication Technologies in Public Administration. Broken Sound Parkway, NW: CRC Press

[43]. Kim, H., Pan, G., & Pan, S. (2007). Managing IT-enabled Transformation in the Public Sector. A case study of e-government in Korea. Government Information Quarterly, 24, 338 – 352.

[44]. Cheng, L., Wen, C., Li, E., & Lin, T. (2012). Service innovation activities in e-government initiatives: the Taiwan experience. International Journal of Services Technology and Management, 17(1), 54-71.

[45]. Larosiliere, G., & Carter, L. (2013). An Empirical Study on the Determinants of E-Government Maturity: A Fit-Viability Perspective. ECIS 2013 Completed Research. Paper 217.

[46]. Nordic Council of Ministers. (2015). Together for Gender Equality – a stronger Nordic Region: Nordic co-operation. Copenhagen: Nordic Co-operation

[47]. Srivastava, S.C. & Teo, T. (2010). E-Government, E-Business, and National Economic Performance. Communications of the Association for Information Systems, 26(14), 267-286.

[48]. World Bank. (2012). Gender Equality and Development. Retrieved from: http://siteresources. worldbank.org/INTWDR2012/Resources/7778105-1299699968583/7786210-1315936222006/Complete-Report.pdf

Determining the Accessibility of E-government Websites in Sub-Saharan Africa against WCAG 2.0 Standard

Silas Formunyuy VERKIJIKA[1], Lizette DE WET[2]

[1]*University of the Free State, 205 Nelson Mandela Drive, Bloemfontein, 9300, South Africa*

Tel: +27 (0) 782208877, Email: vekasif@gmail.com

[2] *University of the Free State, 205 Nelson Mandela Drive, Bloemfontein, 9300, South Africa*

Tel: +27 (0)51 401 3705, Fax: +27 (0)51 4012754, Email: dWetL@ufs.ac.za

Abstract

The purpose of this study was to determine the conformance levels of government websites in Sub-Saharan Africa (SSA) to Web Content Accessibility Guidelines (WCAG) 2.0 and examine which macro factors influenced the accessibility these websites. The findings indicated that the majority of government websites in SSA still had a long way to go to become accessible based on the WCAG 2.0 standards. None of the 217 government websites examined adhered to all the WCAG 2.0 guidelines. Cross country analysis showed that there are three macro factors influencing e-government accessibility in SSA, namely Human Development Index (HDI), Corruption Perception Index (CPI), and percentage of the active population (15-64 years). Countries with high HDI levels and low CPI levels tend to have websites with fewer accessibility errors, while those for countries with high percentage of the active population have more accessibility errors.

Keywords: Government websites, accessibility, Sub-Saharan Africa, WCAG 2.0, HDI, CPI

Introduction

During the last two decades, governments in developing countries have progressively adopted e-government as an essential means of improving their general performance. E-government, which broadly refers to the espousal of Information and Communication Technologies (ICTs) into mainstream government activities, is continuously becoming an extremely valuable strategy for governments to enhance their administrative efficiency, gain citizen's trust, eliminate corruption, and ultimately boost democratic governance (Elbahnasawy, 2014; Jun, Wang, & Wang, 2014; Seifert & Chung, 2009). Eliassen and Sitter (2007) expound that e-government initiatives have significantly improved how the public sector manages its resources and deliver required services to the public. Consequently, e-government development has become a vital precondition in the strategy of many governments worldwide (Hui, Xiaolin & Jianying, 2014; Sorrentino, & De Marco, 2013). With government websites being one of the key platforms for government interaction with citizens and other stakeholders, a key e-government competency has been the creation of universally accessible government websites to allow the broad-spectrum of e-government stakeholders to gain access to government information and e-services. Ensuring e-government accessibility is particularly important as it enables all citizens, including those with any form of cognitive or functional limitations, to effectively access government services.

People with disabilities form a considerable part of the world's population, and the need to provide them with access to government information and electronic services have gained considerable attention over the years. Latest statistics from the World Health Organization (WHO, 2011) indicated that over 15% of the world's population was affected by from some form of disability (over 1 billion people), of which 80% are found in developing countries. The case is even worse for poor people living in developing countries as 20% of them are affected by some form of disability (World Bank, 2011). This is concerning, as many factors within a country can establish and maintain barriers to access of e-government services that prevent people with disabilities from actively engaging in economic, civic, and community life (Kuzma Dorothy & Oestreicher, 2009; World Bank, 2011). As such, several researchers (Kuzma, 2010; Olalere & Lazar, 2011; Youngblood, 2014; Abanumy, Al-Badi & Mayhew, 2005; Adepoju *et al*., 2016; Al Mourad & Kamoun, 2013) across the globe have engaged in e-government accessibility research to examine the compliance levels of e-government portals and provide directions for improving their accessibility. Albeit web accessibility guidelines are well developed, many government websites do not comply with these guidelines (Leist & Smith, 2014). Even in developed countries where e-government accessibility has matured immensely, evidence still indicates that the accessibility compliance of government websites have not improved noticeably over the last two decades (Youngblood, 2014). Consequently, governments in the developed world are continuously enforcing stringent legislations to mandate the accessibility of these websites. This is, however, not the case with countries in the developing world regions, like Sub-Saharan Africa (SSA), where accessibility laws are either non-existent or less stringent (Kuzma et al., 2009).

While e-government accessibility research has gained momentum and is receiving considerable attention in many parts of the globe, there is still a dearth of such research in SSA. E-government development, adoption and diffusion in SSA still lack behind other regions of the globe and the only way to ensure that a wide array of people can access e-government services in SSA is to make the government websites more accessible. Current efforts to examine the state of e-government accessibility in SSA include Adepoju, Shehu and Baker (2016); Costa, Fernandes, Neves, Duarte, Hijón-Neira and Carriço (2013); and Kuzma *et al*., (2009). With almost all countries in SSA having some form of government website and the existing studies covering less than 15% of these countries, it is evident that there is still a huge gap in terms of understanding the state of e-government accessibility in SSA. In order to fill in this gap, and to contribute to the development of universally accessible government websites in SSA, this study will address the following objectives:

- Determine the compliance levels of government website accessibility in SSA;

- Identify the specific accessibility guidelines that are most commonly violated by government websites in SSA; and
- Examine which macro level factors influenced government websites' accessibility in SSA.

Government website Accessibility

Website accessibility refers to the capability of making websites accessible to a wide array of possible users regardless of their technical aptitude or possible disabilities, thus ensuring that all users have equal access to information and functionality (Olalere & Lazar, 2011; Reis, Barroso and Goncalves, 2013; Shi, 2007). The need to ensure that government websites are accessible to people with disabilities (e-inclusion) have been widely emphasised across the globe. E-government services need to be accessible to every stakeholder who needs the services in order for its benefits to be fully enjoyed by all. As such, the delivery of government services over the internet holds promise for all citizens as the World Wide Web (WWW) is primarily designed for everybody. The WWW Consortium (W3C, 2010) explicates that the internet "is fundamentally designed to work for all people, whatever their hardware, software, language, culture, location, or physical or mental ability."

Several researchers (Potter, 2002; Olalere and Lazar, 2011; Kuzma, 2010; Youngblood, 2014) have contributed to the literature on government website accessibility by evaluating non-SSA government websites in different countries. For example, in the United States, Potter (2002) evaluated the accessibility of government websites in Alabama and found that about 80% of the websites had accessibility errors. Over a decade later, Youngblood (2014) revisited the evaluation of Alabama government websites and established that there had not been any substantial improvement since Potters' evaluation. At the level of federal websites in the United States, Olalere and Lazar (2011) found that 90% of the websites failed in at least one of the accessibility guidelines, which is similar to results obtained in prior studies in the USA (Jaeger, 2006; West, 2008). In the United Kingdom (UK), Kuzma (2010) showed that only about 5% of a total of 130 evaluated government websites met all the accessibility criteria. Likewise, in the Netherlands, Butt (2014) evaluated three Dutch government websites and found that all three failed in at least one aspect of website accessibility.

In the Middle East and Asia, researchers have examined e-government accessibility in Saudi Arabia and Oman (Abanumy *et al.*, 2005), Dubai (Al Mourad & Kamoun, 2013), China (Sun & Chen, 2010), and Malaysia (Latif & Masrek, 2010). All these different studies had a common finding suggesting that government websites in the Middle East and Asia still have a long way to go in terms of accessibility. None of these evaluated websites met all the examined accessibility evaluation success criteria.

Lastly, as briefly mentioned before, there have also been some efforts to evaluate government website accessibility in SSA. Adepoju *et al*. (2016) recently examined 34 state-level government websites in Nigeria and found that none of the websites fully met the evaluated accessibility standards. Also, Costa *et al*. (2013) evaluated government websites in three SSA countries (i.e. Angola, Mozambique and South Africa) and established that government websites in all the three countries were plagued by accessibility issues. Kuzma *et al*. (2009) examined the accessibility of government websites in four SSA countries (i.e. South Africa, Namibia, Liberia and Kenya) and concluded that all the countries had a large number of errors for each of the accessibility priority levels. Nonetheless, out of the 24 SSA government websites evaluated in these four countries, there were two (one for Namibia and one for

Kenya) that met all the accessibility criteria. It is important to note that the study by Kuzma *et al.* (2009) was based on Web Content Accessibility Guidelines version 1.0 (WCAG 1.0) which have become obsolete as a result of numerous calls for governments to upgrade to WCAG 2.0 compliance.

Evolution of WCAG

Several accessibility standards and guidelines have been developed, such as the WCAG, Section 508 of the U.S. Rehabilitation Act Amendments of 1998 (henceforth referred to simply as Section 508), Microsoft's Guidelines for Accessible Web Pages, UK's Disability Discrimination Act (DDA) of 1995, and the Stanca Act of 2004 (Abanumy *et al*., 2005; Kuzma et al., 2009; Youngblood, 2014). Among these different accessibility standards and guidelines, the most widely used in the domain of e-government accessibility are the WCAG and Section 508. However, the WCAG is the most preferred standard around the world, as it is internationally accredited (ISO/IEC 40500), most explicit and also written in an objectively testable manner (Lazar, Goldstein & Taylor, 2015). Moreover, competing standards (including Section 508) are mostly based on the WCAG, with many governments around the world currently using WCAG 2.0 as their preferred standard, while others have been updating their laws to incorporate provisions outlined in WCAG 2.0 (Youngblood, 2015; United States Access Board, n.d). As such, WCAG 2.0 has been argued to be the core accessibility standard around the world (Akgul, 2015; Lazar *et al.*, 2015), and thus, the most preferred benchmark for evaluating accessibility of websites in different countries (Al Mourad & Kamoun, 2013; Butt, 2014; Kuzma, 2010).

The WCAG was developed by the Web Accessibility Initiative (WAI) of the W3C and the first version (WCAG 1.0) was released in 1999 (W3C, 2008). Since then, a later version (WCAG 2.0) was released in 2008 (W3C, 2008). On the other hand, Section 508 is a US legislation of accessibility that was signed into law in 1998 and went into effect in 2001. There is actually a huge overlap between Section 508 and WCAG 1.0, as section 508 guidelines were fundamentally developed from the WCAG 1.0 standard (Olalere & Lazar, 2011; Youngblood, 2014). With the development of WCAG 2.0, the US Access Board, which is responsible for developing accessibility policy in the US, made a detailed comparison between WCAG 2.0 and Section 508 and found that there were several new dimensions that Section 508 did not cover. As a result, the US Access Board has been working to revise Section 508 guidelines to match WCAG 2.0 standards (United States Access Board, n.d). This suggests that the WCAC 2.0 standards are the leading accessibility standards at the moment. Additionally, Section 508 guidelines are based on US-specific legislation, while the WCAG standards are applicable worldwide. As such, studies outside the US mostly focus on the WCAG guidelines (Adepoju *et al*., 2016; Al Mourad & Kamoun, 2013; Butt, 2014; Kuzma, 2010; Kuzma *et al*., 2009). With the development of WCAG 2.0, the WCAG 1.0 guidelines became obsolete, with websites that were previously WCAG 1.0 compliance being advised to upgrade to WCAG 2.0 (Al Mourad & Kamoun, 2013; Kamoun *et al*., 2013). As such, this study will only focus on WCAG 2.0 guidelines.

WCAG 2.0 standards emphasise the need for websites to meet four fundamental accessibility principles (W3C, 2010). These principles are perceivable, operable, understandable, and robust. For websites to be perceivable, the information of the website and user components must be presentable to users in ways that can meet their different perceptive preferences. The operable principle relates to the need for ensuring that user interface components and navigation are designed in a way that users can manoeuvre it with different options such as mouse and keyboard controls or different devices. The understandable principle emphasises the need to ensure that the information and user interface operations are clear to the users, while the robust principle upholds that content presented in a way that it can be interpreted reliably by a wide variety of user agents, including assistive technologies (W3C, 2008). These four principles are evaluated based on twelve accessibility guidelines. Table 1 below presents the different accessibility guidelines as they apply to the four WCAG 2.0 central principles.

Table 1: WCAG 2.0 Guidelines (Compiled from W3C website).

Guideline	Description
5. Perceivable	
5.1. Text Alternatives	Provide text alternatives for any non-text content so that it can be changed into other forms (formats) that people need, such as large print, braille, speech, symbols or simpler language.
5.2. Time-based media	Provide alternatives for time-based media.
5.3. Adaptable	Create content that can be presented in different ways (for example simpler layout) without losing information or structure.
5.4. Distinguishable	Make it easier for users to see and hear content, including separating foreground from background.
6. Operable	
6.1. Keyboard accessible	Make all functionality available from a keyboard.
6.2. Enough time	Provide users with enough time to read and use content.
6.3. Seizures	Do not design content in a way that is known to cause seizures.
6.4. Navigable	Provide ways to help users navigate, find content, and determine where they are.
7. Understandable	
7.1. Readable	Make text content readable and understandable.
7.2. Predictable	Make web pages appear and operate in predictable ways.
7.3. Input Assistance	Help users avoid and correct mistakes.
8. Robust	
8.1. Compatible	Maximize compatibility with current and future user agents, including assistive technologies.

WCAG 2.0 evaluations examine these twelve dimensions based on three levels of conformance according to different established success criteria. The conformance levels are levels A, AA, and AAA. Level A depicts the basic website accessibility and is evaluated based on 25 success criteria. It is important for websites to satisfy all the success criteria for level A conformance in WCAG 2.0, as these are considered to be the accessibility aspects that developers must satisfy (West, 2008). Level AA focuses on the most common and biggest barriers faced by people with disabilities, while level AAA is the highest level of accessibility. While it is important to address all success criteria, it is, however, important to note that in some cases, it is not possible to address all level AAA success criteria (W3C, 2008).

Macro level Factors Affecting E-Government Website Accessibility

Macro factors generally refer to national level indices that capture the state of progress in a nation or region using different dimensions especially in the political, legal, economic, social, and technological spheres (Ifinedo, 2012; Ifinedo & Singh, 2011). The development of government websites has long been associated with macro level factors that characterise the jurisdiction of the website. For example, Gaulė and Žilinskas (2013) showed that economic and social factors had a significant influence on the development of government websites in Lithuania. Likewise, Youngblood & Mackiewicz (2012) showed that national income influences the accessibility of government websites. In addition to national income, other important macro factors, such as such as HDI, CPI, population age distribution, and commitment to the rights of people with disabilities also capture different socio-political, legal, economic macro environmental resources and capabilities that can provide an understanding of e-government progress in a nation. This follows from the fact that macro factors are particularly important in e-government as macro environmental resources play a vital role in fostering e-government maturity, as well as the dissemination and acceptance/usage of e-government services by citizens (Dias & Costa, 2013; Ifinedo, 2012). With e-government websites being the primary platforms for dissemination of e-government services, it is expected that these macro factors will have a pertinent association with the quality and thus accessibility levels of e-government websites. These factors are discussed below.

National Income

Financial resources play an important role in the development of government websites (Huang, 2007). This has been evident in Alabama when the allocation of more funds towards government website development significantly enhanced the usability of the websites (Youngblood & Mackiewicz, 2012). Likewise, Gaulė & Žilinskas (2013) illustrated by using data from Lithuania that richer municipalities had better-developed government websites than poor municipalities. A macro factor such as national income does not only end at the website development level but can also explain specific aspects of the government website, such as accessibility, as revealed by Youngblood and Youngblood (2013). These authors showed that there was a significant negative correlation between the gross national income (GNI) of a county and the accessibility of its websites, with lower income counties having considerably higher government website accessibility errors. This finding is, however, not surprising, as the link between e-government development and national income has been widely established (UN, 2014). This is because rich countries allocate more financial resources to e-government development. As such, it can be expected that with more resources, rich countries are more likely to develop better accessible websites. This study, therefore, hypothesises that the higher the national income of a country, the fewer the accessibility errors will be among its government websites. Following prior e-government studies (UN, 2014), national income will be operationalised in terms of the GNI per capita.

Human Development

Human development was operationalised in terms of the HDI. The HDI is a measure of a country’s overall well-being based on three dimensions, namely: health, education, and standard of living (Deneulin & Shahani, 2009). The link between e-government and HDI has been established in prior literature (Holzer & Manoharan, 2009), with HDI having a positive relationship with e-governance. The 2014 UN e-government survey also showed that countries with higher HDI paid more attention to e-inclusion by providing more e-government services for vulnerable groups, like persons with disabilities and the elderly (UN, 2014). E-inclusion generally entails the act of expanding ICT benefits to everybody and website accessibility is a key aspect of e-inclusion in ensuring that people with disabilities and the elderly can have equal access to e-government services. Since countries with higher HDI pay more attention to e-inclusion, there is a high probability that these countries also pay more attention to the accessibility of government websites to ensure that vulnerable groups can fully gain access to e-government services. This study, therefore, hypothesises that countries with a higher HDI will have government websites with fewer accessibility errors, as they pay more attention to making their websites accessible to all stakeholders.

Corruption

Corruption in public administration generally refers to "the misuse of public power or authority for private gains" (UNDP, 2008). E-government is expected to yield several benefits to governments and citizens; however, its development, especially in SSA, is significantly thwarted by corruption (Cloete, 2012). Several researchers (Aladwani, 2016; Corojan & Criado, 2012; Kim, 2014) have highlighted the notion that corruption significantly contributes to the failure of e-government projects in developing nations. From a technical perspective, many studies (Kirui & Kemei, 2014; Ray, 2011) have indicated that e-government projects in developing countries have failed because of poor usability. It is, therefore, possible that corruption in e-government projects can lead to the redirection of resources, thereby leaving little room for developing high quality, usable websites. This is in line with the argument presented by Aladwani (2016) that corruption in developing countries limits the moral and governance abilities of administrative systems managing e-government projects in a manner that inhibits their capability to produce e-government initiatives that meet stakeholder expectation thus resulting in failure of the projects. As mentioned before, one such key stakeholder expectation in terms of government websites is to ensure that these websites are accessible to all stakeholders, including people with disabilities and the elderly. Consequently, if corruption negatively affects the quality of government website projects, there is a possibly that such government websites will have poor accessibility? In this regard, this study hypothesises that government websites in highly corrupt countries will have more accessibility errors than those in less corrupt countries.

Population Age Distribution

The link between population age distribution and e-government services have been widely discussed in extant literature (Baker, Al-Gahtani, & Hubona, 2007; Gaulė and Žilinskas, 2013; Xu & Asencio, 2015; Wigand, 2011). Xu and Asencio (2015) showed that e-government development was negatively associated with the elderly (i.e. people older than 65 years). This trend can be attributed to the fact that older people are more resistant to change and thus less likely to adopt and use e-government services (Baker *et al*., 2007). In Lithuania, Gaulė and Žilinskas (2013) established that while the development of government websites was not associated with the elderly population, it actually had a significant positive correlation with the percentage of active citizens. This could possibly be explained by the fact that active citizens mostly preferred communication via the internet, while the elderly prefer face-to-face communication (Wigand, 2011). Nonetheless, it is generally emphasised that e-government services should be widely available to vulnerable groups as they are also consumers of many government services (Gaulė & Žilinskas, 2013). With a higher percentage of people with disabilities belonging to the elderly population (Youngblood & Mackiewicz, 2012), there is a greater need to develop accessible government websites to cater for the elderly. As such, this study hypothesises that the higher the percentage of elderly in a country, the more accessible the government websites will be. Similarly, since the active citizens are currently the predominant users of e-government services (Xu & Asencio, 2015) and their percentage is positively correlated with the development of government websites (Gaulė & Žilinskas, 2013), it is expected that the percentage of active citizens will positively correlate with high government website accessibility.

Commitment to Disability

As already mentioned in the previous sections, a key goal of accessibility research in e-government is to enable people with disabilities to gain equal access to e-government services (Akgul, 2015; Bakhsh & Mehmood, 2012; Jaeger, 2006). While several countries in the developed world have laws protecting people with disabilities, most developing world countries, especially those in SSA, lack such laws (Kuzma *et al*., 2009). However, in 2006, the UN passed a Convention on the Rights of the Disabled in a bid to protect people with disabilities worldwide. To date, several countries in SSA have signed the treaty, while others have gone so far as to ratify the treaty. Protecting the rights of people with disabilities in the context of e-government entails ensures that they can easily access e-government services. Arbour (2007) explicates that the UN convention provides an incentive for governments to improve access to ICTs for the disabled. This is because Article 9 of the UN Convention on the Rights of the Disabled emphasises the need for making ICTS accessible in such a way. As such, it is expected that countries that have committed to the treaty will increase access to their e-government services to people with disabilities. Since this can be attained through government website accessibility, this study hypothesis that a country's level of commitment to the Rights of the Disabled treaty (i.e. by signing or ratifying the treaty) will have a significant impact on the accessibility of its government websites.

Methodology

Sample Selection

In order to determine how well government websites in SSA adhere to accessibility guidelines, it is important to have a representative set of websites from SSA, as well as enough websites from a given SSA Country. As such, seven websites were selected from each SSA country included in the study. Seven websites are enough to depict the state of accessibility in a country as in Kuzma et al. (2009), while also maintaining a manageable amount of total websites for the study. The websites were grouped around seven government ministries as a means to ensure consistency across the different countries. The different ministries included in the study were: ministries of Finance, Education, Health, Tourism, Labour, International Affairs and the website of the Presidency. All the countries in SSA did not share the exact same portfolios for each of the ministries, as some governments had one ministry to cover more than one portfolio. However, the websites were carefully evaluated and selected based on them covering the selected portfolios. Additionally, only websites presented in English and/or French were selected to allow the researchers to fully verify that the website was the official website of a given government ministry of an SSA country. Out of the forty-nine countries in SSA, thirty-one (63.3%) fulfilled the conditions to be selected for this study. A total of eight countries (Eritrea, Somalia, Angola, Mozambique, Sao Tome and Principe, Cape Verde, Sudan and Mauritania.) were eliminated because their websites were not in English or French, while ten countries (Guinea, Swaziland, South Sudan, Togo, Guinea-Bissau, Niger, Equatorial Guinea, Central African Republic, Congo, and Comoros) were eliminated because e-government was still in its infancy with few or no websites to be considered. In total, 217 government websites from 31 countries in SSA were evaluated in this study.

Accessibility evaluation

Accessibility can always be evaluated either with the use of automated accessibility testing tools or with manual evaluation methods by human evaluators. Even though a combination of both methods provides the most optimal accessibility evaluation, using only automated evaluation still provides a reliable indication of website accessibility. Similar to prior studies (Abanumy *et al.*, 2005; Adepoju *et al.*, 2016; Al Mourad & Kamoun, 2013) this study adopted an automated tool for accessibility evaluation. In order to assess the WCAG 2.0 conformance of government websites in SSA, an appropriate accessibility tool needed to be selected. Even though numerous automated accessibility testing tools exist, they differ in several ways, such as cost, presentation of reports, conformance levels, etc.

Amidst these tools, TAW (Test de Accesibilidad Web) was selected for this study because of it being a free tool and its breadth and depth of report presentation that is easier to comprehend in line with the WCAG 2.0 guidelines. TAW is a Java-based tool developed by the Spanish Center for the Development of Information and Communication Technologies. It has also been used to examine accessibility in several prior studies (Adepoju *et al*., 2016; Akgul, 2015; Al Mourad & Kamoun, 2013; Butt, 2014). The validity of TAW in comparison with other accessibility tools was also presented by Al Mourad and Kamoun (2013) by showing that the accessibility evaluation results from TAW correlated with results from another widely accepted accessibility evaluation tool known as EvalAccess 2.0. TAW was designed to evaluate all three levels of conformance, thus testing all three priority levels.

Only the homepages of the 217 government websites were examined. It is frequently argued that the homepages of government websites are usually the first point of contact with users and, therefore, very important to be highly accessible (Akgul, 2015; Olalere & Lazar, 2011). This is because homepages shape a user's first impression of the website (Olalere & Lazar, 2011). Additionally, Vigo, Abascal, Aizpurua and Arrue (2009) showed that the accessibility error profile of a homepage mirrored that of other pages in the website. Consequently, the focus on limiting e-government web page accessibility to the homepage has been widely adopted in e-government accessibility studies (Akgul, 2015; Al Mourad & Kamoun, 2013; Olalere & Lazar, 2011; Youngblood & Mackiewicz, 2012). This also allows for cross-study comparisons of accessibility evaluations.

Macro level measures

As explained above, five macro level indices were used for examining cross-country differences in accessibility. These include the HDI, GNI, CPI, Commitment to UN treaty of the Rights of the Disabled, and population age distribution. The most recent data for each of the macro indices was used to capture the current state of each country in relation to the current state of its government website accessibility. The following data sources were used to obtain data for the Macro Level indices (Table 2).

Table 2: Data Sources for Macro level Indices

Variable	Description of data
HDI	2014 Human Development Index data from the 2015 Human Development Report (UNDP, 2015).
National Income	2014 Gross National Income (GNI) per capita based on purchasing power parity. GNI World Bank data last updated on February 27, 2016 (World Bank, 2016a).
CPI	2015 CPI data from Transparency International (Transparency

	International, 2015).
UN disability	Country status as on January 31, 2016, regarding the Convention on the Rights of Persons with Disabilities (United Nations, 2016).
Population Age Distribution	2014 age demographics data from the World Bank (World Bank, 2015). Two data groups of interest were used in this study namely: the active population group (i.e. age 15-64 years.) and the elderly population group (i.e. older than 65 years.)

Results and Discussion

Conformance to WCAG 2.0 standard

The results in Table 3 depict the accessibility compliance level of government websites in SSA based on the 3 priority levels across the four domains of the WCAG 2.0 guidelines. Looking at all WCAG 2.0 domains, it is evident that all 217 government websites had some form of accessibility error. The mean number of errors per website was 53.5 with a median of 41, suggesting that over 100 government websites in SSA have more than 41 accessibility errors. These findings further confirm the dire state of government website accessibility in SSA, as shown by prior studies (Adepoju et al., 2016; Costa et al., 2013; Kuzma et al., 2009; Makoza & Chigona, 2013). This trend of poor accessibility is, however, not only common to government websites in SSA. Kamoun *et al* (2013) evaluated 21 Dubai government websites for WCAG 2.0 compliance and found that all had accessibility errors. Similarly, an evaluation of 130 government websites in the UK for WCAG 2.0 compliance showed that only 5% had no accessibility errors (Kuzma, 2010). However, the UK websites fared far better than those in SSA, as the average errors per website were 3.6 with an average of 7.7 warnings compared to 53.5 mean errors and 440.7 mean warnings for SSA websites.

Table 3: Accessibility Errors

Domains	**Accessibility Errors**							
	Number Websites with Error (%)				Average Number of Errors (Median)			
	A	**AA**	**AAA**	**W**	**A**	**AA**	**AAA**	**W**
PERCEIVABLE								
1.1	181(83.4)	0(0)	0(0)	191(88.5)	10.1(5)	0(0)	0(0)	18.1(13)
1.2	4 (1.8)	0(0)	0(0)	8(3.7)	0.1(0)	0(0)	0(0)	0.4(0)
1.3	204(94.0)	0(0)	0(0)	195(88.0)	12.5(4)	0(0)	0(0)	34.0(17)
1.4	0(0)	0(0)	0(0)	200(92.2)	0(0)	0(0)	0(0)	27.1(22)
Overall		211(97.2)		205(94.5)		22(12)		79 (59)
OPERABLE								
2.1	5(2.3)	0(0)	49(22.6)	49(22.6)	0.1(0)	0(0)	1.6(0)	1.4(0)
2.2	27(12.4)	1(0.5)	2(0.9)	0(0)	0.2(0)	0(0)	0.1(0)	0(0)
2.3	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
2.4	185(85.25)	0(0)	203(93.6)	217(100)	7.1(5)	0(0)	8.1(5)	31.9(29)
Overall		214(98.6)		217(100)	17.1(12)			33(30)
UNDERSTANDABLE								
3.1	85(39.2)	0(0)	0(0)	1(0.5)	0.4(0)	0(0)	0(0)	0.1(0)

3.2	69(32.8)	0(0)	2(0.9)	151(69.9)	0.4(0)	0(0)	0.1(0)	11.2(6)
3.3	122(56.2)	0(0)	0(0)	154(70.9)	1.2(1)	0(0)	0(0)	8.6(8)
		174(80.2)		187(86.2)	2.1 (1)			19.8 (16)
ROBUST								
4.1	193(88.9)	0(0)	0(0)	200(92.2)	11.8(7)	0(0)	0(0)	308.1(61)
	193(88.9)			200(92.2)	11.8 (7)			308.1(61)
All Categories		217(100)		217(100)	53.5(41)			440.7(232)

A, AA, and AAA indicates accessibility errors in the three levels of conformance, while W indicated the total accessibility warnings.

The most common accessibility errors were operable errors, where 98.6% of the websites had at least one type of operable error. Similarly, all the websites had accessibility warnings for the operable dimension. The websites had an average of 17.1 errors and 33 warnings. The main operable dimension that is a call for concern based on high errors and warnings is user navigation. It is imperative to make websites accessible in ways that allow users to easily navigate and find content. If not, this would hinder the overall navigation of a government website, which is very disturbing, as navigation is one of the essential usability dimensions vital for user adoption and usage of government websites.

The second WCAG 2.0 domain needing attention among SSA government websites was the perceivable domain. The most violated perceivable guideline was the creation of content that could be presented in different ways without losing its meaning, including being presented for use by assistive technologies. Equally violated was the lack of text alternatives for non-text content.

The third critical domain was the robust domain which dealt with maximising compatibility with current and future tools. A total of 88.9% of the websites demonstrated robust errors, with errors averaging 11.8 and warnings 308.1.

The understandable domain had the most websites in compliance. About 20% of the websites had no understandable errors. The understandable factor in which more than half of the websites faltered, had to do with helping users to avoid and correct mistakes. The country level analysis is provided below in Figure 1.

Country level analysis

Figure 1 depicts the total number of errors for all seven websites in each of the 31 SSA countries.

Insert Figure 1 here

Figure 1: Accessibility Errors among SSA Countries

Rwanda, Botswana, and Zimbabwe were the top scoring countries with the least accessibility errors. On the other end, Djibouti, Ghana, and Benin were the worst in terms of government website accessibility. It is not surprising to see Rwanda and Zimbabwe at the top of accessibility in SSA, as they were part of the countries that have fully ratified the UN Convention on the Rights of Persons with Disabilities. This suggests that these countries are practicing what they signed up for. Even though Botswana is not a signatory of the convention, the country has a national policy on care for people with disabilities and has implemented several programs focused on improving accessibility in government institutions. However, it is surprising that the three worst scoring countries in terms of accessibility have all ratified the UN convention. Ghana, Benin, and Djibouti ratified the convention in 2012, yet to date; they are still to enforce accessibility of government websites. Next, we examined the country level factors that depict the differences in government website accessibility.

Association with macro factors

Table 4: Regression Analysis of Macro Factors and E-government Accessibility

Variables	Regression Results		
	Beta	**T-Value**	**Significance**
Intercept		-1.139	0.266
Human Development (HDI)	-0.773	-3.743	0.001***
National Income (GNI)	-0.090	-0.309	0.760
Percentage Elderly Population	0.354	1.177	0.251
Percentage Active Population	0.847	2.467	0.021**
Corruption (CPI)	-0.470	-2.247	0.034**
Commitment to Disability	0.104	0.712	0.483
Model Parameters			
R^2		0.523	
Adjusted R^2		0.404	
F-Value (Sig.)		4.392 (0.004)***	

***sig at 1%, ** sig. at 5%

The results in Table 4 indicate that the HDI, active population, and CPI are significant indicators of the state of e-government accessibility in SSA countries. The significant negative association of HDI indicates that countries with higher HDIs had fewer accessibility errors. This is in line with the findings of the 2014 UN e-government survey (UN, 2014) that concluded that countries with a higher HDI paid greater attention in providing services to vulnerable groups like persons with disabilities. In terms of e-inclusion, accessibility is one of the ways to ensure that vulnerable groups can gain access to e-government services. As such, this increased attention to e-inclusion from countries with a higher HDI is evident in SSA. High HDI countries are seen to have government websites with fewer accessibility errors. The significant positive association of percentage of active population depicts that countries with a high population of active citizens who have a high demand for e-government services resulted in high accessibility errors. Since the active population prefers the internet and have a high demand for e-government services, governments in SSA with a high percentage of active citizens might focus more on providing different kinds of e-government services without putting enough effort in their accessibility. This could result from the fact that the weak demand for e-government services from the elderly population does not signal the need for e-inclusion. Lastly, the significant negative beta for CPI indicates that countries that are less corrupt (i.e. countries with a high CPI) tend to have fewer accessibility errors. This is possibly because less corrupt countries are more likely to be transparent in awarding contracts for government website development, thus selecting the most qualified team to develop the websites. On the other hand, highly corrupt countries can award contracts based on who knows who, thus hiring poorly qualified developers who might not have the necessarily skills to develop highly accessible websites. Additionally, the misappropriation of funds required for the development of government websites can significantly hinder the project, resulting in the development of poorly accessible websites. With corruption noted to significantly hinder the maturity of e-government initiatives (Signh *et al*., 2007) and to contribute to their failures (Aladwani, 2016), it is, therefore, not surprising that corrupt nations develop poorly accessible websites. Without the development of highly accessible government websites, these websites are likely to stifle and fail due to lower user adoption and usage.

Limitations and directions for future studies

This study had three fundamental limitations. Firstly, the scope of government websites covered in the study is limited to ensure full generalisation of the findings to all of SSA. The eight SSA countries that were eliminated from the sample, because their websites were not in English or French are a significant number that if included in this study could change the outcome of the findings. However, evidence from two of these countries (Angola, Mozambique) as presented by Costa *et al*. (2013), shows similarities with data from the SSA countries represented in this study. Nonetheless, it is imperative to acknowledge the fact that the findings in this study best represent the state of government website accessibility in French and English speaking SSA countries. Future accessibility studies in SSA could include countries with non-English or French websites.

Secondly, the study only focused on automated accessibility evaluation. This provided limited results as a detailed accessibility evaluation requires a combination of both manual and automated evaluation (Abanumy *et al*., 2005; Adepoju *et al.,* 2016; Al Mourad & Kamoun, 2013). Additionally, the evaluation only focused on WCAG 2.0 criteria as it is one of the popular testable criteria that can be evaluated via automated testing. Future studies in SSA should incorporate both evaluation methods to provide an optimal assessment of the accessibility of government websites in the region. Also, evaluation of accessibility based on other standards such as the Section 508 should be considered.

Lastly, the study was limited in its evaluation scope of the websites, as only the homepages were evaluated. While there is support for the view that evaluation of homepages provides valuable insights on the accessibility of a website (Akgul, 2015; Al Mourad & Kamoun, 2013; Olalere & Lazar, 2011; Youngblood & Mackiewicz, 2012), evaluations that focus on the entire website are likely to provide a more thorough picture of the state of accessibility, as many more accessibility guidelines can be tested. This is one angle that future studies in SSA can examine and also determine if the accessibility evaluation of homepages in the region provides an adequate representation of the accessibility errors throughout the website.

Conclusion

As e-government continues to gain momentum as a key means of dissemination of government information and services to citizens, there is an ever increasing need to ensure the accessibility of government websites so that all citizens can experience the benefits of e-government. In the study, the accessibility of e-government websites in SSA was examined based on WCAG 2.0 standards. The key objective was to determine conformance levels with WCAG 2.0 and also examine which macro factors were associated with government websites' accessibility in SSA.

The findings indicated that the majority of websites in SSA still have a lot to do to become accessible websites based on the WCAG 2.0 standards. This indicates the need for governments in SSA to adopt appropriate strategies for advancing the accessibility of their government websites. These findings reiterate the view that government website accessibility in SSA countries remains poor (Adepoju et al., 2016; Costa et al., 2013; Kuzma et al., 2009; Makoza & Chigona, 2013). The most violated WCAG 2.0 guidelines by government websites in SSA were: user navigation (guideline 2.4), providing text alternatives to non-text content (guideline 1.1), the creation of content that can be presented in different ways, including use by assistive technologies, without losing its meaning (guideline 1.3), compatibility with current and future tools (guideline 4.1), and helping users to avoid and correct mistakes (guideline 3.3). This is more concerning as most of the websites do not meet level A compliance, which is the most basic level of compliance that needs to be met by all websites (Lightner, 2014). It is, therefore, imperative for governments in SSA to enforce measures to improve the accessibility of government websites in their countries. Many governments, especially in developed countries have already mandated WCAG 2.0 for all government websites (Rogers, 2016). SSA governments can also follow the same approach and mandate as well as train its IT staff to update the current websites in accordance with WCAG 2.0 guidelines. It is also vital for web developers responsible for government websites in SSA to take special note of these commonly violated accessibility guidelines and to ensure that they are addressed. Similarly, accessibility workshops for web developers, similar to the one conducted by UNESCO in Rwanda (UNESCO, 2015), could also ensure that web developers are trained on how to address these common accessibility barriers in SSA.

Additionally, Cross country analysis showed that three macro factors that were associated with the accessibility of government websites in SSA. These factors were the HDI, CPI, and percentage of active population. Countries that have a high HDI or that are less corrupt tend to have fewer accessibility errors, while countries with a high percentage of active population have more accessibility errors. Kerbing corruption in SSA countries remains a priority if governments are to advance e-government development and create high-quality accessible websites. Corruption is already contributing to the failure of e-government projects in developing countries (Aladwani, 2016), and so is a serious macro factor to consider when working towards enforcing accessibility standards for government websites. Similarly, SSA governments need to promote human development in order to stimulate both the demand and supply for e-government services (Stier, 2015), which is likely to result in the development of high-quality government websites that meet accessibility standards.

This study provides both practical and theoretical contributions. For the practical contributions, the study highlights the current state of government website compliance with WCAG 2.0 standards is most SSA countries from which evaluations have not been documented to date. This provides a knowledge base for government officials and developers in these countries to understand possible accessibility issues plaguing their e-government websites. This not only creates awareness of the problem but can also stimulate further examination of other e-government websites in SSA countries. The study also provides practical recommendations that can be useful for governments in implementing or enforcing accessibility standards. Regarding the theoretical contributions, the study advanced knowledge on the accessibility of government websites in developing countries by providing evidence from 31 SSA countries. This adds to the currently limited work on accessibility of government websites in the region. Additionally, researchers (Dias & Costa, 2013; Huang, 2007; Ifinedo, 2012) have suggested the need to consider the role that macro environmental factors play in e-government development as such knowledge holds significant policy implications. This study provided a contribution in this domain by identifying three macro factors associated with the accessibility of government websites in SSA. Future studies can further explore these associations to provide a deeper understanding of how governments can better use macro environmental resources for advancing e-government as a whole and the development of quality and accessible government websites in particular.

References

Abanumy, A., Al-Badi, A., & Mayhew, P. (2005). E-Government Website Accessibility: In-Depth Evaluation of Saudi Arabia and Oman. *The Electronic Journal of E-government, 3(3), 99-106.*
Adepoju, S., Shehu, I., & Baker, P. (2016). Accessibility Evaluation and Performance Analysis of E-government Websites in Nigeria. *Journal of Advances in Information Technology*, 7(1), 49-53.
Akgul, Y. (2015). Web Content Accessibility of Municipal Websites in Turkey. In C. Addams (Ed). Proceedings of the 15th European Conference on eGovernment 2015: ECEG 2015 (pp. 1- 8). University of Portsmouth, UK.
Al Mourad, B., & Kamoun, F. (2013). Accessibility Evaluation of Dubai E-government Websites: Findings and Implications. *Journal of E-Government Studies and Best Practices, Vol. 2013 (2013), Article ID. 978647, DOI: 10.5171/2013. 978647.*
Aladwani, A. (2016). Corruption as a source of E-government projects failure in developing countries: A theoretical exposition. *International Journal of Information Management*, 31(1), 105-112
Arbour, L. (2007). Record number of countries sign UN treaty on disabilities on opening day. Retrieved from: http://www.un.org/apps/news/story.asp?NewsID=22085&Cr=disab&Cr1
Baker, E., Al-Gahtani, S., & Hubona, G. (2007). The effects of gender and age on new technology implementation in a developing country: Testing the theory of Planned Behaviour (TPB). *Information Technology and People*, 20(4), 352-375
Bakhsh, M., & Mehmood, A. (2012). Web Accessibility for Disabled: A Case Study of Government Websites in Pakistan. 10th International Conference on Frontiers of Information Technology (pp. 342-347).
Butt, M. (2015). Result-Oriented Aproach for Websites Accessibility Evaluation: Approach tested for three Dutch government websites. *International Journal of Computer Science and Information Security, 12(7), 22-30.*
Cloete, F. (2012). E-Government lessons from South Africa 2001- 2011: Institutions, state of progress and measurement. *The African Journal of Information and Communication*, 12, 128-142.
Corojan, A., & Criado, J.I. (2012). E-government for transparency, anti-corruption, and accountability: challenges and opportunities for central American countries. In K.J. Bwalya, S.F.C. Zulu (Eds.), Handbook of research on e-government in emerging economies: adoption, e-participation, and legal frameworks (pp. 328-350). Hershey, PA : IGI Global
Costa, D., Fernandes, N., Neves, S., Duarte, C., Hijón-Neira, R., & Carriço, L. (2013). Web Accessibility in Africa: A Study of Three African Domains. Proceedings of the 14th IFIP TC 13 International Conference, Cape Town, South Africa, September 2-6, 2013 (pp. 331-338).
Deneulin, S., & Shahani, L. (2009). An Introduction to the Human Development and Capability Approach: Freedomand Agency. London: Earthscan
Dias, G. P. and Costa, M. (2013). Significant socio-economic factors for local e-government development in Portugal. *Electronic Government*, 10 (3-4), 284–309
Elbahnasawy, N. (2014). E-government, internet adoption, and corruption: an empirical investigation. *World Development*, 57, 114–126
Eliassen, K. A., & Sitter, N. (2007). *Understanding Public Management*. London: Sage publications.
Gaulė, E., & Žilinskas, G. (2013). E-Governance Development Factors In Lithuania: The Study Of Municipal Websites. *Viešoji politika ir administravimas, 12(1), 80-93.*
Huang, Z. (2007). A comprehensive analysis of U.S. counties' e-government portals:

development status and functionalities. *European Journal of Information Systems*, 16, 149–164.

Holzer, M., & Manoharan, A. (2009). E-Governance and Quality of Life: Associating Municipal E-Governance with Quality of Life Worldwide. In C.G. Reddick (Ed). Handbook of Research on Strategies for Local E-Government Adoption and Implementation: Comparative Studies (pp. 408-418). New York, NY: Information Science Reference

Hui, Z., Xiaolin, X., & Jianying, X. (2014). Diffusion of e-government: A literature review and directions for future directions. *Government Information Quarterly*, 31(4), 631-636. doi:10.1016/j.giq.2013.10.013

Ifinedo, P. (2012). Drivers of e-government maturity in two developing regions: focus on Latin America and Sub-Saharan Africa. *Journal of Information Systems and Technology Management*, 9(1),5-22.

Ifinedo, P., & Singh, M. (2011). Determinants of eGovernment Maturity in the Transition Economies of Central and Eastern Europe. *Electronic Journal of E-government*, 9(2), 166 – 182.

Jaeger, P. T. (2006). Assessing Section 508 compliance on federal e-governmentweb sites: A multi-method, user-centered evaluation of accessibility for persons with disabilities. *Government Information Quarterly*, 23(2), 169–190, http://dx.doi.org/10.1016/j.giq.2006.03.002.

Jun, K., Wang, F., & Wang, D. (2014). E-Government Use and Perceived Government Transparency and Service Capacity. *Public Performance & Management Review*, 38(1), 125-151. doi:10.2753/PMR1530-9576380106

Kim, C.K. (2014). Anti-corruption initiatives and e-government: a cross-national study. *Public Organization Review*, 14 (3), 385–396

Kirui, E., & Kemei, K. (2014). Usability of E-Government Services in Developing Countries. *International Journal of Computer Trends and Technology (IJCTT)*, 15(3), 102-107.

Kuzma, J., Dorothy, Y., & Oestreicher, K. (2009). Global e-government Web Accessibility: An Empirical Examination of EU, Asian and African Sites. Retrieved from: https://eprints.worc.ac.uk/591/1/Global_e-government_Web_Accessibility.pdf

Kuzma, J.M. (2010). Accessibility design issues with UK e-government sites. *Government Information Quarterly*, 27,141-146.

Lazar, J., Goldstein, D., & Taylor, A. (2015). Ensuring Digital Accessibility through Process and Policy. Waltham, MA: Morgan Kaufmann

Latif, M., & Masrek, M. (2010). Accessibility Evaluation on Malaysian E-Government Websites. *Journal of E-government Studies and Best Practices, 2010 (2010), Article ID 935272.*

Leist, E., & Smith, D. (2014). Accessibility Issues in E-Government. *Electronic Government and the Information Systems Perspective,8650,12-25*

Leist, E., & Smith, D. (2014). Accessibility Issues in E-government. *Lecture Notes in Computer Science*, 8650, pp. 15-25

Makoza, F., & Chigona, W. (2013, Sept 10-13). Accessibility of E-government websites: case of Malawi. *Proceedings of the 15th Annual Conference on World Wide Web Applications* (pp. 4 -15). Cape Town: South Africa.

Olalere, A., & Lazar, J. (2011). Accessibility of U.S. federal government home pages: Section 508 compliance and site accessibility statements. *Government Information Quarterly, 28*(3), 303–309, http://dx.doi.org/10.1016/j.giq.2011.02.002.

Potter, A. (2002). Accessibility of Alabama government web sites. *Journal of Government*

Information, 29(5), 303–317.
Ray, S., (2011), Identifying Barriers to E-Government Services for Citizens in Developing Countries: An Exploratory Study International Journal of Electronic Government Research, 7(3), 79-91
Reis, A., Barroso, J., & Goncalves, R. (2013). Supporting Accessibility in Higher Education Information Systems. Universal Access in Human-Computer Interaction. *Applications and Services for Quality of Life*, 8011,250-255
Schuppan, T. (2009). E-Government in developing countries: Experiences from sub-Saharan Africa. *Government Information Quarterly*, *26*(1), 118-127. doi:10.1016/j.giq.2008.01.006
Seifert, J.W., & Chung, J. (2009). Using e-government to reinforce government-citizen relationships: Comparing government reform in the United States and China. Social Science Computer Review, 27(3), 3–23
Shi, Y. (2007). The accessibility of Chinese local government Web sites: An exploratory study. *Government Information Quarterly*, 24(2), 377- 403.
Sorrentino, M., & De Marco, M. (2013). Implementing e-government in hard times: When the past is wildly at variance with the future. Information Polity: *The International Journal Of Government & Democracy In The Information Age*, 18(4), 331-342. doi:10.3233/IP-130319
Sun, Z., & Chen, H. (2010). An accessibility study of Chinese local government websites. In Proc. International Conference on Networking and Digital Society, 2010, pp. 270-273.
Transparency International. (2015). Corruption Perception Index, 2015. Retrieved from: http://www.transparency.org/cpi2015
UNDP (2015). Human Development Report 2015. Retrieved from: http://hdr.undp.org/sites/default/files/2015_human_development_report.pdf
UNESCO. (2015). Making Rwandese educational portals accessible to people with disabilities. Retrieved from: http://www.unesco.org/new/en/communication-and-information/resources/news-and-in-focus-articles/all-news/news/making_rwandese_educational_portals_accessible_to_people_with_disabilities/
United Nations Development Program (UNDP) (2008). Tackling corruption, transforming lives: Accelerating human development in Asia and the Pacific. New Delhi, India: Macmillan Publishers.
United Nations. (2016). Convention on the Rights of Persons with Disabilities. Retrieved from: https://treaties.un.org/Pages/ViewDetails.aspx?src=IND&mtdsg_no=IV-15&chapter=4&lang=en
United States Access Board. (n.d). Comparison Table of WCAG 2.0 to Existing 508 Standards. Retrieved from: https://www.access-board.gov/guidelines-and-standards/communications-and-it/about-the-ict-refresh/background/comparison-table-of-wcag2-to-existing-508-standards
Vigo. M.,Abascal, J., Aizpurua, A. andArrue, M. (2009).Tool Independence for the Web Accessibility Quantitative Metric. Disability and Rehabilitation: Assistive Technology, 4(4), 248-263
W3C (2010). Accessibility — W3C. Retrieved from. http://www.w3.org/standards/webdesign/accessibility
W3C. (2008). Web Content Accessibility Guidelines (WCAG) 2.0. Retrieved from: https://www.w3.org/TR/WCAG20/
West, D.M. (2008). State and federal electronic government in the United States, 2008. The

Brookings Institution (Retrieved October 11, 2011, from http://www.brookings.edu/~/media/Files/rc/reports/2008/0826_egovernment_west/0826_egovernment_west.pdf).

Wigand, D.L. (2011). A Framework for Citizen Centric Websites. In E. Downey et al. (Eds). E-Government Website Development: Future Trends and Strategic Models: Future Trends and Strategic Models. New York, NY: Information Science Reference.

World Bank. (2015). Population, ages 15-64 (% of total). Retrieved from: http://data.worldbank.org/indicator/SP.POP.1564.TO.ZS

World Bank. (2016). Disability: Overview. Retrieved from: http://www.worldbank.org/en/topic/disability/overview

World Bank. (2016). GNI per capita ranking, Atlas method and PPP based. Retrieved from: http://data.worldbank.org/data-catalog/GNI-per-capita-Atlas-and-PPP-table

World Health Organization (WHO). (2011). World Report on Disability. Retrieved from: http://www.who.int/disabilities/world_report/2011/report.pdf?ua=1

Xu, H., & Asencio, H. (2015). E-government in U.S Local government: Disparities, Obstacles and Development Strategies. In A. Monoharan (Ed.). E-Government and Websites: A Public Solutions Handbook (Chapter 10). New York, NY: Routledge

Youngblood, M.E., & Youngblood, S.A. (2013). User Experience and Accessibility: An Analysis of County Web Portals. Journal of Usability Studies, 9(1), 25-41.

Youngblood, N.E. (2014). Revisiting Alabama state website accessibility. *Government Information Quarterly*, 31(3), 476-487. doi:10.1016/j.giq.2014.02.007

Youngblood, N.E., & Mackiewicz, J. (2012). A usability analysis of municipal government website home pages in Alabama. *Government Information Quarterly*, 29, 582-588.

Youngblood, N.E. (2015). The digital inclusiveness of state library websites. In B. Wentz, P.T. Jaeger & J.C. Bertot (Eds). Accessibility for Persons with Disabilities and the Inclusive Future of libraries (pp 193-212). United Kingdom, UK: Emerald Group Publishing Limited