

**CONCEPTUAL DESIGN MODEL OF
COMPUTERIZED PERSONAL-DECISION AID (CompDA)**

A thesis submitted to Dean of Awang Had Salleh Graduate School of Arts and
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College of Arts and Sciences
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by

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Kolej Sastera dan Sains
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Siti Mahfuzah Sarif

2011

ABSTRAK

Sehingga kini, perhatian yang diberikan kepada penambahbaikan sistem sokongan keputusan untuk organisasi adalah sangat meluas. Namun begitu, kajian akademik mengenai penambahbaikan sistem sokongan keputusan berkomputer (SSPB) untuk keputusan peribadi adalah berkurangan dan sebahagiannya sudah lapuk. Kebelakangan ini, kewujudan SSPB untuk keputusan peribadi bercambah seperti cendawan dan semakin mendapat perhatian dari pengguna-pengguna sistem. Namun, persepsi pengguna mengenai strategi dan teknik keputusan yang sesuai masih tidak berlandaskan kajian yang sistematik. Sorotan karya turut menjelaskan kecenderungan pengguna sistem untuk tidak memilih kaedah matematik yang kompleks dalam membantu membuat keputusan peribadi walaupun kaedah ini telah dibuktikan mampu menangani isu risiko dan ketidakpastian dalam keputusan. Tambahan pula, proses pembangunan kebanyakan SSPB didapati tidak berlandaskan model konseptual dan teori. Sehubungan itu, kajian ini mencadangkan satu model rekabentuk konseptual untuk sistem sokongan keputusan-peribadi berkomputer (SSPPB). Objektif berikut turut dibentuk bagi menyokong matlamat utama kajian: (i) mengenalpasti strategi dan teknik membuat keputusan yang sesuai untuk SSPPB; (ii) menggabungkan strategi dan teknik yang telah dikenalpasti dalam pembangunan model reka bentuk konseptual SSPPB; (iii) mengimplementasi model reka bentuk konseptual dalam pelbagai situasi melalui kaedah prototaip; dan (iv) mengukur persepsi kebolehbantuan prototaip SSPPB yang dibangunkan. Kaedah reka bentuk penyertaan dijalankan untuk mencapai objektif i dan ii. Dapatan daripada kaedah tersebut digunakan dalam pembangunan model reka bentuk konseptual SSPPB. Bagi mencapai objektif iii, model rekabentuk konseptual telah diimplementasi dalam dua kajian kes yang bertujuan memilih: A- metodologi pembangunan dalam kursus perkomputeran mudah-alih (m^d -Matrix), dan B- telefon bimbit dalam persekitaran pembelian (e^p -Matrix). Manakala objektif iv tercapai melalui pembangunan instrumen yang dinamakan Q-HELP bagi mengukur persepsi kebolehbantuan prototaip SSPPB. Kajian ini telah mengenalpasti empat konstruk untuk mengukur kebolehbantuan: kebolehpercayaan, usaha membuat keputusan, keyakinan dan kesedaran membuat keputusan. Secara keseluruhan, 122 responden telah mengambil bahagian di mana 63 daripada kes A dan 59 daripada kes B. Lapan hipotesis telah dibentuk merangkumi ujian korelasi di antara keempat-empat konstruk dalam Q-HELP dengan kebolehbantuan, ujian untuk menentukan samada penggunaan prototaip SSPPB mampu mengurangkan masa membuat pilihan secara signifikan dan ujian untuk mengesahkan purata kebolehbantuan prototaip SSPPB adalah tinggi. Ujian-t Sampel Berpasangan, analisis Korelasi Pearson dan analisis deskriptif telah digunakan untuk menguji hipotesis di atas. Keputusan ujian hipotesis menunjukkan: keempat-empat konstruk mempunyai korelasi yang signifikan dengan kebolehbantuan, penggunaan m^d -Matrix dan e^p -Matrix mampu mengurangkan masa membuat keputusan secara signifikan, purata kebolehbantuan m^d -Matrix tidak menunjukkan keputusan yang tinggi, dan purata kebolehbantuan e^p -Matrix menunjukkan keputusan yang tinggi. Walau bagaimanapun, kajian ini merumuskan kedua-dua prototaip SSPPB sebagai membantu pengguna dari aspek kebolehpercayaan, meringankan usaha membuat keputusan serta meningkatkan keyakinan dan kesedaran dalam membuat keputusan. Kesimpulannya, hasil kajian ini menghasilkan: (i) satu model rekabentuk konseptual SSPPB, (ii) dua prototaip SSPPB (dan algoritmanya) yang mengesahkan implementasi model rekabentuk konseptual dalam dua situasi yang berbeza, (iii) satu instrumen kajian yang mengukur kebolehbantuan SSPPB dari segi proses dan hasil, dan (iv) analisis perbandingan di antara model, strategi dan teknik keputusan yang boleh membantu dalam kajian akan datang.

ABSTRACT

To date, the attentions given to the improvement of decision support at organizational level has been enormous. On the contrary, academic research in improving the performance of computerized decision aid (CDA) for personal decision is lacking, in which some are dated. Nowadays, the existence of CDA which handles personal decision is mushrooming and progressively getting attention from users. Despite that, users' perceptions of the suitable decision strategy and technique for CDA have not been subjected to systematic investigation. Literature reviews also indicate that most users do not go for complex mathematical techniques despite the fact that these techniques are better at handling the risks and uncertainties in decisions. In fact, more often than not, the development process of CDAs does not seem to adhere to any conceptual and theoretical model. In view of that, this study aims to propose a conceptual design model for computerized personal-decision aid (CompPDA). The following objectives are outlined to support the general aim: (i) to identify appropriate decision strategy and technique for CompPDA, (ii) to incorporate identified strategy and technique in the construction of conceptual design model for CompPDA (iii) to validate the conceptual design model in different situations via prototyping method and (iv) to measure the users' perceived helpfulness of the CompPDA prototypes. Participatory design method was implemented in order to achieve objective i and ii. The findings were incorporated into the construction of the conceptual design model of CompPDA. In achieving objective iii, the conceptual design model was validated in two different case studies via prototyping: A- choosing development methodology in mobile computing course (m^d -Matrix); and B- purchasing a mobile phone (e^p -Matrix). In achieving objective iv, an instrument (named as Q-HELP) was developed to measure the helpfulness (HLP) of the prototypes. This study identified four relevant constructs pertinent to helpfulness; reliability (REL), decision making effort (EFF), confidence (CON), and decision awareness (AWR). Altogether, 122 respondents participated where 63 were from case study A and 59 from case study B. Eight hypotheses were formulated comprising testing for correlation between all the constructs in Q-HELP with helpfulness, testing the average time spent to make a selection with and without the proposed CompPDA and testing if the mean score of helpfulness of the proposed CompPDA is high. Paired Samples *t* Test, Pearson Correlation analyses and descriptive analyses were utilized to validate the hypotheses. The results show that: REL and HLP are significantly correlated, EFF and HLP are significantly correlated, CON and HLP are significantly correlated, AWR and HLP are significantly correlated, the use of m^d -Matrix and e^p -Matrix significantly reduces the time spent to make selection, mean score of helpfulness of m^d -Matrix is fairly high and mean score of helpfulness of e^p -Matrix is high. However, it is concluded that the overall results exhibit sufficient indication that m^d -Matrix and e^p -Matrix were found helpful to users in terms of reliability, lessening the decision making effort, increasing confidence and also awareness in decision making. This study has produced the following outcomes, along with achieving all of its objectives: (i) a conceptual design model for CompPDA which incorporates suitable decision strategies and techniques identified via systematic investigations; (ii) two functional CompPDA prototypes to validate the conceptual design model and to demonstrate its applicability in different situations, (iii) an instrument for measuring helpfulness which includes dimensions from outcome and process aspects; and (iv) comparative analyses of decision models, strategies and techniques which provide basis for future studies.

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DEDICATION

To:

Mak (*Hjh. Zaiton Puteh*) and

Abah (*Hj. Sarif Joned*)

With love;

Kakak (*Siti Mahfuzah Sarif*)

TABLE OF CONTENTS

PERMISSION TO USE	i
DECLARATION	ii
ABSTRAK.....	iii
ABSTRACT.....	iv
ACKNOWLEDGEMENT.....	v
DEDICATION	vi
TABLE OF CONTENTS.....	vii
LIST OF FIGURES.....	xiii
LIST OF TABLES.....	xv
LIST OF ABBREVIATIONS	xvii
LIST OF PUBLICATIONS.....	xix
AWARDS AND RECOGNITIONS.....	xx
CHAPTER 1: BACKGROUND OF STUDY	1
1.1 Overview	1
1.2 Background	1
1.3 Preliminary Study.....	3
1.3.1 Method.....	3
1.3.2 Findings	4
1.3.3 User Model (Personas).....	7
1.4 Research Motivations	11
1.4.1 Manifestation of Computerized Decision Aids for Personal Decisions.....	11
1.4.2 Realism of Personal-Decision Support Studies	13
1.5 Problem Statement.....	13
1.5.1 Research Gap and Questions	16
1.6 Research Objectives.....	17
1.7 Scope of Study.....	17
1.8 Contributions of the Study.....	18
1.8.1 Conceptual Design Model of CompPDA.....	18
1.8.2 Improvised Decision Techniques (Non-compensatory & Compensatory).....	19
1.8.3 Prototypes & Algorithms.....	20
1.8.4 Instrument That Measures Helpfulness (Q-HELP)	20

1.8.5	Test Results of the Prototypes	20
1.9	Theoretical and Research Framework	21
1.10	Definition of Terminologies	23
1.11	Thesis Outline.....	24
CHAPTER 2: LITERATURE REVIEW.....		26
2.1	Overview	26
2.2	Decision Making.....	26
2.2.1	The Importance of Decision Thinking	27
2.2.2	Decision Making vs. Decision Aiding	29
2.3	The Information, Processes and Strategies of Decision Making.....	30
2.3.1	Decision Making Information.....	30
2.3.2	Decision Making Processes	32
2.3.3	Decision Strategies.....	36
2.3.3.1	Aided Analytic, Unaided Analytic and Non-analytic	36
2.3.3.2	Compensatory and Non-compensatory Strategies.....	37
2.3.4	Implications of Information, Processes and Strategies of Decision Making to this Study.....	39
2.4	Personal Decision Making.....	39
2.4.1	Personal Decision Problems.....	40
2.4.2	Personal Decision Makers	42
2.4.3	Implications of Characteristics of Personal Decision Problem and Personal Decision Maker to this Study	45
2.5	Preferential Choice Problem.....	46
2.6	Multi-Criteria Decision Making (MCDM)	47
2.6.1	Classifications of MCDM Techniques	47
2.6.2	Decision Techniques for MCDM.....	49
2.6.2.1	Weighted Additive Model.....	49
2.6.2.2	Pugh Matrix.....	50
2.6.2.3	Analytic Hierarchy Process.....	53
2.6.2.4	Elimination by Aspects	53
2.6.2.5	Take the Best.....	54
2.6.3	Implications of MCDM Techniques to This Study	55
2.7	Computerized Decision Aids (CDA)	55
2.7.1	Implications of CDA to this Study.....	59

2.7.2	Past Studies of CDA for Personal Decision Making	60
2.7.3	Design Issues of CDA	61
2.7.3.1	Implications of Design Issues of CDA to this Study	63
2.8	Interaction Design	63
2.8.1	Implications of Interaction Design to this Study	65
2.9	Decisional Guidance	65
2.9.1	Implications of Decisional Guidance to this Study	67
2.10	Theoretical Ground of Decision Aids	67
2.10.1	Descriptive, Normative and Prescriptive Decision Theories	67
2.10.2	Behavioral Decision Theory	69
2.10.3	Cognitive Theory	70
2.10.4	Utility Theory	71
2.10.5	Preference	72
2.10.6	Dominance	73
2.10.7	Implications of Decision Theories to this Study	74
2.11	Participatory Design	75
2.11.1	Participatory Design in the Study of Decision Aid	77
2.11.2	Implications of Participatory Design to this Study	77
2.12	Evaluation of Decision Aids	78
2.12.1	Helpfulness of Decision Aids	79
2.12.2	More Definitions of Helpfulness	81
2.13	Summary	82
CHAPTER 3: RESEARCH METHODOLOGY		84
3.1	Overview	84
3.2	Design Research	84
3.3	Phases in Research Methodology	88
3.4	Phase 1: Problem Identification	91
3.4.1	Identify Research Gap	91
3.4.2	Literature Research 1	92
3.4.3	Consultation with Experts	92
3.4.4	Preliminary Study	93
3.4.5	Pre-evaluation on Relevance	93
3.5	Phase 2: Solution Design	96

3.5.1	Design Artifacts	96
3.5.1.1	Construction of Conceptual Design Model for CompPDA	96
3.5.1.2	Prototyping	98
3.5.1.3	Instrument Design.....	100
3.5.2	Literature Research 2	112
3.6	Phase 3: Evaluation	112
3.6.1	Hypotheses Refinement.....	113
3.6.2	Case Studies	115
3.6.3	Expert Reviews.....	116
3.6.4	Experimental Study.....	116
3.6.4.1	Sampling.....	117
3.6.4.2	Data Collection	119
3.6.5	Data Analysis.....	119
3.6.5.1	Unit of Analysis	120
3.7	Summary	121
CHAPTER 4: CONCEPTUAL DESIGN MODEL OF CompPDA.....		122
4.1	Overview	122
4.2	Decision Making Processes	123
4.3	Decision Strategies for Personal Decision Making.....	127
4.4	Decision Techniques for Personal Decision Making	130
4.4.1	Participatory Design (Focus Group Study)	131
4.4.2	Subjects	132
4.4.3	Procedures and Results (Cycle 1): Decision Techniques Identification	132
4.4.4	Procedures and Results (Cycle 2): Decision Technique Improvisation	134
4.4.4.1	Improvised TTB (Stage 1)	135
4.4.4.2	Improvised PUG (Stage 2)	137
4.4.4.3	Decision Criteria	146
4.4.5	Significant of Findings from Focus Group Study	148
4.5	Decisional Guidance.....	150
4.5.1	Components of Decisional Guidance	152
4.5.2	Proposed Decisional Guidance Components for CompPDA	155
4.6	The Proposed Conceptual Design Model for CompPDA.....	158
4.7	Expert Review Focus Group	161

4.7.1	Instrument and Procedures	162
4.7.2	Findings	163
4.7.3	Reviewed Conceptual Design Model of CompDA	168
4.8	Summary	171
CHAPTER 5: CompDA PROTOTYPES: m^d-MATRIX & e^p-MATRIX.....		172
5.1	Overview	172
5.2	Case Study 1: Educational decision.....	173
5.2.1	Background: Case Study 1	174
5.2.2	Decision Problem Identification: Case Study 1	175
5.2.2.1	Problem Identification Method	176
5.2.3	Decision Information Gathering: Case Study 1	178
5.2.3.1	Alternative Identification: Mobile Development Methodologies	178
5.2.3.2	Criteria Definition: Properties of SDM	181
5.2.3.3	Evaluation of Alternatives: Experts' Consultation	184
5.3	Case Study 2: Purchasing Decision.....	189
5.3.1	Decision Problem Identification: Case Study 2	190
5.3.2	Decision Information Gathering: Case Study 2	191
5.3.2.1	Alternative Identification: Mobile Phone Models	191
5.3.2.2	Criteria Definition: Features and Performance of Mobile Phones	192
5.3.2.3	Evaluation of Alternatives: Authorized Source	193
5.4	Design and Development of CompDA Prototypes.....	194
5.4.1	Translation of the Conceptual Design Model in m ^d -Matrix and e ^p -Matrix ..	194
5.4.1.1	Flow of CompDA Prototypes	195
5.4.1.2	Screen Shots of the CompDA Prototypes	198
5.4.1.3	Pseudo-codes of CompDA Prototypes	207
5.5	Summary	209
CHAPTER 6: HELPFULNESS OF CompDA PROTOTYPES		210
6.1	Overview	210
6.2	Experimental Study: Measuring Helpfulness	210
6.2.1	Demographic Background.....	211
6.2.2	Experiment Design	212
6.2.3	Data Distribution	214

6.2.4	General Findings	216
6.3	Hypotheses Testing.....	220
6.3.1	Testing H_1	222
6.3.2	Testing H_2	223
6.3.3	Testing H_3	224
6.3.4	Testing H_4	225
6.3.5	Testing H_5	226
6.3.6	Testing H_6	227
6.3.7	Testing H_7 and H_8	228
6.4	Summary	230
CHAPTER 7: DISCUSSION AND CONCLUSION		231
7.1	Overview	231
7.2	Research Question 1	232
7.3	Research Question 2	232
7.4	Research Question 3	233
7.5	Research Question 4	234
7.6	Aim and Objectives: Revisit.....	234
7.7	Limitations and Recommendations	235
7.7.1	Conceptual Design Model	235
7.7.2	CompDA Prototypes.....	236
7.8	Conclusion.....	237
REFERENCES.....		238
APPENDIX A.....		264
APPENDIX B.....		267
APPENDIX C.....		276
APPENDIX D.....		284
APPENDIX E		288
APPENDIX F		291
APPENDIX G.....		294
APPENDIX H.....		297
APPENDIX I.....		300

LIST OF FIGURES

Figure 1.1	Mapping respondents to behavioral variables	8
Figure 1.2	Examples of websites that offer personal decision aid	12
Figure 1.3	Various computerized decision aids which support personal decisions	12
Figure 1.4	Theoretical and Research Framework	22
Figure 2.1	The decision pyramid	29
Figure 2.2	Decision Making Information (Ullman, 2002)	31
Figure 2.3	General model of decision making (Bahl & Hunt, 1984)	34
Figure 2.4	Compensatory vs. non-compensatory (Chu & Spires, 2003)	38
Figure 2.5	Relation between characteristics of decision problems	42
Figure 2.6	Demonstrative example of Pugh Matrix in selecting a design concept.....	50
Figure 2.7	Relationship among CDAs	60
Figure 2.8	Goal, criteria and factors of computerized decision model.....	63
Figure 2.9	Multi-level assistance.....	65
Figure 2.10	Taxonomy of methodologies in PD (Muller et al., 1993)	76
Figure 2.11	Approaches to evaluation of decision aids	78
Figure 2.12	Overview of the literature studies	83
Figure 3.1	Phases in the research process	90
Figure 3.2	Pre-evaluation on problem relevance	95
Figure 3.3	Summary of instrument development.....	100
Figure 3.4	Proposed constructs for measuring overall helpfulness of CDA.....	103
Figure 4.1	Summary of activities in constructing the conceptual design model	123
Figure 4.2	Decision process in conceptual design model for CompPDA	126
Figure 4.3	Decision strategies in conceptual design model for CompPDA.....	130
Figure 4.5	Variants of PUG implementation	138
Figure 4.6	Hypothetical decision situation	143
Figure 4.7	Dominance-search model in improvised PUG	145
Figure 4.8	Model of decision strategies and techniques for CompPDA	149
Figure 4.9	Model of decisional guidance for CompPDA	158
Figure 4.10	Proposed conceptual design model of CompPDA	160
Figure 4.11	Expert review sessions	162
Figure 4.12	Clarity of terminologies.....	165
Figure 4.13	Relevancy of proposed elements.....	165
Figure 4.14	The flow, usability and readability of conceptual design model	166
Figure 4.15	Revised conceptual design model for CompPDA.....	170
Figure 5.1	The flow of case study 1 and 2.....	173
Figure 5.2	Aid available at Sony Ericsson website to compare phones	191
Figure 5.3	The flowchart of CompPDA prototypes	197
Figure 5.4	Screen shots of three main steps in m^d -Matrix	198
Figure 5.5	Screen shots of three main steps in e^p -Matrix.....	199
Figure 5.6	Inclusion of the design elements in CompPDA prototypes	200
Figure 5.7	Form interaction style in CompPDA prototypes	201
Figure 5.8	Styles of guidance in m^d -Matrix	202

Figure 5.9	Styles of guidance in e ^p -Matrix	203
Figure 5.10	Consistency of dialog/user interface in e ^p -Matrix	204
Figure 5.11	Feedback in dialog/user interface of e ^p -Matrix	204
Figure 5.12	Closure in dialog/user interface of m ^d -Matrix	204
Figure 5.13	Error recovery in e ^p -Matrix	205
Figure 5.14	Reversal of actions in e ^p -Matrix	205
Figure 5.15	Multi-level assistance in the CompDA prototypes.....	206
Figure 6.1	Participants using CompDA prototypes during the experimental study	214
Figure 6.2	Graphs and statistics of subjects who agree that CompDA prototypes shorten the decision time	218
Figure 6.3	Graphs and statistics of subjects who will use CompDA prototypes again .	219
Figure 6.4	Graphs and statistics of subjects who agree that decision makers should confer with CompDA before making selection.....	220
Figure 6.5	Relation of REL, EFF, CON and AWR in measuring HLP of a CompDA	226

LIST OF TABLES

Table 1.1	Questions Asked in the Preliminary Study.....	3
Table 1.2	Use Computer to Manage Personal Affairs	4
Table 1.3	Confident with Computer Skills	5
Table 1.4	Preference of Type of CDAs	5
Table 1.5	Potential Personal-decision Situations to Use CDA	6
Table 1.6	Expectations from Using CDA in Handling Personal-decisions	6
Table 1.7	Motivation Details for Behavior Pattern #1.....	9
Table 1.8	Motivation Details for Behavior Pattern #2.....	9
Table 1.9	Motivation Details for Behavior Pattern #3.....	10
Table 2.1	Various Decision Making Processes	33
Table 2.2	Decision Process Based on Decision Information	35
Table 2.3	Categories of Decision Strategies.....	37
Table 2.3	Different Characteristics of Personal Decision Problem (Jungermann, 1980)...	41
Table 2.4	Characteristics of Decision Problems (Beach & Mitchell, 1978).....	42
Table 2.5	General Characteristics of Personal Decision Maker (Jungermann, 1980).....	43
Table 2.6	Characteristics of Decision Makers (Ku, 2003)	44
Table 2.7	Categories of MCDM Methods	48
Table 2.8	Principles of EBA	54
Table 2.9	Components of ES.....	56
Table 2.10	Differences between DSS and ES (Turban, 1995)	58
Table 2.11	Underlying Principles of Interaction Design.....	64
Table 2.12	Decisional Guidance Categories.....	66
Table 2.13	Cognitive Operations in Preferential Choice Problem	70
Table 2.14	Assumptions in Utility Theory (Etti et al., n.d.)	72
Table 2.15	Cases of Preferences in Decision Making.....	72
Table 2.16	Dimensions of Helpfulness for Online Reviews (Otterbacher, 2009)	81
Table 3.1	Design Science Guidelines (Hevner et al., 2004).....	86
Table 3.2	Two Dimension Research Framework	88
Table 3.3	Evaluation Attributes for Various Decisions Support Technologies	102
Table 3.8	Research Hypotheses.....	113
Table 4.1	Comparison of Decision Making Processes.....	125
Table 4.2	Summary of Selected Steps in Decision Making Process.....	126
Table 4.3	Advantages and Disadvantages of Compensatory and Non-compensatory Strategies (Payne, 1976; Ullman, 2002; Yin & Rothrock, 2006).....	127
Table 4.4	Related Works on Integrating Compensatory and Non-compensatory Strategies	128
Table 4.5	Characteristics of Decision Techniques (Hastie & Dawes, 2001).....	131
Table 4.6	Results of Focus Group Study in Cycle 1	133
Table 4.7	Hypothetical Decision Situation.....	135
Table 4.8	Features of PUG Variants.....	139
Table 4.9	Questions Asked in the Focus Group Study	140
Table 4.10	Responses from Participants.....	141

Table 4.11	Features of Computerized Decision Aid Samples	151
Table 4.12	Decisional Guidance Components for CompPDA	156
Table 4.13	Conditions for Classification of Generic Components	156
Table 4.14	Decisional Guidance Components for CompPDA	157
Table 4.15	Demographic Profiles of Experts.....	161
Table 4.16	Frequency of Responses from Expert Review Focus Group	164
Table 4.17	Further Comments from the Experts.....	167
Table 4.18	Comparison Between Components for “Intelligence” and “Analysis”	169
Table 5.1	Respondents’ Opinion on Selecting Development Methodologies.....	177
Table 5.2	Summaries of Mobile Application Development Methodologies	179
Table 5.3	Mobile Development Methodologies Included in m ^d -Matrix.....	181
Table 5.4	Selection Criteria of Mobile-related Development Methodologies	183
Table 5.5	Findings from Experts’ Rating of Mobile Development Methodologies.....	186
Table 5.6	Findings from Inspection of Alternatives on Narrative Criteria	193
Table 5.7	Findings from Inspection of Alternatives on Rating Criteria.....	193
Table 5.8	Pseudo-code for Improvised TTB.....	207
Table 5.9	Pseudo-code for Improvised PUG.....	208
Table 6.1	Demographic Background of Samples in Case 1 (Purposive Sampling).....	211
Table 6.2	Demographic Background of Samples in Case 2 (Convenience Sampling).....	211
Table 6.3	Summary of Procedure, Apparatus and Data Collection Method of Experimental Study in Case 1	213
Table 6.4	Summary of Procedure, Apparatus and Data Collection Method of Experimental Study in Case 2	213
Table 6.5	Statistical Tests Used to Validate Research Hypotheses	215
Table 6.6	Normal Distribution of Samples for REL, EFF, CON, AWR and HLP in Case 1 ..	216
Table 6.7	Normal Distribution of Samples for REL, EFF, CON, AWR and HLP in Case 2 ..	216
Table 6.8	Average Time Spent	217
Table 6.9	Correlation of REL and HLP in Case 1	222
Table 6.10	Correlation of REL and HLP in Case 2	222
Table 6.11	Correlation of EFF and HLP in Case 1	223
Table 6.12	Correlation of EFF and HLP in Case 2	223
Table 6.13	Correlation of CON and HLP in Case 1	224
Table 6.14	Correlation of CON and HLP in Case 2	224
Table 6.15	Correlation of AWR and HLP in Case 1.....	225
Table 6.16	Correlation of AWR and HLP in Case 2.....	225
Table 6.17	Descriptive Statistics of the Paired Samples Using m ^d -Matrix.....	227
Table 6.18	Paired Samples Test Results (UUsing m ^d -Matrix)	227
Table 6.19	Descriptive Statistics of the Paired Samples Using e ^p -Matrix.....	228
Table 6.20	Paired Samples Test Results (Using e ^p -Matrix)	228
Table 6.21	Descriptive Statistics of Overall Helpfulness of m ^d -Matrix and e ^p -Matrix ...	229
Table 6.22	Response Classification	229

LIST OF ABBREVIATIONS

AHP	Analytic Hierarchy Process
CBA	Cost-Benefit Analysis
CDA	Computerized Decision Aid
CDSS	Customer Decision Support System
CompPDA	Computerized Personal-Decision Aid
CS	Computer Science
DSS	Decision Support System
EBA	Elimination by Aspects
EDP	Electronic Data Processing
EIP	Elementary Information Processes
ES	Expert System
GIS	Geographic Information System
HCI	Human Computer Interaction
HLI	Higher Learning Institution
IPO	Intuitive Preference Order
IS	Information System
ITM	Iterative Triangulation Methodology
JME	Java Micro Edition
KMO	Kaiser-Meyer-Olkin test
MAUT	Multi-Attribute Utility Theory
MCDM	Multi-Criteria Decision Making
MIS	Management Information System
PC	Personal Computer
PD	Participatory Design
PhD	Doctor of Philosophy

PPO	Prescribed Preference Order
Q-HELP	Questionnaire of Helpfulness
RS	Recommender System
SDLC	System Development Life Cycle
SDM	Software Development Methodology
SE	Software Engineering
TTB	Take-the-Best
WAM	Weighted Additive Matrix

LIST OF PUBLICATIONS

JOURNALS

- **Sarif, S.** & Shiratuddin, N. (2010). Measuring Helpfulness of Personal Decision Aid Design Model. *Global Journal of Computer Science and Technology*, 10(5), 64-80.
- Norshuhada, S. & **Siti Mahfuzah, S.** (2009). The m^d -Matrix: a learning tool in the mobile application development course. *International Journal of Mobile Communications*, 7(4), 494-514.

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PROCEEDINGS

- Norshuhada, S. & **Siti Mahfuzah, S.** (2009). e^p -Matrix: A Computerized Decision Aid Incorporating Pugh Matrix Analysis for Purchasing Decision. In *Proceedings of International Conference on Software Engineering & Computer Systems (ICSECS'09): ICT and Industry - The way forward* (pp. 208 - 212).
- Norshuhada, S. & **Siti Mahfuzah, S.** (2008). md -Matrix: Mobile Application Development Methodologies Matrix. In *Proceedings of the International MultiConference of Engineers and Computer Scientists*, 19-21 March, 2008, Hong Kong.

POSTER

- Norshuhada, S. & **Siti Mahfuzah, S.** (2009, December). m^d -Matrix: An assistive learning tool in blended project based learning for mobile development course. Poster session presented at Same Places, Different Spaces: Ascilite, Auckland.

AWARDS AND RECOGNITIONS

Here are projects related to this study that have been awarded at both national and international levels:

- **Best Award**

Event : Malaysia Technology Expo 2008, Kuala Lumpur.
Project Title : Agent Assisted m^d-Matrix (Mobile Development Methodologies Matrix).
Researcher : Norshuhada Shiratuddin & **Siti Mahfuzah Sarif**.

- **Gold Medals**

1. Event : International Innovation Expo 2008, Kuala Lumpur.
Project Title : AADMA - Avatar Assisted Decision Making Advisor in Retail Environment.
Researcher : Norshuhada Shiratuddin & **Siti Mahfuzah Sarif**.
2. Event : Malaysia Technology Expo 2008, Kuala Lumpur.
Project Title : Agent Assisted m^d-Matrix (Mobile Development Methodologies Matrix).
Researcher : Norshuhada Shiratuddin & **Siti Mahfuzah Sarif**.

- **Silver Medals**

1. Event : Seoul International Invention Fair 2008, Korea
Project Title : e^p-Matrix - Decision making eTool
Researcher : Norshuhada Shiratuddin & **Siti Mahfuzah Sarif**
2. Event : The International Exhibition of Invention 2008, Geneva
Project Title : Agent-Assisted eDecision Matrix: m^d-Matrix & e^p-Matrix.
Researcher : Norshuhada Shiratuddin & **Siti Mahfuzah Sarif**

CHAPTER 1

BACKGROUND OF STUDY

1.1 OVERVIEW

As an introduction to in-depth discussion on the research topic, Chapter 1 provides deliberations on issues that underlie the foundation of the study; the statement of the research problem; research objectives and scope of research; and also, the definition of the terms that are used in this study.

1.2 BACKGROUND

Decisions are an inevitable part of human activities. Although most of the decisions made are minor in terms of its consequences, but still, making an actual decision out of any situation is indeed necessary. Living in the 21st century, it is inevitable to not associate anything with the use of technology and this includes decision making. As technologies are more user-oriented than before, more decision aid technology can be found on the basis of assisting mankind to make decisions.

Human regularly makes decisions of varying importance on daily basis, thus, making the idea of seeing personal decision making as a researchable matter seems odd. However, decades of studies have proven that most human are much poorer at decision making than they think (Anderson, 1985; Newell & Simon, 1972). Thus, explains the existence of decision aids in wide range of domains, which include management, engineering and medicine.

The contents of
the thesis is for
internal user
only

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