

Copyright is owned by the Author of the thesis. Permission is given for a copy to be downloaded by an individual for the purpose of research and private study only. The thesis may not be reproduced elsewhere without the permission of the Author.

**CHALLENGES IN STRATEGIC
FACILITIES MANAGEMENT:
ANALYSIS OF PROBLEMS FACED BY
UNIVERSITY FACILITIES MANAGERS
IN NEW ZEALAND AND AUSTRALIA**

MYZATUL AISHAH KAMARAZALY

2014

**CHALLENGES IN STRATEGIC
FACILITIES MANAGEMENT:
ANALYSIS OF PROBLEMS FACED BY
UNIVERSITY FACILITIES MANAGERS
IN NEW ZEALAND AND AUSTRALIA**

MYZATUL AISHAH KAMARAZALY

[SID 05172667]

A THESIS PRESENTED IN FULFILMENT OF THE REQUIREMENTS
FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY

(PHD)

IN

CONSTRUCTION

SCHOOL OF ENGINEERING & ADVANCED TECHNOLOGY

COLLEGE OF SCIENCES

MASSEY UNIVERSITY

NOVEMBER 2014

TABLE CONTENTS

TABLE CONTENTS	II
LIST OF TABLES	VIII
TABLE OF FIGURES	XVIII
ABSTRACT	1
ACKNOWLEDGEMENT	3
DEDICATION	6
CHAPTER 1: INTRODUCTION	7
1.1 INTRODUCTION	7
1.2 BACKGROUND TO THE RESEARCH	7
1.3 JUSTIFICATION OF STUDY	11
1.4 STATEMENT OF RESEARCH PROBLEM	12
1.4.1 Research aim questions and objectives	13
1.4.2 Research motivations	14
1.5 GAPS IN THE LITERATURE	15
1.6 RESEARCH PROPOSITIONS	16
1.7 RESEARCH SCOPE AND LIMITATIONS	18
1.7.1 RESEARCH SCOPE	18
1.7.2 LIMITATIONS OF STUDY	18
1.8 BENEFITS OF RESEARCH FINDINGS	19
1.9 STRUCTURE OF THE REPORT	20
CHAPTER 2: LITERATURE REVIEW	22
2.1 OVERVIEW ON FACILITIES MANAGEMENT	22
2.1.1 Facilities management in context	23
2.1.2 The uniqueness of university facilities	25
2.1.3 Roles of facilities managers	26
2.1.4 The challenges facing university facilities managers	29
2.1.5 Solutions to the challenges facing UFM	32

2.1.6 Key functions in the FM cycle	34
2.1.7 Conceptual framework for the study	37
2.1.8 Current Internal challenges	39
2.1.9 Current External challenges	41
2.1.10 Future Challenges	50
2.2 SUMMARY	52
2.3 ASSUMPTIONS UNDERLYING THE RESEARCH PROPOSITIONS	55
2.4 RESEARCH PROPOSITIONS	56
CHAPTER 3: RESEARCH METHOD	57
3.1 INTRODUCTION	57
3.2 OVERVIEW OF RESEARCH METHOD	57
3.3 OVERALL RESEARCH STRATEGY	58
3.4 PILOT SURVEY: PLANNING AND IMPLEMENTATION	63
3.4.1. INTRODUCTION	63
3.4.2. INTERVIEW SCOPE AND SAMPLING FRAME	63
3.4.3 INTERVIEW STRATEGY	64
3.4.4 SAMPLING TECHNIQUE	65
3.4.5 SAMPLING SIZE	65
3.4.6 INTERVIEW PLANNING AND SCHEDULING	66
3.4.7 QUALITATIVE DATA GATHERING INSTRUMENT	67
3.4.8 CONDUCT OF THE INTERVIEWS	67
3.5. QUESTIONNAIRE SURVEY: PLANNING AND IMPLEMENTATION	68
3.5.1. INTRODUCTION	68
3.5.2 RESPONDENT POPULATIONS AND SAMPLING FRAMES	68
3.5.3 SAMPLE SIZE	69
3.5.4 SAMPLING TECHNIQUE ADOPTED	72
3.5.5 QUESTIONNAIRE SURVEY	73
3.6 MODEL TEST SURVEY: PLANNING AND IMPLEMENTATION	78
3.6.1 INTRODUCTION	78
3.6.2 MODEL TEST SURVEY INSTRUMENT	79
3.6.3 TARGET POPULATION FOR THE MODEL TEST SURVEY	79
3.6.4 MODE OF SURVEY	80
3.7 METHODS EMPLOYED IN THE DATA ANALYSES	80
3.7.1 ASSUMPTIONS	80
3.7.2 QUALITATIVE DATA ANALYSES	81
3.7.3 PRELIMINARY ANALYSIS OF THE QUANTITATIVE DATA	81
3.7.4 ANALYTICAL PROCEDURES ADOPTED IN TESTING THE PROPOSITIONS	86
3.7.5 VALIDITY IN THE MEASUREMENT PROCEDURES	87
3.8 RESEARCH ETHICS	91

3.9 CHAPTER SUMMARY	92
CHAPTER 4: QUALITATIVE DATA PRESENTATION, RESULTS AND DISCUSSIONS	93
4.1 OVERVIEW	93
4.2 PILOT SURVEY RESPONSES	93
4.3 DEMOGRAPHIC DATA PRESENTATION, RESULTS AND DISCUSSIONS	94
4.3.1 Interviewee’s office location	94
4.3.2 Interviewee’s designation in their respective FM departments	94
4.3.3 Interviewee’s length of experience	95
4.4 RESPONSES TO MAIN QUESTIONS, ANALYSIS, RESULTS AND DISCUSSIONS	96
4.4.1 Key internal challenges constraining the achievement of strategic FM goals	96
4.4.2. Key external challenges constraining the achievement of strategic FM goals	102
4.4.3 Key challenges facing tomorrow’s university facilities managers	108
4.4.4 Practical solutions for addressing the challenges	109
4.5 CHAPTER SUMMARY	119
CHAPTER 5: QUANTITATIVE DATA PRESENTATION, ANALYSIS, RESULTS AND DISCUSSIONS	120
5.1 OVERVIEW	120
5.2 QUESTIONNAIRE RESPONSES	120
5.2.1 DEMOGRAPHIC BACKGROUND OF THE RESPONDENTS	121
5.3 FINDINGS IN RELATION TO THE FIRST OBJECTIVE	123
5.4 FINDINGS IN RELATION TO THE SECOND OBJECTIVE	126
5.4.1 BROAD CATEGORIES OF INTERNAL CHALLENGES	126
5.4.2 SUBCOMPONENTS OF THE INTERNAL CHALLENGES CONSTRAINING THE ACHIEVEMENT OF STRATEGIC FM GOALS	129
5.4.3 BROAD CATEGORIES OF EXTERNAL CHALLENGES	137
5.4.4 EXTERNAL CHALLENGES CONSTRAINING THE ACHIEVEMENT OF STRATEGIC FM GOALS	140
5.5 FINDINGS IN RELATION TO THE THIRD OBJECTIVE	148
5.5.1 PRACTICAL SOLUTIONS FOR ADDRESSING THE CHALLENGES	148
5.6 FINDINGS IN RELATION TO THE FOURTH OBJECTIVE	170
5.6.1 Key future challenges facing tomorrow’s university facilities managers	170
5.7 CHAPTER SUMMARY	188
CHAPTER 6: MODEL TEST SURVEYS	189

6.1 INTRODUCTION	189
6.2 MODEL TEST SURVEYS RESPONSES	189
6.2.1 CASE STUDY I: UNIVERSITY A	190
6.2.2. CASE STUDY II – UNIVERSITY B	197
6.2.3 CASE STUDY III – UNIVERSITY C	199
6.2.4 CASE STUDY IV – UNIVERSITY D	202
6.2.5 CASE STUDY V – UNIVERSITY E	204
6.2.6 PRACTICAL SOLUTIONS FOR ADDRESSING THE CHALLENGES FACING UNIVERSITY FACILITIES MANAGERS	208
6.3 RESEARCH MODEL	274
6.3.1 Overview	274
6.3.2 Research model	274
6.4 SUMMARY	280
CHAPTER 7: TESTS OF RESEARCH PROPOSITIONS	281
7.1 INTRODUCTION	281
7.2 TESTS OF PROPOSITION 1.1	284
7.3 TESTS OF PROPOSITION 1.2	289
7.4 TESTS OF PROPOSITION 2.1	291
7.4.1 Case Study I: University A	292
7.4.2 Case Study II: University B	297
7.4.3 Case Study III: University C	301
7.4.4 Case Study IV: University D	304
7.4.5 Case Study V: University E	307
7.5 TESTS OF PROPOSITION 2.2	311
7.5.1 Case Study I: University A	317
7.5.2 Case Study II: University B	324
7.5.3 Case Study III: University C	326
7.5.4 Case Study IV: University D	329
7.5.5 Case Study V: University E	331
7.6 TESTS OF PROPOSITION 3.1	334
7.7 SUMMARY OF PROPOSITION TESTING	336
CHAPTER 8: CONCLUSIONS AND RECOMMENDATIONS	338
8.1 KEY FINDINGS OF THE STUDY	338
8.2 IMPLICATIONS OF THE FINDINGS TO THE FM PRACTICE & CONTRIBUTIONS TO KNOWLEDGE	343
8.3 RECOMMENDATIONS	344

REFERENCES	347
APPENDICES	364
APPENDIX A:	365
DOCUMENTS USED IN PLANNING AND CONDUCTING PILOT INTERVIEWS	365
Appendix A1: Letter of request for interview	366
Appendix A2: Interviewee's choice of date and time slots	368
A3: Letter of confirmation of interview schedule	369
Appendix A4: Interview questions	370
Appendix A4: Interview questions (cont'd)	371
Appendix A4: Interview questions (cont'd)	372
Appendix A4: Interview questions (cont'd)	373
Appendix A4: Interview questions (cont'd)	374
Appendix A4: Interview questions (cont'd)	375
Appendix A4: Interview questions (cont'd)	376
Appendix A4: Interview questions (cont'd)	377
Appendix A5: Participant consent form	378
Appendix A6: Authority to release of transcripts	379
Appendix A7: Research assistant confident	380
Appendix A8: Transcriber's confidentiality agreement	381
APPENDIX B:	382
DOCUMENTS USED IN PLANNING AND CONDUCTING QUESTIONNAIRE SURVEY	382
Appendix B1: Covering letter for the questionnaire administration (Information sheet)	383
Appendix B2: Sample copy of the questionnaire	384
Appendix B2: Sample copy of the questionnaire (cont'd)	385
Appendix B2: Sample copy of the questionnaire (cont'd)	386
Appendix B2: Sample copy of the questionnaire (cont'd)	387
Appendix B2: Sample copy of the questionnaire (cont'd)	388
Appendix B2: Sample copy of the questionnaire (cont'd)	389
Appendix B2: Sample copy of the questionnaire (cont'd)	390
Appendix B3: Form for requesting summary of the key research findings	391
Appendix B4: Questionnaire survey reminder letter	392
Appendix B5: Supporting Letter from TEFMA	393
APPENDIX C:	394
DOCUMENTS USED IN PLANNING AND CONDUCTING MODEL TEST SURVEY	394
Appendix C1: Covering Letter	395
Appendix C2: Interview Reminder Letter	396
Appendix C3: Interviewee's choice of date and time slots	397
Appendix C4: Confirmation of interview schedule	398
Appendix C5: Interview Questions	399
APPENDIX D:	402
GUIDELINE TO CHOICE OF APPROPRIATE STATISTICAL TECHNIQUE FOR HYPOTHESIS TESTING	402

APPENDIX E: SUMMARY OF KEY RESEARCH FINDINGS AND THE ACCOMPANYING CHARTS & TABLES – QUALITATIVE DATA RESULTS PRESENTATION	411
E.1. PRACTICAL SOLUTIONS FOR ADDRESSING THE CHALLENGES IMPACTING ON STRATEGIC FACILITIES MANAGEMENT GOALS	411
APPENDICES F:	424
QUANTITATIVE DATA RESULTS PRESENTATION	424
F.1 MAINSTREAM QUESTIONNAIRE RESPONSES	424
F.2 MODEL TEST SURVEYS	441
F.2.1 CASE STUDY II – UNIVERSITY B	441
F.2.2 CASE STUDY III – UNIVERSITY C	446
F.2.3 CASE STUDY IV – UNIVERSITY D	450
F.2.4 CASE STUDY V – UNIVERSITY E	455
APPENDIX G:	460
TABLES FOR PROPOSITIONS TESTS RESULTS	460
APPENDIX H: SUMMARY OF RESEARCH FINDINGS	484
APPENDIX I: ETHICAL CLEARANCE FOR THE STUDY	509
APPENDIX J: PUBLICATIONS OF RESEARCH FINDINGS	513

LIST OF TABLES

Table 1: Categorisation of FM tasks (Source: Transfield and Akhlagi, 1995, p.45).....	27
Table 2: Internal challenges faced by university facilities managers.....	30
Table 3: Institutional challenges facing UFM's	31
Table 4: External challenges facing university facilities managers	32
Table 5: Solutions to the challenges faced by university facilities managers.....	33
Table 6: Solutions to the challenges faced by university facilities managers (Cont'd).....	34
Table 7: PESTELI Analysis Framework (Source: Alexander, 2009).....	42
Table 8: PESTELI Analysis Framework (Cont'd) (Source: Alexander, 2009)	43
Table 9: Sample sizes for different sizes of population (assuming data are collected from all cases of sample).....	70
Table 10: Sample size of the study	71
Table 11: Sample size required for this study.....	72
Table 12: Interviewee's office location	94
Table 13: Interviewee's designation in their respective organization	95
Table 14: Interviewee's length of experience.....	95
Table 15: Broad categories of internal challenges constraining on the achievement of strategic FM goals	96
Table 16: Internal challenges constraining the achievement of strategic FM goals – Finance	97
Table 17: Internal challenges constraining the achievement of strategic FM goals - Operational method / process.....	98
Table 18: Internal challenges constraining the achievement of strategic FM goals - Stakeholder needs / service providers	99
Table 19: Internal challenges constraining the achievement of strategic FM goals – Manpower.....	100
Table 20: Internal challenges constraining the achievement of strategic FM goals - Machinery / equipment	101
Table 21: Internal challenges constraining the achievement of strategic FM goals – Materials	101
Table 22: Broad categories of external challenges constraining the achievement of strategic FM goals.....	102
Table 23: External challenges constraining on the achievement of strategic FM goals – Political constraints.....	103
Table 24: External challenges constraining on the achievement of strategic FM goals – Economic constraints.....	104
Table 25: External challenges constraining on the achievement of strategic FM goals - Socio-cultural constraints	105
Table 26: External challenges constraining on the achievement of strategic FM goals – Technological constraints	106
Table 27: External challenges constraining on the achievement of strategic FM goals – Environmental and sustainability constraints.....	107
Table 28: External challenges constraining on the achievement of strategic FM goals - Legislative constraints.....	107

Table 29: External challenges constraining on the achievement of strategic FM goals - Institutional constraints	108
Table 30: Key challenges facing tomorrow's university facilities managers.....	109
Table 31: Practical solutions for addressing internal challenges – Finance.....	110
Table 32: Practical solutions for addressing external challenges - Economic constraints...	113
Table 33: Practical solutions for addressing future challenges - Emergency management	116
Table 34: Analysis of responses to questionnaire survey	121
Table 35: Analysis of non-response to questionnaire survey	121
Table 36: Respondents' designation in their organization	122
Table 37: Respondents' length of experience.....	123
Table 38: Broad categories of current internal challenges (C1) and issues faced by university facilities managers	124
Table 39: Broad categories of current external challenges and issues faced by university facilities managers	125
Table 40: Levels of impact - Broad category of internal challenges	127
Table 41: Frequencies of occurrence - Broad category of internal challenges.....	128
Table 42: Risk levels - Broad categories of internal challenges	129
Table 43: Level of impact - Current internal (CI) challenges relating to inadequate operational finance.....	131
Table 44: Frequencies of occurrence - Current Internal (CI) challenges relating to operational finance/ budget.....	132
Table 45: Risk levels - Current Internal (CI) challenges relating to operational finance/ budget	133
Table 46: Respondents' responses on the levels of impact on the broad categories of external challenges	138
Table 47: Respondents' responses on the frequencies of occurrence on the broad categories of external challenges	139
Table 48: Respondents' responses on the risk levels on the broad categories of external challenges	140
Table 49: Level of impact - Current External (CE) challenges relating to political constraints	141
Table 50: Frequencies of occurrence - Current External (CE) challenges relating to political constraints	142
Table 51: Risk levels - Current External (CE) challenges relating to political constraints	143
Table 52: Practical solutions for addressing Current Internal (CI) challenges - Finance	149
Table 53: Rating on impact levels of practical solutions for current internal challenges – Finance.....	150
Table 54: Practical solutions for addressing Current Internal (CI) challenges - Operational efficiency	150
Table 55: Rating on impact levels of practical solutions for current internal challenges – Operational efficiency.....	151
Table 56: Practical solutions for addressing Current Internal (CI) challenges - Risk Management.....	152
Table 57: Rating on impact levels of practical solutions for current internal challenges – Risk management.....	152

Table 58: Practical solutions for addressing Current Internal (CI) challenges - Stakeholder needs/ Service providers	153
Table 59: Rating on impact levels of practical solutions for current internal challenges – Stakeholder needs/ Service providers	154
Table 60: Practical solutions for addressing Current Internal (CI) challenges - Maintenance	155
Table 61: Rating on impact levels of practical solutions for current internal challenges - Maintenance	155
Table 62: Practical solutions for addressing Current Internal (CI) challenges - Manpower	156
Table 63: Rating on impact levels of practical solutions for current internal challenges - Manpower.....	157
Table 64: Practical solutions for addressing Current Internal (CI) challenges - Health and Safety	158
Table 65: Rating on impact levels of practical solutions for current internal challenges – Health and safety	158
Table 66: Practical solutions for addressing Current Internal (CI) challenges - Materials...	160
Table 67: Rating on impact levels of practical solutions for current internal challenges – Materials	161
Table 68: Practical solutions for addressing Current External (CE) challenges - Economic.	162
Table 69: Rating on impact levels of practical solutions for current external challenges - Economic.....	162
Table 70: Practical solutions for addressing Current External (CE) challenges – Sustainability/ environmental issues	163
Table 71: Rating on impact levels of practical solutions for current external challenges – Sustainability/ environmental.....	164
Table 72: Rating on impact levels of practical solutions for current external challenges - Technological	165
Table 73: Practical solutions for addressing Current External (CE) challenges - Regulatory/ compliance.....	166
Table 74: Rating on impact levels of practical solutions for current external challenges – Regulatory/ compliance.....	166
Table 75: Practical solutions for addressing Current External (CE) challenges - Socio-cultural issues.....	167
Table 76: Rating on impact levels of practical solutions for current external challenges – Socio-cultural	167
Table 77: Practical solutions for addressing Current External (CE) challenges - Institutional	169
Table 78: Rating on impact levels of practical solutions for current external challenges – Institutional.....	170
Table 79: Predicted levels of impact for key future challenges facing tomorrow’s university facilities managers	171
Table 80: Predicted frequencies of occurrence for key future challenges facing tomorrow’s university facilities managers	172
Table 81: Predicted risk levels for key future challenges facing tomorrow’s university facilities managers.....	173

Table 82: Practical solutions for addressing Future (F) challenges - Emergency management	174
Table 83: Rating on impact levels of practical solutions for emergency management challenges	175
Table 84: Practical solutions for addressing Future (F) challenges - Statutory compliance	176
Table 85: Rating on impact levels of practical solutions for statutory compliance challenges	176
Table 86: Practical solutions for addressing Future (F) challenges - Sustainability	177
Table 87: Rating on impact levels of practical solutions for sustainability challenges	177
Table 88: Practical solutions for addressing Future (F) challenges - Technology	178
Table 89: Rating on impact levels of practical solutions for technology challenges	178
Table 90: Practical solutions for addressing Future (F) challenges - User needs assessment and satisfaction	179
Table 91: Rating on impact levels of practical solutions for user needs assessment and satisfaction challenges	180
Table 92: Practical solutions for addressing Future (F) challenges - Business and financial management	181
Table 93: Rating on impact levels of practical solutions for business and financial management challenges	181
Table 94: Practical solutions for addressing Future (F) challenges - Occupational health and safety	182
Table 95: Rating on impact levels of practical solutions for occupational health and safety challenges	182
Table 96: Practical solutions for addressing Future (F) challenges - Leadership and innovation in FM	183
Table 97: Rating on impact levels of practical solutions for leadership and innovation in FM challenges	184
Table 98: Practical solutions for addressing Future (F) challenges - Space management...	185
Table 99: Rating on impact levels of practical solutions for space management challenges	186
Table 100: Practical solutions for addressing Future (F) challenges – Outsourcing	187
Table 101: Rating on impact levels of practical solutions for outsourcing challenges	188
Table 102: University A - Levels of impact for CI challenges	191
Table 103: University A - Frequencies of occurrence for CI challenges.....	191
Table 104: University A - Risk scores for CI challenges.....	192
Table 105: University A - Levels of impact for CE challenges	193
Table 106: University A - Frequencies of occurrence for CE challenges.....	193
Table 107: University A - Risk scores for CE challenges.....	194
Table 108: University A - Levels of impact for Future challenges.....	195
Table 109: University A - Frequencies of occurrence for Future challenges	196
Table 110: University A - Risk scores for Future challenges	196
Table 111: Summary of Model Test Survey Results (Case Study I - III).....	207
Table 112: Summary of Model Test Survey Results (Case Study IV - V) (Cont'd)	208
Table 113: Practical solutions to finance-related current internal FM challenges.....	211

Table 114: Practical solutions for addressing current internal challenges - Operational efficiency	216
Table 115: Practical solutions for addressing current internal challenges - Risk management	219
Table 116: Roles in risk management (FMAS Level: Lead) (Source: FMAA, 2004; Adapted from Enterprise Wide Risk Management, CPA Australia, Melbourne, 2002).....	220
Table 117: Roles in risk management (FMAS Level: Manage) (Source: FMAA, 2004; Adapted from Enterprise Wide Risk Management, CPA Australia, Melbourne, 2002).....	220
Table 118: Roles in risk management (FMAS Level: Practice) (Source: FMAA, 2004; Adapted from Enterprise Wide Risk Management, CPA Australia, Melbourne, 2002).....	221
Table 119: Practical solutions for addressing current internal challenges - Stakeholder needs/service providers.....	222
Table 120: Practical solutions for addressing current internal challenges – Maintenance.....	225
Table 121: Practical solutions for addressing current internal challenges - Manpower	226
Table 122: Practical solutions for addressing current internal challenges - Machinery/equipment.....	229
Table 123: Practical solutions for addressing current internal challenges - Health & Safety	230
Table 124: Practical solutions for addressing current internal challenges - Materials.....	231
Table 125: Practical solutions for addressing current external challenges - Economic.....	233
Table 126: Practical solutions for addressing current external challenges - Sustainability/environmental issues	236
Table 127: Practical solutions for addressing current external challenges - Technological	238
Table 128: Practical solutions for addressing current external challenges - Regulatory/compliance.....	241
Table 129: Practical solutions for addressing current external challenges - Socio-cultural issues.....	243
Table 130: Practical solutions for addressing current external challenges - Institutional.....	245
Table 131: Practical solutions for addressing future challenges - Emergency management	249
Table 132: Practical solutions for addressing future challenges - Statutory compliance.....	251
Table 133: Practical solutions for addressing future challenges - Sustainability.....	253
Table 134: Practical solutions for addressing future challenges - Technology.....	256
Table 135: Practical solutions for addressing future challenges - User needs assessment and satisfaction.....	257
Table 136: Practical solutions for addressing future challenges - Business and financial management.....	259
Table 137: Practical solutions for addressing future challenges - Occupational health & safety	263
Table 138: Practical solutions for addressing future challenges - Leadership & innovation in FM	265
Table 139: Practical solutions for addressing future challenges - Space management	268
Table 140: Practical solutions for addressing future challenges - Outsourcing.....	271
Table 141: Opinions of New Zealand and Australia’s university facilities managers on the broad internal challenges	286

Table 142: Opinions of New Zealand and Australia’s university facilities managers on the broad external challenges.....	287
Table 143: Opinions of New Zealand and Australia’s university facilities managers on the future challenges	288
Table 144: Overall result tests of Proposition 1.1.....	289
Table 145: Cross tabulation for testing Proposition 1.2 - Broad internal challenges	290
Table 146: Cross tabulation for testing Proposition 1.2 - Broad external challenges	290
Table 147: Cross tabulation and Spearman's correlation test for testing Proposition 2.1 - Broad internal challenges (University A)	293
Table 148: Cross tabulation and Spearman's correlation test for testing Proposition 2.1 - Broad external challenges (University A).....	294
Table 149: Cross tabulation and Spearman's correlation test for testing Proposition 2.1 - Future challenges (University A).....	295
Table 150: Cross tabulation and Spearman's correlation test for testing Proposition 2.1 – Broad categories of Current Internal challenges (University B)	297
Table 151: Cross tabulation and Spearman's correlation test for testing Proposition 2.1 – Broad categories of Current External challenges (University B).....	298
Table 152: Cross tabulation and Spearman's correlation test for testing Proposition 2.1 – Future challenges (University B).....	299
Table 153: Cross tabulation and Spearman's correlation test for testing Proposition 2.1 – Broad categories of Current Internal challenges (University C)	301
Table 154: Cross tabulation and Spearman's correlation test for testing Proposition 2.1 – Broad categories of Current External challenges (University C).....	302
Table 155: Cross tabulation and Spearman's correlation test for testing Proposition 2.1 – Broad categories of Future challenges (University C).....	303
Table 156: Cross tabulation and Spearman's correlation test for testing Proposition 2.1 – Broad categories of Current Internal challenges (University D).....	304
Table 157: Cross tabulation and Spearman's correlation test for testing Proposition 2.1 – Broad categories of Current External challenges (University D)	305
Table 158: Cross tabulation and Spearman's correlation test for testing Proposition 2.1 – Broad categories of Future challenges (University D)	306
Table 159: Cross tabulation and Spearman's correlation test for testing Proposition 2.1 – Broad categories of Current Internal challenges (University E).....	307
Table 160: Cross tabulation and Spearman's correlation test for testing Proposition 2.1 – Broad categories of Current External challenges (University E).....	308
Table 161: Cross tabulation and Spearman's correlation test for testing Proposition 2.1 – Broad categories of Future challenges (University E).....	309
Table 162: Overall result of tests of Proposition 2.1	310
Table 163: Generic matrix of variables for multivariate related sample analysis of concordance using Kendall's W	312
Table 164: Example of analysis of the level of agreement of the sets of relative occurrence frequency rankings of the internal challenges faced by facilities managers as obtained from three sources.	315

Table 165: Case Study I - Level of agreement of the sets of relative occurrence frequency rankings of the broad internal challenges faced by facilities managers as obtained from three sources.	318
Table 166: Descriptive statistics: Broad internal challenges for Case Study I (University A)	319
Table 167: Mean ranks: Broad internal challenges for Case Study I (University A).....	319
Table 168: Test Statistics: Broad internal challenges for Case Study I (University A).....	319
Table 169: Case Study I - Level of agreement of the sets of relative occurrence frequency rankings of the broad external challenges faced by facilities managers as obtained from three sources.	320
Table 170: Descriptive statistics - Broad external challenges for Case Study I (University A)	321
Table 171: Mean ranks - Broad external challenges for Case Study I (University A).....	321
Table 172: T Test Statistics - Broad external challenges for Case Study I (University A)	321
Table 173: Case Study I - Level of agreement of the sets of relative occurrence frequency rankings of the future challenges faced by facilities managers as obtained from three sources.	322
Table 174: Descriptive statistics - Future challenges for Case Study I (University A)	323
Table 175: Mean ranks - Future challenges for Case Study I (University A)	323
Table 176: T Test statistic - Future challenges for Case Study I (University A)	324
Table 177: SPSS Output: Broad internal challenges for Case Study II (University B).....	325
Table 178: SPSS Output: Broad external challenges for Case Study II (University B)	325
Table 179: SPSS Output: Future challenges for Case Study II (University B)	326
Table 180: SPSS Output: Broad internal challenges for Case Study III (University C).....	327
Table 181: SPSS Output: Broad external challenges for Case Study III (University C)	328
Table 182: SPSS Output: Future challenges for Case Study III (University C)	328
Table 183: SPSS Output: Broad internal challenges for Case Study IV (University D)	329
Table 184: SPSS Output: Broad external challenges for Case Study IV (University D).....	330
Table 185: SPSS Output: Future challenges for Case Study IV (University D).....	330
Table 186: SPSS Output: Broad internal challenges for Case Study V (University E).....	332
Table 187: SPSS Output: Broad external challenges for Case Study V (University E)	332
Table 188: SPSS Output: Future challenges for Case Study V (University E)	333
Table 189: Cross tabulation for testing Proposition 3.1 - Future challenges.....	335
Table 189: Practical solutions for addressing internal challenges - Operational efficiency	411
Table 190: Practical solutions for addressing internal challenges – Risk management	411
Table 191: Practical solutions for addressing internal challenges – Stakeholder needs/ Service providers	412
Table 192: Practical solutions for addressing internal challenges – Maintenance.....	412
Table 193: Practical solutions for addressing internal challenges – Manpower	413
Table 194: Practical solutions for addressing internal challenges – Materials.....	414
Table 195: Practical solutions for addressing external challenges - Sustainability/ environmental issues	415
Table 196: Practical solutions for addressing external challenges - Technological issues ..	416
Table 197: Practical solutions for addressing external challenges - Regulatory/ compliance constraints	416

Table 198: Practical solutions for addressing external challenges - Socio-cultural issues ..	417
Table 199: Practical solutions for addressing external challenges - Institutional constraints	417
Table 200: Practical solutions for addressing future challenges - Statutory compliance....	418
Table 201: Practical solutions for addressing future challenges – Sustainability	418
Table 202: Practical solutions for addressing future challenges – Technology	419
Table 203: Practical solutions for addressing future challenges - User needs assessment and satisfaction.....	419
Table 204: Practical solutions for addressing future challenges - Business and financial management issues	420
Table 205: Practical solutions for addressing future challenges - Occupational health and safety.....	420
Table 206: Practical solutions for addressing future challenges - Leadership and innovation in FM	421
Table 207: Practical solutions for addressing future challenges - Space management	422
Table 208: Practical solutions for addressing future challenges – Outsourcing.....	423
Table 209: Levels of impact - Current Internal (CI) challenges relating to operational method/ process	424
Table 210: Levels of impact - Current Internal (CI) challenges relating to stakeholder needs/ service providers.....	425
Table 211: Levels of impact - Current Internal (CI) challenges relating to manpower	425
Table 212: Levels of impact - Current Internal (CI) challenges relating to machinery	426
Table 213: Levels of impact - Current Internal (CI) challenges relating to materials	426
Table 214: Frequencies of occurrence – Challenges relating to operational method/ process	427
Table 215: Frequencies of occurrence - Challenges relating to stakeholder needs/ service providers	427
Table 216: Frequencies of occurrence - Challenges relating to manpower	428
Table 217: Frequencies of occurrence - Challenges relating to machinery.....	428
Table 218: Frequencies of occurrence - Challenges relating to materials.....	429
Table 219: Risk levels - Challenges relating to operational method/ process.....	429
Table 220: Risk levels - Challenges relating to stakeholder needs/ service providers	430
Table 221: Risk levels - Challenge relating to manpower	430
Table 222: Risk levels - Challenges relating to machinery	431
Table 223: Risk levels - Challenges relating to materials	431
Table 224: Levels of impact - Challenges relating to economic constraints.....	432
Table 225: Levels of impact - Challenges relating to socio-cultural constraints.....	432
Table 226: Levels of impact - Challenges relating to technological constraints	433
Table 227: Levels of impact - Challenges relating to legislative constraints	433
Table 228: Levels of impact - Challenges relating to environmental/ sustainability constraints	434
Table 229: Levels of impact - Challenges relating to institutional constraints	434
Table 230: Frequencies of occurrence - Challenges relating to economic constraints	435
Table 231: Frequencies of occurrence - Challenges relating to socio-cultural constraints .	435
Table 232: Frequencies of occurrence - Challenges relating to technological constraints .	436

Table 233: Frequencies of occurrence - Challenges relating to legislative constraints	436
Table 234: Frequencies of occurrence - Challenges relating to environmental and sustainability constraints	437
Table 235: Frequencies of occurrence - Challenges relating to institutional constraints ...	437
Table 236: Risk levels - Challenges relating to economic constraints	438
Table 237: Risk levels - Challenges relating to socio-cultural constraints	438
Table 238: Risk levels - Challenges relating to technological constraints.....	438
Table 239: Risk levels - Challenges relating to legislative constraints	439
Table 240: Risk levels - Challenges relating to environmental and sustainability constraints	439
Table 241: Risk levels - Challenges relating to institutional constraints.....	440
Table 242: University B - Levels of impact for CI challenges	441
Table 243: University B - Frequencies of occurrence for CI challenges.....	441
Table 244: University B - Risk scores for CI challenges	442
Table 245: University B - Levels of impact for CE challenges.....	442
Table 246: University B - Frequencies of occurrence for CE challenges.....	443
Table 247: University B - Risk scores of CE challenges	443
Table 248: University B - Levels of impact for Future challenges.....	444
Table 249: University B - Frequencies of occurrence for Future challenges	445
Table 250: University B - Risk scores for Future challenges	445
Table 251: University C - Levels of impact for CI challenges.....	446
Table 252: University C - Frequencies of occurrence for CI challenges.....	446
Table 253: University C - Risk scores for CI challenges	447
Table 254: University C - Levels of impact for CE challenges.....	447
Table 255: University C - Frequencies of occurrence for CE challenges.....	448
Table 256: University C - Risk scores for CE challenges	448
Table 257: University C - Levels of impact for Future challenges.....	449
Table 258: University C - Frequencies of occurrence for Future challenges	449
Table 259: University C - Risk scores for Future challenges	450
Table 260: University D - Levels of impact for CI challenges	451
Table 261: University D - Frequencies of occurrence for CI challenges.....	451
Table 262: University D - Risk scores for CI challenges.....	451
Table 263: University D - Level of impacts for CE challenges	452
Table 264: University D - Frequencies of Occurrence for CE Challenges.....	452
Table 265: University D - Risk scores for CE challenges.....	453
Table 266: University D - Levels of impact for Future challenges.....	453
Table 267: University D - Frequencies of occurrence for Future challenges.....	454
Table 268: University D - Risk scores for Future challenges	454
Table 269: University E - Levels of impact for CI challenges.....	455
Table 270: University E - Frequencies of occurrence for CI challenges	455
Table 271: University E - Risk scores for CI challenges	456
Table 272: University E - Levels of impact for CE challenges.....	456
Table 273: University E - Frequencies of occurrence for CE challenges	457
Table 274: University E - Risk scores for CE challenges	457
Table 275: University E - Levels of impact for Future challenges	458

Table 276: University E - Frequencies of occurrence for Future challenges	458
Table 277: University E - Risk scores for Future challenges.....	459
Table 278: Case Study II - Level of agreement of the sets of relative occurrence frequency rankings of the broad internal challenges faced by facilities managers as obtained from three sources.	460
Table 279: Case Study II - Level of agreement of the sets of relative occurrence frequency rankings of the broad external challenges faced by facilities managers as obtained from three sources.	462
Table 280: Case Study II - Level of agreement of the sets of relative occurrence frequency rankings of the future challenges faced by facilities managers as obtained from three sources.	464
Table 281: Case Study III - Level of agreement of the sets of relative occurrence frequency rankings of the broad internal challenges faced by facilities managers as obtained from three sources.	466
Table 282: Case Study III - Level of agreement of the sets of relative occurrence frequency rankings of the broad external challenges faced by facilities managers as obtained from three sources.	468
Table 283: Case Study III: Level of agreement of the sets of relative occurrence frequency rankings of the future challenges faced by facilities managers as obtained from three sources.	470
Table 284: Case Study IV: Level of agreement of the sets of relative occurrence frequency rankings of the broad internal challenges faced by facilities managers as obtained from three sources.	472
Table 285: Case Study IV: Level of agreement of the sets of relative occurrence frequency rankings of the broad external challenges faced by facilities managers as obtained from three sources.	474
Table 286: Case Study IV: Level of agreement of the sets of relative occurrence frequency rankings of the future challenges faced by facilities managers as obtained from three sources.	476
Table 287: Case Study VVV: Level of agreement of the sets of relative occurrence frequency rankings of the broad internal challenges faced by facilities managers as obtained from three sources.	478
Table 288: Level of agreement of the sets of relative occurrence frequency rankings of the broad external challenges faced by facilities managers as obtained from three sources...	480
Table 289: Case Study V: Level of agreement of the sets of relative occurrence frequency rankings of the future challenges faced by facilities managers as obtained from three sources.	482

TABLE OF FIGURES

Figure 1: Key challenge for the facilities manager on the internal front (Source: Transfield and Akhlaghi, 1995)	10
Figure 2: Model of the overall challenges facing facilities managers	38
Figure 3: Three stages of data gathering involved in this study (Source: Adapted from Mbachu and Nkado, 2006).....	59
Figure 4: Schematic illustration of the research strategy adopted in this study.....	62
Figure 5: Conceptual framework - Operational context for this study.....	83
Figure 6: Flowchart of the presentation of main questionnaire survey results – Operational finance.....	130
Figure 7: Flowchart of mainstream surveys data presentation of current internal challenges.	134
Figure 8: Flowchart of mainstream surveys data presentation of current external challenges.	145
Figure 9: Contemporary and future challenges facing university facilities managers (Source: adapted from Kamarazaly et al, 2013).....	276
Figure 10: Research model for this study	277
Figure 11: Flow chart process for identifying risk levels of challenges impacting on the achievement of strategic FM goals.	279
Figure 12: Snapshot of research objectives, propositions and analytical methods adopted.	282

ABSTRACT

Like any set of professionals, the facilities managers (FMgrs) in universities face several challenges that constrain performance of their crucial roles. These range from internal managerial issues to external constraints which can be structured as PESTELI (i.e. political, economic, socio-cultural, technological, environmental, legal and institutional) constraints. The literature is replete with inexhaustible list of the challenges. However, a major gap in the literature is the lack of clear indications of the risk levels attached to these challenges or extent of their impact on the performance of the FMgrs. This study therefore aimed to contribute to filling this knowledge gap by exploring in depth the challenges and their relative levels of influences on the performance of university FMgrs. The specific objectives of the study were four-fold: (i) to identify the current internal and external challenges faced by universities facilities managers; (ii) to analyse the risk levels of the identified challenges based on their relative levels of impact on the achievement of the university strategic FM goals and their occurrence frequencies; (iii) to establish some innovative measures for addressing the key challenges; and (iv) to determine the key challenges facing tomorrow's university facilities managers.

Using the descriptive survey method, the study focused on the facilities managers in the Australasian universities. These comprised eight universities in New Zealand and forty universities in Australia. Views of facilities managers in these universities were obtained during three stages of data gathering: qualitative data gathering at the pilot interview stage, quantitative data gathering at the questionnaire survey stage, and some case studies at the model test survey stage. Descriptive statistics, multi-attribute analysis, rank correlation tests and statistical tests of significance were employed in the analysis of the research data and the tests of research hypotheses.

Results showed that the critical challenges facing the university facilities managers (UFMs) comprised issues relating to the following: finance-related current internal challenge, economic-related current external challenges and sustainability-related future challenges. Overall, poor funding was identified as the root of all other issues faced by the UFMs, hence majority of the suggested strategies for addressing the key challenges related largely to financial improvement measures. Other key measures included optimizing asset utilization, supporting business case for capital investment

with demonstrable returns on investment, improving FM's strategic relevance through linking FM and corporate strategies, and investment in efficient technologies such as the building automation and management systems.

The findings have contributed to filling an important knowledge gap by not only identifying the current and future challenges facing the UFM, but also prioritising them based on their relative influences on the achievement of the strategic goals of the FM departments. This way, the limited resources at the disposal of the UFM could be disbursed more cost-effectively in addressing the critical challenges in line with their identified risk levels. This would be of practical benefit to the facilities and property managers in formulating appropriate responses to the identified critical constraints with a view to achieving more satisfactory outcomes in their operations.

Keywords: Australasia, challenges, facilities managers, risk analysis, strategic facilities management, university facilities.

ACKNOWLEDGEMENT

This thesis would not have been possible without the guidance and the help of individuals who had contributed and extended their valuable assistance, support, experiences and advice in the preparation and completion of this study. The love of families, relatives and friends was my utmost driving force and inspiration all these years. It has been a long and challenging journey and to be able to successfully complete this study is ultimately a high point in my academic career. I could have not come this far without the contribution of many great individuals and I would like to express my deepest sincere appreciation to them.

First and foremost, I must thank God for His blessings in my everyday life, granting me the prosperity, happiness, contentment and love throughout my Ph.D. pursuit and most of all for giving me the strength to complete this research study and my Ph.D. programme.

I would like to record my gratitude and appreciation to my research supervisor, Dr Mbachu for all of his contributions of time, brilliant ideas, steadfast encouragement, and valuable advice that made my Ph.D. experience productive and inspiring. I have been amazingly fortunate to have a supervisor who gave me the opportunity to develop my own individuality and self-sufficiency by being allowed to perform my research with such independence. His patience, support and guidance helped me overcome many obstacles encountered during my Ph.D. journey. I would also like to thank him for his insightful and thought-provoking comments and constructive criticisms at the different stages of my research which had helped me focused my ideas and put all things together to bring this study to fruition; thus holding me to a high research standards. The utmost trust, respect and honesty that we build and sustained throughout this journey are the key to the accomplishment of this research study. Thank you for everything you have done, Dr Mbachu.

My gratitude also goes to my co-supervisor, Professor Robyn Phipps. Her expertise, helpful criticism, beneficial insights she has shared and unstinting support assisted me greatly in this research. I am also thankful to Prof Robyn Phipps for encouraging the use of correct grammar and consistent notation in my writings and for carefully reading and commenting on the revisions of this thesis.

Great appreciation is extended to the facilities managers registered with Tertiary Education Facilities Management Association (TEFMA), for their willingness to participate in the research surveys, their time spent in thoughtfully responding to the questionnaires, valuable knowledge in the interviews and share their valuable experiences related to facilities management practice in universities.

The approval granted for the undertaking of the questionnaire surveys, interviews and case studies by Massey University Human Ethics Committee (MUHEC), is hereby acknowledged.

This research study was funded and strongly supported by Massey University Doctoral Research Scholarship, and for which I am very grateful.

Special thanks to other professors, lecturers, administrators from the School of Engineering and Advanced Technology (SEAT) and library staffs at the Massey University for their kind assistance in supporting my academic aspirations.

None of this would have been possible without the love and patience of my family. I would like to express my heart-felt gratitude to my family; to whom this thesis is dedicated to, for their constant source of love, concern, support and strength all these years. My gratitude also goes to my extended family that has aided and encouraged me throughout this endeavour. I warmly appreciate the generosity and understanding of my extended family.

I am indebted to my parents (Haji Kamarazaly Mohd Yunus and Hajjah Annizar Mohamed) for their love, understanding and continuous prayers for my success. They have been my source of strength, motivation and they have showed me the power of faith in continuing to pursue my Ph.D. studies regardless of all the obstacles that I've encountered before I enrolled for Ph.D. programme in New Zealand and during my Ph.D. journey. My parents have done so many great sacrifices to help me achieve all that I could in life, and this Ph.D. study is one of them; and for that, I owe my every achievement to both of them.

To my parents-in-law (Haji Syed Ahmad Bokharey and Hajjah Kamariah Mohd Noor), I would like to convey my heart-felt thanks for their blessings, constant love, advise, and encouragement in all my pursuits.

I am heartily thankful to my husband and daughter; without who this effort would have been worth nothing. To my loving, supportive, encouraging, and patient husband, Syed Kamarul Bakri B. Syed Ahmad Bokharey, I truly appreciate your sacrifices, indulgence, constant love and unfailing support. To my little angel, Sharifah Khadijah Raihanah, you're God's greatest gift in my life, the source of all the strength, happiness and joy for me. Without the presence and continuous tolerance from both of you, I would not have persevered. May God bless and grant both of you His blessings, success, good health and eternal happiness in life.

Last but not least, I would like to thank everyone who had contributed to this thesis in any way either directly or indirectly. Your support, assistance and contribution are greatly appreciated.

DEDICATION

With joy in my heart, I specially dedicate this thesis to my father, Haji Kamarazaly Mohd Yunus and my mother, Hajjah Annizar Mohamed, who strived perpetually to see that I attain the education they were not privileged to have.