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

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

6.2 MODEL TEST SURVEYS RESPONSES
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
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
Appendix 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

E.1. PRACTICAL SOLUTIONS FOR ADDRESSING THE CHALLENGES IMPACTING ON STRATEGIC FACILITIES MANAGEMENT GOALS 411

APPENDICES F:

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:

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 ................................................................. 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 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 issues .............................................................................................................................. 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 issues .............................................................................................................................. 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 .............................................................................................................................. 169
Table 79: Predicted levels of impact for key future challenges facing tomorrow’s university facilities managers .............................................................................................................................. 170
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

xv
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 for 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

xvi
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

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