UNIVERSITI PUTRA MALAYSIA

IMPROVING KNOWLEDGE CAPTURE DURING CONCEPTUAL DESIGN PHASE OF BUILDING PROJECTS

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IMPROVING KNOWLEDGE CAPTURE DURING CONCEPTUAL DESIGN PHASE OF BUILDING PROJECTS

By

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Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirements for the Degree of Doctor of Philosophy

March 2011
Dedicated to

My dearest parents

Whose endless love and care supported me all through the way
Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Doctor of Philosophy

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March 2011

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Incomplete knowledge flow between architects and mechanical/electrical engineers engenders large expense and untimely delivery of building projects. It is essential to consider mechanical/electrical requirements from the early stages of design; and many experienced architects acknowledge this knowledge entities and the necessity for considering them at the right time. Therefore, inefficient knowledge flow among professionals during architectural conceptual design is emphasized as a problem for this study. For overcoming this problem, the study intends to improve knowledge capture during conceptual design phase of building projects by formalizing the fundamental requirements of necessary mechanical/electrical knowledge during this phase. To achieve this goal, this research develop three objectives: 1) Specify an appropriate knowledge capture technique for tacit dominated conceptual design phase; 2) Identify fundamental mechanical/electrical
requirements to consider by architects during conceptual design phase; and
3) Develop a framework for formalizing tacit mechanical/electrical knowledge during conceptual design phase. Firstly, the study selects an appropriate technique to capture expert’s tacit knowledge based on a literature survey by matching existing knowledge capture techniques with conceptual design characteristics. Secondly, mechanical/electrical knowledge is obtained through a case study during conceptual design of a green building project. The mechanical/electrical knowledge and activities are matched in the McMillan Framework (2001) for the conceptual design phase. Later, mechanical/electrical knowledge is matched and assigned to the architectural concept design activities. At the conclusion of the exercise, the study developed a mechanical/electrical knowledge-based framework for the conceptual design phase. Validation of the results was obtained by using computational organizational theory simulation. This study contributes in extending McMillan’s Framework to include explicit fundamental required mechanical/electrical knowledge during the conceptual design phase; developing a tacit knowledge capture technique by combining tacit observation and explicit repertory grid documentation; and improving Nissen’s (2006) multidimensional model (MDM) by integrating knowledge into Macmillan’s framework for conceptual design activities. These results support the need to mitigate potential knowledge losses in tacit-dominant area between experts during conceptual design phase of building projects.
Abstrak tesis yan dikemukakan kepada Senat Universiti Putra Malaysia
Sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

PENINGKATAN PEMEROLEHAN PENGETAHUAN DALAM FASA KONSEP PROJEK-PROJEK REKA BENTUK BANGUNAN

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Aliran ilmu yang tidak efisyen di antara arkitek-arkitek dan jurutera mekanikal/elektrikal diketahui mengakibatkan kos yang tinggi dan kelewatan penyerahan projek binaan tersebut. Adalah penting untuk mempertimbangkan keperluan mekanikal/elektrikal dari fasa awal reka bentuk; dan ramai arkitek yang berpengalaman mengiktirafkan entity ilmu ini dan kepentingannya untuk dipertimbangkan pada masa yang tepat. Justru, kajian ini memfokus kepada permasalahan aliran ilmu yang kurang efisyen di kalangan professional semasa reka bentuk konsep seni bina. Bagi mengatasi permasalahan tersebut, kajian ini bertujuan untuk menambahbaik pemerolehan ilmu semasa fasa reka bentuk konsep projek binaan melalui proses formalisasi keperluan asas mekanikal/elektrikal yang diperlukan semasa fasa ini. Bagi mencapai sasaran ini, kajian membangunkan tiga objektif: 1) merumuskan spesifikasi teknik pemerolehan ilmu untuk fasa reka bentuk yang *tacit-dominant*; mengenal pasti asas keperluan mekanikal/elektrikal untuk dipertimbangkan oleh arkitek semasa fasa reka
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I certify that a Thesis Examination Committee has met on 17 March 2011 to conduct the final examination of Zohreh Pourzolfaghar on her thesis entitled “Improving Knowledge Capture During Conceptual Design Phase of Building Projects” in accordance with the Universities and University College Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The committee recommends that the student be awarded the Doctor of Philosophy.

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ix
DECLARATION

I declare that the thesis is my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously and is not concurrently submitted for any other degree at UniversitiPutraMalaysia or at any other institution.

ZOHREH POURZOLFAGHAR

Date: 17 march 2011
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABSTRACT</td>
<td>iii</td>
</tr>
<tr>
<td>ABSTRAK</td>
<td>v</td>
</tr>
<tr>
<td>ACKNOWLEDGEMENTS</td>
<td>vi</td>
</tr>
<tr>
<td>APPROVAL</td>
<td>viii</td>
</tr>
<tr>
<td>DECLARATION</td>
<td>x</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>xiv</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>xvi</td>
</tr>
</tbody>
</table>

## CHAPTER

### 1 INTRODUCTION

1.1 Background of the Study 1
1.2 Definition of Terms 4
1.3 Statement of the Problem 6
1.4 Research Questions 7
1.5 Research Objectives 8
1.6 Research Methodology 8
1.6.1 Research Framework 9
1.6.2 Research Question 10
1.6.3 Theoretical Proposition 10
1.6.4 Unit of Analysis 11
1.6.5 Linking Data to Proposition 11
1.6.6 Criteria for Interpreting the Findings 12
1.7 Importance of Study 14
1.8 Organization of Thesis 19

### 2 LITERATURE REVIEW

2.1 Introduction 21
2.2 Knowledge Management 23
2.2.1 Knowledge Definitions 23
2.2.2 Knowledge Typology 25
2.2.3 Knowledge Management Process 27
2.2.4 Management Literature 37
2.3 Dynamic Knowledge Flow 39
2.3.1 Knowledge Flow Theory (Nonaka, 1995) 39
2.3.2 Knowledge Flow Theory (Nissen, 2002) 43
2.3.3 Knowledge Conversion Process 45
2.3.4 Knowledge Conversion Techniques 47
Observation 48
Brainstorming 48
Protocol Analysis (Think-Aloud Method) 50
Consensus Decision Making 50
Repertory Grid 51
Nominal Group Technique (NGT) 51
Delphi Method 52
Concept Mapping 52
Blackboarding 53
Kinematic Analysis 54
Cognitive Map 55
Formal Interview 56
2.3.5 Conversion Techniques against Tacitness and Multidisciplinary Area 62
2.3.6 Conclusion for Knowledge Flow Literature 67
2.4 Design Process 68
2.4.1 Design Process Definitions 71
2.4.2 Design Process Models 73
2.4.3 Information Flow in Design Point of Departure for Design Literature 89
2.4.4 Review 90
2.5 Theoretical Framework 92
2.6 Summary 94

3 RESEARCH METHODOLOGY 95
3.1 Introduction 95
3.2 Research Methodology 96
3.3 Case Study Research Methodology for this Study 98
3.3.1 Research Question 98
3.3.2 Theoretical Proposition 100
3.3.3 Unit of Analysis 101
3.3.4 Linking Data to Proposition 109
3.3.5 Criteria for Interpreting Data 111
3.4 Validation 126
3.4.1 Construct Validity 126
3.4.2 Internal Validity 127
3.4.3 External Validity 127
3.4.4 Reliability 129
3.5 Limitation of Study 130
3.6 Summary 131

4 RESULTS AND ANALYSIS 132
4.1 Introduction 132
4.2 Observation 133
4.2.1 Observation Protocol 133
4.2.2 Case of Observations 134
4.3 Development of knowledge-based framework for Conceptual Design Phase 165
4.4 Summary 169

5 MODEL VALIDATION 171
5.1 Introduction 171
5.2 Model Simulation 172
Test Case 1: Base Case (Sufficient Awareness)  181
Test Case 2: Proposed Case (Insufficient Awareness)  183

5.3 Cases Analysis  184
5.4 Discussion and Conclusion  188
5.5 Summary  195

6  CONCLUSION  198
6.1 Introduction  198
6.2 Research Question and Objectives  198
6.3 Summary of Findings  199
   6.3.1 Summary of Findings from Literature Review  200
   6.3.2 Findings from Observation  201
6.5 Limitation of Study  206
6.6 Knowledge Contribution  206
6.7 Benefits of Study  210
6.8 Recommendation for Future Study  210

REFERENCES  212
APPENDICES  227
BIODATA OF STUDENT  248