



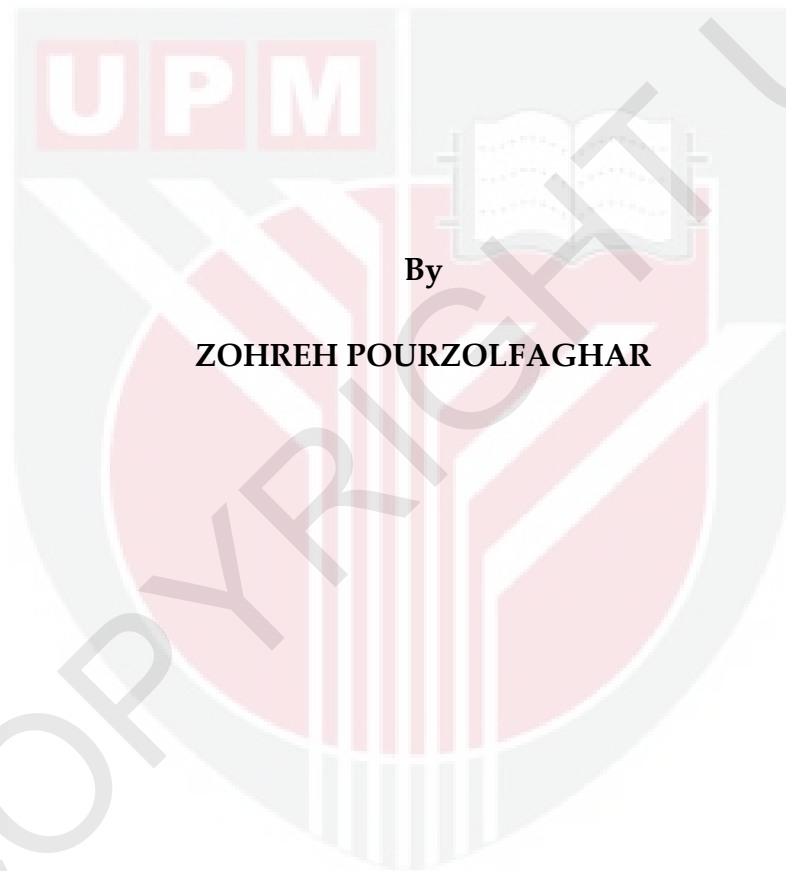
UNIVERSITI PUTRA MALAYSIA

***IMPROVING KNOWLEDGE CAPTURE DURING CONCEPTUAL DESIGN PHASE
OF BUILDING PROJECTS***

ZOHREH POURZOLFAGHAR

FK 2011 67

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DESIGN PHASE OF BUILDING PROJECTS**



By

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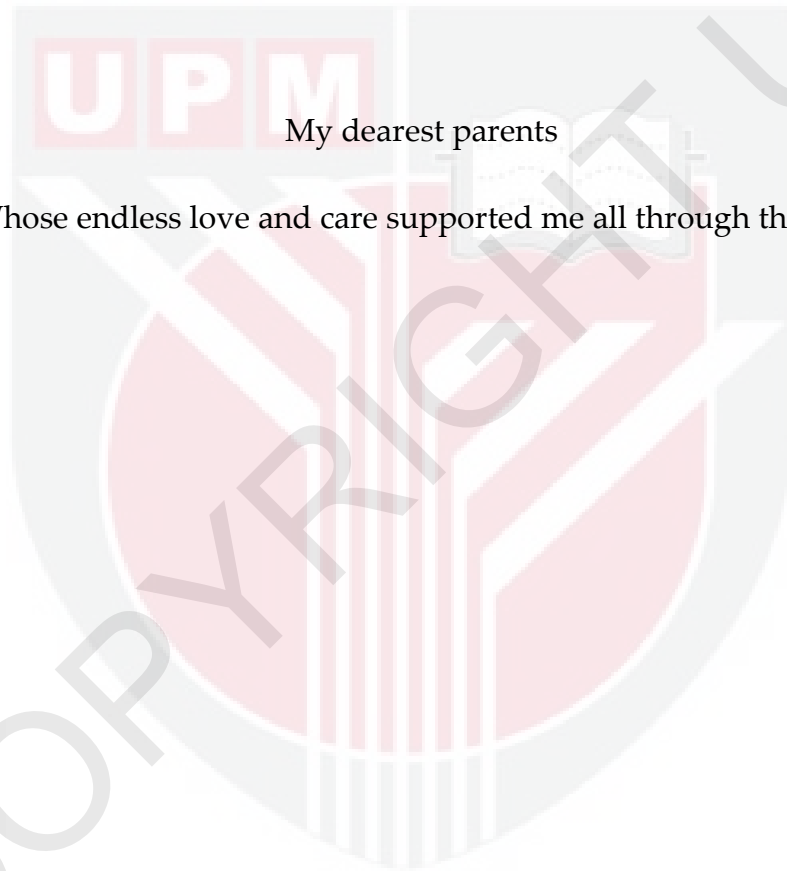
**Thesis Submitted to the School of Graduate Studies, Universiti Putra
Malaysia, in Fulfilment of the Requirements for the Degree of Doctor of
Philosophy**

March 2011

Dedicated to

My dearest parents

Whose endless love and care supported me all through the way



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Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Doctor of Philosophy

IMPROVING KNOWLEDGE CAPTURE DURING CONCEPTUAL DESIGN PHASE OF BUILDING PROJECTS

By

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March 2011

Chairman: Associate Professor Rahinah Ibrahim, PhD

Faculty: Engineering

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 yang dikemukakan kepada Senat Universiti Putra Malaysia

Sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

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

Oleh

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Aliran ilmu yang tidak efisien 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. Justeru, kajian ini memfokus kepada permasalahan aliran ilmu yang kurang efisien 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

bentuk konsep; dan 3) membangunkan sebuah kerangka bagi mengformalisasikan ilmu mekanikal/elektrikal yang *tacit* semasa fasa reka bentuk konsep. Pertamanya, memilih teknik yang bersesuaian bagi memperoleh ilmu melalui kajian perbandingan teknik pemerolehan ilmu sedia ada yang berpadanan dengan ciri-ciri reka bentuk konsep. Keduanya, mendapatkan ilmu mekanikal/elektrikal melalui kajian kes sebuah projek bangunan hijau semasa reka bentuk konsepnya. Ilmu dan aktiviti-aktiviti mekanikal/elektrikal dan aktiviti akan dipadankan dengan Kerangka McMillan (2001) untuk fasa reka bentuk konsep. Setelah itu ilmu mekanikal/elektrikal dipadankan dan ditugaskan kepada aktiviti reka bentuk konsep seni bina. Di akhir langkah ini, kajian membangunkan sebuah kerangka berasaskan ilmu mekanikal/elektrikal untuk fasa reka bentuk konsep. Kesahan hasil kajian didapati dengan menggunakan simulasi *computational organizational theory*. Kajian ini menyumbang di dalam memanjangkan Kerangka McMillan untuk melibatkan keperluan asas ilmu mekanikal/elektrikal yang eksplisit semasa fasa reka bentuk konsep; membangunkan sebuah teknik pemerolehan ilmu yang menggabungkan pemerhatian *tacit* dan *explicit repertory grid documentation*; dan menambah baik multidimensional model (MDM) oleh Nissen (2006) dengan mengintegrasikan ilmu ke dalam aktiviti-aktiviti reka bentuk konsep Kerangka MacMillan. Dapatan dari kajian ini menyokong keperluan untuk mengurangkan potensi kehilangan ilmu di dalam bidang yang *tacit-dominant* di kalangan pakar semasa fasa reka bentuk konsep projek binaan.

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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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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

	Page
ABSTRACT	iii
ABSTRAK	v
ACKNOWLEDGEMENTS	vii
APPROVAL	viii
DECLARATION	x
LIST OF TABLES	xiv
LIST OF FIGURES	xvi
CHAPTER	1
1	INTRODUCTION
	1
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
	21
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	Point of Departure for Knowledge 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
	Summary of Findings from Literature	200
	6.3.1 Review	201
	6.3.2 Findings from Observation	201
6.4	Knowledge-based Macmillan (2001) Framework for Conceptual Design Phasel	202
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