UNIVERSITI TEKNOLOGI MARA

RESILIENT TELECOMMUNICATION NETWORK DESIGN KNOWLEDGE

MOHD IDHAMM BIN IBRAHIM

IT Project submitted in partial fulfillment
of the requirements for the degree of
Master of Science in Information Technology

Faculty of Computer and Mathematical Sciences

July 2016

ABSTRACT

Telecommunication industry has growing fast recently. Telecommunication network become important for communication not only for business but also for the many life-style and some critical communication services such as government defense, banking sectors and transportation control. Ensuring the communication network to stay up all the time is not an easy task to the network designers. In telecommunication industry, employee attrition is very high and unmanageable where demand of network designer is very high from others organizations and competitors. Every year, organization experiencing staff retirement, transferred and resignation which they take away the valuable network design knowledge with them. Network design knowledge is an abstract and scattered around the organization and individual designers due to network design is a project based task and the requirement from customer with another customer is different makes the knowledge captured are often kept in silos. This research has discovers three types of knowledge which is Telecommunication Network Resilient Definitions, Resilient Network Design Knowledge and Resilient Network Design Process Knowledge. In the end of findings, author proposed a process model in designing resilient telecommunication network and a guideline for future reference. The knowledge captured through expert's interview, documents analysis and observation where author directly involved in designing resilient telecommunication network. Therefore, in the taxonomy development, the concept and relationship are derived from customer requirements and the technologies used to fulfill the customer needs. Taxonomy approach was utilized to classify the telecommunication technologies and group for easy understanding. The significance of the research is about exploring the telecommunication network design processes and modelled the processes into structured ways for future reference. Organization can use this resilient telecommunication network design process model as guidance to inexperience and young designers to design the network and propose the best solution to the customers. The findings discovered in the network design activities, intensified knowledge happened in the interpreting customer requirements phase. During this phase, lots of tacit and explicit knowledge created and embedded in the solutions to the customer requirements.

ACKNOWLEDGEMENT

Praise be to Allah SWTMost Gracious, Most Beneficent

First and foremost, praise to Allah for giving me courage, strength, good health and determination to complete this thesis. Without His blessing and permission, this thesis could not have been completed.

I would like to express my deepest appreciation to all those who provided me the possibility to complete this report. A special gratitude I give to my supervisor Associate Prof Dr. Haryani bt Haron, whose contribution in stimulating suggestions and encouragement, helped me to coordinate my project and ideas given in order to completed this report.

Nevertheless, I would like to express my special gratitude and thanks to my parents , my lovely wife '.

and my "heroes" for their love and support.

Last but not least, many thanks go all my colleagues and close friends whose have willingly helped me out with their abilities.

Thank you, may ALLAH bless all of you.

TABLE OF CONTENTS

AUTHOR'S DECLARATION i

ABSTRACT ii

ACKNOWLEDGEMENT iii

TABLE OF CONTENTS **iv**

LIST OF TABLES vii

LIST OF FIGURES viii

CHAPTER ONE: LITERATURE REVIEW **1**

1.1 Research Background 1

1.2 Problem Statement 2

1.3 Research Question 2

1.4 Research Objective 3

1.5 Research Scope 3

1.6 Significant of Research 3

1.7 Organization of Research 4

CHAPTER TWO: **LITERATURE REVIEW** **6**

2.1 Introduction 6

2.2 Telecommunication Network 6

2.3 Telecommunication Network Evolutions 8

2.4 Telecommunication Industry 9

2.5 Fixed / Wired Network 10

2.6 Mobile / Celular Network 11

2.7 Previous Study On Resilient Telecommunication Network 13

2.8 Knowledge Management and Taxonomy Approach 15

2.9 Resilient Issues In Telecommunication Network 17

2.9.1 Cyber Fraud 17

2.9.2 Disaster Threat 19

2.9.3 Terrorism Threat 20
2.9.4 Vandalism and Cable Theft 21
2.10 Summary 22

CHAPTER THREE: RESEARCH METHODOLOGY 23
3.1 Introduction 23
3.2 Research Approach 23
3.2.1 Qualitative Study 23
3.2.2 Case Study 24
3.3 Data Collection 24
3.4 Research Design 25
3.5 Summary 30

CHAPTER FOUR: NETWORK DESIGN KNOWLEDGE 31
4.1 Introduction 31
4.2 Data Collection 31
4.2.1 Respondents 31
4.2.2 Document Analysis 33
4.2.3 Observations 34
4.3 Knowledge Network Design 34
4.3.1 Knowledgeof Resilient Telecommunication Network Definition 35
4.3.2 Knowledge of Resilient Telecommunication Network Design Approach 37
4.3.3 Knowledgeof Resilient Telecommunication Network Design Phases 39
4.4 Resilient Telecommunication Network Design Processes 40
4.4.1 Phase 1 - Analysis Requirement 41
4.4.1.1 Identifying Network Objectives 41
4.4.1.2 Identifying Network Technical 42
4.4.2 Phase 2 - Develop Conceptual Design 42
4.4.2.1 Design Topology 43
4.4.2.2 Technology and Network Equipment Selection 44
4.4.2.3 Capacity and Bandwidth Planning 46