



Faculty of Information and Communication Technology

**PPRT SELECTION TECHNIQUE USING
ANALYTICAL HIERARCHY PROCESS**

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Masters of Computer Science (Software Engineering and Intelligence)

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ANALYTICAL HIERARCHY PROCESS**

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**A project submitted
in fulfillment of the requirements for the degree of Master of Computer Science
(Software Engineering and Intelligence)**


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DECLARATION

I declare that this project entitle “PPRT Selection Technique Using Analytical Hierarchy Process” is the result of my own research except as cited in the references. The project has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature : 

Name : MOHD SHARIF BIN MOHAMAD

Date : 25 JUNE 2010

DEDICATION

To Allah

I devoted my life and death to You, Allah. May my life is within Your guidance.

To My Parent

Mohamad bin Jantan & Saharah bte Madi

Thank you for your sacrifice and love. No such compensate except from Allah.

To My Beloved Nur Hasanah

Your support, patience, and encouragement give me strength throughout the whole course. May Allah bless us.

To my Parents in Law

Ali bin Ahmad & Latifah bte Idris

Thank you for your support, advice and motivation

To Lecturers and Teachers

Thank you for all the knowledge. May your knowledge are beneficial and useful for all humanity.

To my Son

Luqman Hakim

I will pay back the time I did not spend with you

ACKNOWLEDGEMENT

In the Name of Allah, Most Gracious, Most Merciful,

First and foremost, all praise to Allah, Subhanahu-wa-Ta'ala, the Almighty, Who gave me an opportunity, courage and patience to carry out this work. I feel privileged to glory His name in the sincerest way through this small accomplishment. I seek His mercy, favour and forgiveness.

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Mohd Sharif bin Mohamad, May 2010.

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LIST OF ABBREVIATIONS AND GLOSSARY

AHP	<i>Analytic Hierarchy Process</i> , a method which can allow the decision makers to model a complex problem in a hierarchical structure showing the relationship of the goal, criteria, sub criteria and alternatives.
PPRT	<i>Program Perumahan Rakyat Termiskin</i> , a program which is conducted by the state government purposely to aid the poor people with more comfortable living house
MCDM	Multi Criteria Decision Making
Eigenvalue	A special set of scalars associated with a linear system of equations that are sometimes also known as characteristic roots, characteristic values
FAHP	Fuzzy Analytical Hierarchy Process
EXCO	Executive Council of Melaka
JAPERUN	Jawatankuasa Penyelaras Dewan Undangan Negeri
UPPD	Unit Pembela dan Pembangunan Desa
Penghulu	Government servant who is in charged to take care of one state assembly area

ABSTRACT

When making a selection for numbers of application which is done manually without any help from any systematic technique, it may raise an issue of accuracy, precise and biasness. In the PPRT application, the selection and evaluation are done manually. In this project, a technique based on Analytical Hierarchy Technique (AHP) is designed and developed in order to make an evaluation and selection of PPRT application. The aim is to ensure the selection process is more precise, accurate and can avoid any biasness issue. This technique is studied and designed based on the poverty assessment technique from district offices in Melaka, Malaysia. A hierarchical indexes are designed based on the criteria that been used in the official form of PPRT application. A number of 23 samples of data which had been endorsed by Exco of Melaka state are used to test this technique. Furthermore the comparison of those two method are given in this paper. All the calculations of this technique are done in a software called Expert Choice version 11.5 to get the result of grading for all the samples. The result of this technique shows that there are three (3) samples that are not qualify. The developed technique also satisfies in term of ease of accuracy and preciseness but need a further study due to some limitation as explained in the recommendation of this paper.

ABSTRAK

Apabila membuat pemilihan secara manual bagi sejumlah permohonan yang banyak tanpa bantuan dari sebuah teknik yang sistematik, ia mungkin akan mewujudkan isu-isu dari segi ketepatan, ketelitian, prasangka. Dalam projek ini, suatu teknik yang mengaplikasikan Analytical Hierarchy Process (AHP) direka dan dibina untuk membuat penilaian dan pemilihan permohonan Program Perumahan Rakyat Termiskin (PPRT). Tujuannya adalah untuk memastikan proses pemilihan adalah lebih tepat, teliti dan boleh mengelakkan isu-isu prasangka. Teknik ini dikaji dan direka berdasarkan kepada teknik penilaian kemiskinan dari pejabat-pejabat daerah di negeri Melaka, Malaysia. Indeks hierarki direka berdasarkan kepada kriteria-kriteria yang digunakan di dalam borang permohonan rasmi PPRT. Sebanyak 23 sampel data yang telah diperakukan kelulusannya oleh Majlis Mesyuarat Kerajaan Negeri (MMKN) Melaka digunakan untuk menguji teknik ini. Perbandingan dua kaedah tersebut dinyatakan dalam laporan ini. Semua perkiraan bagi teknik ini telah dibuat menggunakan perisian Expert Choice versi 11.5 untuk mendapatkan keputusan pemarkahan bagi semua sampel tersebut. Hasil daripada teknik ini menunjukkan terdapat tiga (3) sampel data yang tidak layak. Teknik yang dibangunkan juga memenuhi jangkaan untuk mendapatkan ketepatan dan

ketelitian tetapi memerlukan kajian yang selanjutnya seperti yang diterangkan di dalam laporan ini.

CHAPTER 1

INTRODUCTION

1.1 Introduction

In the state of Melaka administration, the worthiness of the poor citizens is one of the important tasks that need to be accomplished by the government. In becoming a developed state which will be declared by 20 October 2010, the decrement of poverty is the objective of the state government to achieve one of the developed state indicators.

To help the poor citizens, state government has allocated some fund to help those people by building a new house for them. This program is called Program Perumahan Rakyat Termiskin (PPRT). In this program, the qualified person will be given RM 17,000 to build a new house and maximum of RM 8,000 if the house needs just to be repaired depends on the damages. These amounts are fixed and the designs of the new house are standard.

Currently, this program is conducted and supervised by Land and District Office, Jawatankuasa Penyelarasan Dewan Undangan Negeri (JAPERUN), and Unit Pembela dan Pembangunan Desa (UPPD), Chief Minister Department. The application will go through JAPERUN in each assembly area, Land District Office for each district and finally after investigation by the Penghulu the application will be sent to the UPPD

to synchronize all the applications and prepare for a paper and bring into EXCO meeting every week. The investigation process is done manually without any proper guidelines or system that can help them to do this efficiently. This will probably cause bias and misjudged.

In this particular project, it focuses on developing a proper technique to select those applicants who are really qualified based on several main criteria that were extracted from the official PPRT application form. It is developed by using the Analytical Hierarchy Process (AHP). It is a technique which was applied to evaluate the status of poverty in China (Enzhao and Yang, 2008) is being implemented into this project. An established software namely Expert Choice version 11.5 is used to calculate the weight each of the samples to determine their qualification status.

1.2 Problem Statement

When the process is done manually and by human, the chance of getting inaccurate answer and decision with biasness is likely to be high. The criteria used to evaluate the qualified applicants are not clear and can be easily being manipulated. For example for such problem is when there are three applications and each application is being investigated by the same person (i.e. staff from Unit Pembangunan Desa [UPD] or Penghulu). Furthermore the allocation for the applicants is limited. In consequence, probably there are there are two applicants have the same marks of evaluation.

The officer may use his/her instinct or assumption to choose which applicant is qualified for the endorsement. When assumption is being used in making a decision, it

could be influenced by biasness. For example, the office may choose the applicant B due to his wage is around RM 400 with one child, instead of applicant C who wage is RM 550 but with three children.

Wife decisions and effective implementations are able to boost the abilities of an administrative system. The open decision information is one of the attributes of a good governance. Therefore, in an open and transparent decision-making process, the qualitative management should strive to reduce uncertainties with system analysis so as to better the effectiveness and quality of administrative decisions. Thus, to take the selection and decision making process is more persistent as well as accurate, a technique which applying an artificial intelligence technique should be designed and implemented.

This system shall adapting the Analytical Hierarchy Technique (AHP) technique since the selection of the PPRT applicants involve multiple criteria that is been discussed later in this project. There is lot of answers for each of the criteria that being evaluated which can cause mass ambiguity. This system is purposely being studied and developed to help the decision making process, in this case it is the selection of PPRT applications more accurate and transparent reducing the biasness and misjudgment.

1.3 Objectives

In this project, there are three objectives set to be achieved; that are:

1. To examine the current method of PPRT application selection process which is currently done manually without any proper systematic technique

2. To design and develop the PPRT selection technique by using Analytical Hierarchy Technique (AHP)
3. To implement a PPRT selection technique which can be used to choose the qualified applicants more accurate and precise based on the several multiple criteria.

1.4 The Proposed Project Framework

In this report, there will be several methods used to complete the whole study. As illustrated in Figure 1.1, beginning from identifying the real problems of current technique of PPRT selection which is currently done manually, it will then move to identify the objectives of the project. These objectives then will be used as the target to complete this project. To study the technique that is going to be used to overcome the problems, literature review is done to study the techniques that can suit the solution for the problems. The literature is done by referring to the resources from conference proceedings, articles and others.

The next stage is to analyze the current technique of PPRT selection which is been used by the officer to select PPRT application. This is done by studying the flow of the PPRT endorsement from the beginning of application until the end of endorsement by the state government. AHP will be then used to calculate the weight for selecting the qualified PPRT applications by using several AHP steps after the indexes of criteria have been identified based on the official application form. Next in the implementation stage, this technique will be implemented for 23 samples data of the

endorsed PPRT application by state government before the result is analyzed and discussed.

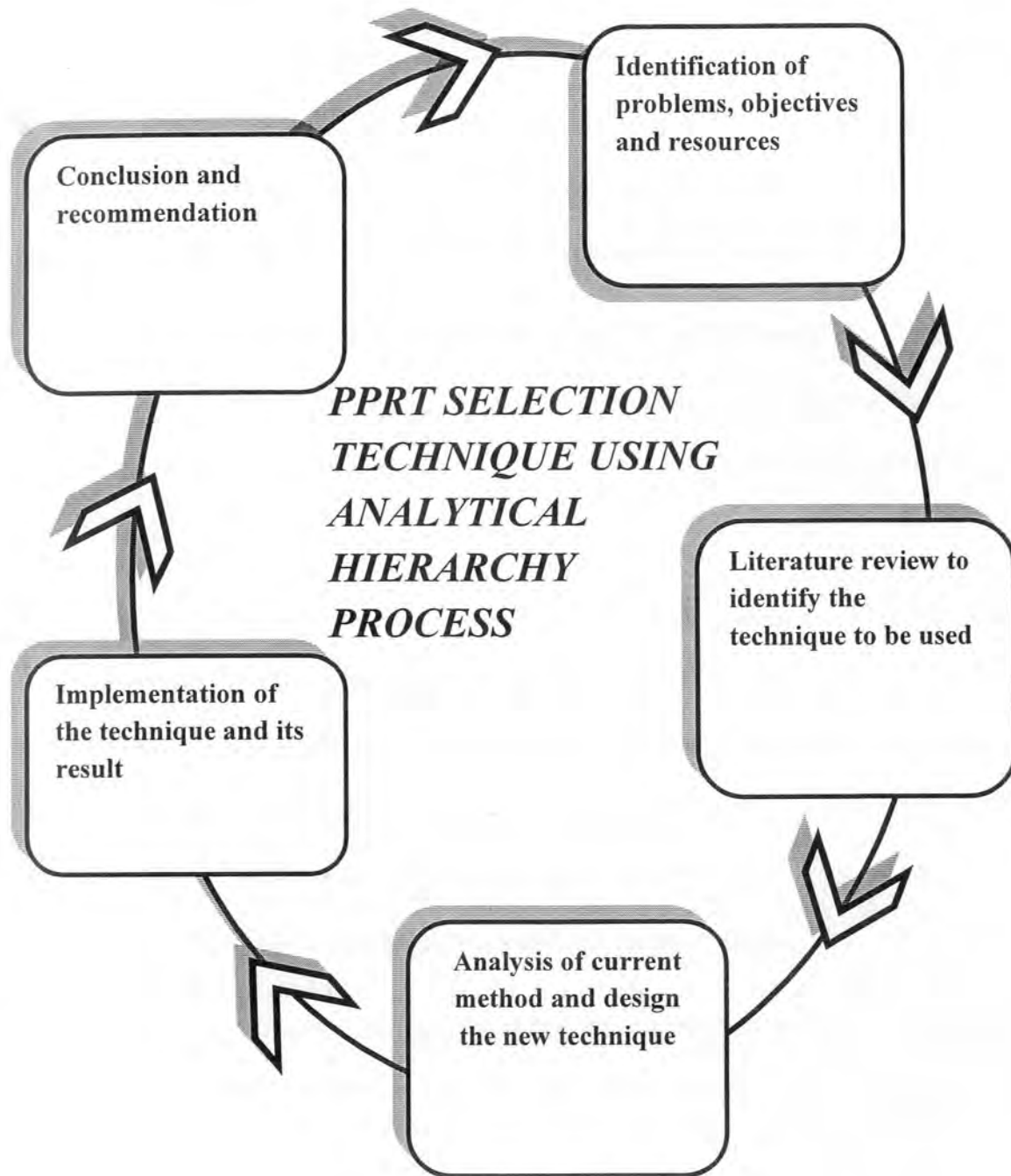


Figure 1.1: Proposed Framework of Project

1.5 Report Organization

This report is divided into six (6) chapters. Chapter 1 is an introduction and overview of the conducted project. This chapter will introduce the Program Perumahan Rakyat Termiskin (PPRT) brief overview and the issues in selecting the applications. Problem statements, project objectives, and report framework also will be discussed.

Chapter 2 consists of literature review related to artificial intelligent techniques such as Analytical Hierarchy Process (AHP), Fuzzy Logic, and Decision Tree. The comparison in term of advantages and disadvantages of those three techniques will also be discussed.

Chapter 3 discusses the analysis done to the current method of PPRT selection that being implemented by Penghulu or the District Office. Also discussed in this chapter is the analysis on the sample data which have been collected from Unit Pembela dan Pembangunan Desa (UPPD) as the case study. Then, the proposed technique of selecting PPRT application will be explained and the methodology is shown in details including the distribution of weight of every criterion of the indexes.

Chapter 4 discusses the implementation of the AHP technique by using the samples data and the comparison between the initial methodology and the proposed AHP technique.

Chapter 5 focuses on the result after implementation of AHP technique onto the PPRT selection and its analysis as well.

Chapter 6 focuses on the discussion about the conclusions of the project outcomes and recommendations according to the stated objectives. This chapter ends with the discussion of the final conclusions and recommendations.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter identifies the purpose and structure of the literature review that supports this project effort. The purpose of the literature review is to identify and synthesize appropriate references to demonstrate and illustrate the presence of knowledge gaps to be addressed by this project. These references include journal articles, conference papers, published reports, and other readily available sources of information, such as selected *World Wide Web* pages from the Internet. This literature review will cover Analytical Hierarchy Process (AHP), Fuzzy Logic, and Decision Tree, comparison among those three Artificial Intelligence techniques and a summary.

2.2 Analytical Hierarchy Process (AHP)

Decision making tool aims to realize conflicts that occur due to various different opinions and subjective assessments by decision makers. Unlike simple decision making problem (where it involves one criteria most of the time), in real world, we are considering more than one criterion and alternative as well. With this consideration, our

decision making tool is based on one of the multi criteria decision making (MCDM) in Turban (1991); namely Analytical Hierarchy Process (AHP). AHP is able to handle these typical scenarios.

With this tool, it helps us make better decisions and improve the decision making process. However, AHP face a weakness in capturing the vague, uncertainty and imprecise judgment by different users. This may caused by level of experiences, lacking of experimental data and other undecided factors. Therefore, a variation of AHP named Fuzzy AHP comes into implementation. It is being explored to overcome the compensatory approach and the inability of the AHP in handling proper linguistic variables.

Inherently, fuzzy set theory has proven advantages within vague, imprecise and uncertain contexts. One basic application of fuzzy set theory is fuzzy synthetic evaluation (FSE), which is a decision-making approach within a fuzzy environment (Yang, 2003). At the same time, AHP can give a comprehensive and consistent analysis on the weights of all factors; therefore, many works on the integration of FSE and AHP have been performed to obtain the benefits from both. In Bojadziev (1997), some researchers use a membership function to describe how the alternatives satisfy the criteria (factors) and then use an AHP to make the decision. Some works use the AHP to get the weights of the factor only, fuzzify the weights, and then use fuzzy synthesis evaluation (FSE) or ranking as the decision-making strategy. Van Laarhoven and Pedrycz (1983) employed triangular fuzzy to represent a pair wise comparison ratio in AHP instead of exact numbers and a new decision-making methodology called fuzzy AHP came to exist .

According to (Lee, Mak, and Wen, 2008), inability of traditional AHP to deal with the imprecision and subjectiveness in the pair wise comparison process have been improved in Fuzzy AHP. Instead of single crisp value, Fuzzy AHP used a range of value to incorporate decision maker's uncertainty. From this range, decision maker can select the value that reflects his confidence and also he can specify his attitude like optimistic, pessimistic or moderate (Jeganathan, 2003). Optimistic attitude is represented by the highest value of range, moderate attitude is represented by the middle value of the range and pessimistic attitude is represented by the lowest value of the range.

In the fuzzy set terminology, the ratio supplied by the decision maker is a fuzzy number described by a membership function. Here, a membership function describes the degree with which elements in the judgment interval belong to the preference set. In norm, triangular fuzzy number is used to represent the decision maker's assessment on alternatives with respect to each criterion. The concept of fuzzy extent analysis is applied to solve the fuzzy reciprocal matrix for determining the criteria importance and alternative performance. In Prakash (2003), the alpha-cut analysis is used to transform the fuzzy performance matrix representing the overall performance of all alternatives with respect to each criterion into an interval performance matrix, to avoid the complex and unreliable process of comparing fuzzy utilities.

Fuzzy Analytical Hierarchy Process (AHP) evaluates the weightings of all indexes in the valuation system scientifically and objectively, avoids determining the weightings at will, and considers the faintness of mankind's judgment (Xing and Zhang, 2008). It is a kind of quantitative method with strong operability. And triangular fuzzy