FUZZY EXPERT SYSTEM PACKAGE FOR THE ASSESSMENT OF MARINE TECHNOLOGY TRAINING PROGRAMS

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To my Father and Mother, Sisters, my Dear Wife and Daughters, whose prayers always afforded me the power to accomplish this work. To all I dedicate this work with great respect and love.

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ABSTRACT

There are many education and training packages in marine technologies around Malaysia. According to usual practice, it takes about four months for each training package to be assessed. So if it is not up to the minimum requirement, it is difficult for the provider or the students to make changes in the middle of the course. In this study, a fuzzy expert system was designed to provide an alternative way to assess a marine technology training program. This method incorporated fuzzy method with expert system and multi-criteria decision making technique. The entire process was programmed using FORTRAN and Microsoft Excel. Three marine programs from three different education providers were tested. Set of data inserted and the outcomes were analyzed. The results showed that the fuzzy expert system developed is reliable, user friendly and flexible.

ABSTRAK

Terdapat banyak pakej – pakej pembelajaran dan latihan di dalam teknologi marin di dalam Negara sekarang. Di dalam scenario sekarang penilaian sesuatu program mengambil masa lebih kurang empat bulan. Jika program tersebut tidak memenuhi keperluan minima, ia amat menyukarkan bagi melakukan sebarang perubahan di tengah – tengah kursus yang sedang berjalan. Kajian ini mengenengahkan pengunaan sistem kepakaran fuzzysebagai jalan alternatif untuk menilai sesuatu program latihan teknologi marin. Cara ini menggabungkan teknik fuzzy bersama sistem pakar serta kaedah anggaran membuat keputusan pelbagai kriteria. Keseluruhan proses diprogramkan dengan menggunakan perisian komputer FORTRAN dan Microsoft Excel. Tiga program marin daripada tiga pusat pembelajaran telah diuji. Set data telan dimasukkan dan keputusan telah di analisa. Keputusan dari ujian yang dijalankan menunjukkan system kepakaran fuzzy yang telah dibangunkan adalah lebih pantas, mesra pengguna dan fleksibel.

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Abbreviation

MTTP	-	Marine Technology Training Package
IHL	-	Institute of Higher Learning
HEP	-	Higher Education Provider
MQA	-	Malaysian Qualification Agency
MCDM	-	Multi Criteria Decision Making
LAN	-	Lembaga Akreditasi Negara
EAC	-	Engineering Accreditation Council
BEM		Board of Engineers Malaysia
IPT		Institut Pengajian Tinggi

CHAPTER 1

INTRODUCTION

1.1 Research Objective

The objective of this research is to develop a fuzzy expert system package for the assessment of marine technology training programs.

1.2 Research Background

There are various education and training packages in Marine Technology on offer around the country. Each package has been designed to meet a certain demand criteria and hence they tend to change. There are many occasions where these packages need to be assessed and compared. These include those made by the package provider themselves, by bodies accrediting the packages as well as by their clients. A fuzzy expert system package that could assist in assessing and comparing these packages will offer many benefits to those interested. This expert system will help the user to assess their training programs. Comparing to current method of auditing, using this research outcome, the duration of assessment will be shorten. This will helps provider to do correction and adjustment before it commences.

The main purpose of this research is to develop an expert system package for the assessment of marine technology training programs. The main reason for developing an alternative system is to facilitate the assessment of a training program using fuzzy expert system is that it flexible, user friendly and produce faster results. Nowadays higher education providers use Malaysian Qualifications Agency to standardize their programs. With the committees assign by this agency, they will standardize the criteria through auditing. The auditing applied by this committee is done through the internal auditing by the provider and the actual auditing by the committee through site auditing. The results of this audit will come out as a report. Any changes, development and adjustment of the programs are noted and actions are taken. If all the criteria are fulfilled, accreditation will be given to the provider. It shows that this program is up to the standard and reliable to proceed. The problem arise here is that this process take about four months to commence and need another three month to come out with the report and the accreditation. Therefore if any changes need to be done, it will be done in the middle of current course which is very difficult and will prevent the smoothness of the programs.

To overcome this problem, we will used fuzzy multi criteria decision making (MCDM) method as a tool to help the HEP determine and assess whether the programs they offered suitable or not to implement. The advantages of fuzzy MCDM expert system are can help users make a quick decision and with the availability of current technology (computer programming) it able to put the large amount of data and update it.

There are a lot of criteria to assess the marine technology training package (MTTP) and most of them use different units. With each element of MTTP using different unit such as number of teacher is integer and minimum duration of course use month as unit, fuzzy can help us to combine the data and produce results fast and flexible.

1.3 Current methods in used in assessing training package

Higher education providers use Malaysian Qualifications Agency (MQA) to standardize their programs. With the committees assign by this agency, they will standardize the criteria through auditing. The auditing applied by this committee is done through the internal auditing by the provider and the actual auditing by the committee through site auditing. The results of this audit will come out as a report. Any changes, development and adjustment of the programs will be noted and must take actions. If all the criteria are fulfilled, accreditation will be given to the provider. It shows that this program is up to the standard and reliable to proceed. The problem here is that these processes take about four months to commence and need another three month to come out with the report and the accreditation. So if any changes need to be done, it will be done in the middle of current course which is very difficult and will prevent the smoothness of the programs. This expert system will help tremendously in term of improving its duration of the results, flexibility and user friendliness.

1.4 Using fuzzy in assessing marine technology training program

In current situation, higher education provider (HEP) takes longer duration for evaluating its programs. To overcome this problem, an alternative way is to use fuzzy multi criteria decision making (MCDM) method as a tool to help the (HEP) determine and assess whether the programs they offered suitable or not to implement. The advantages of fuzzy MCDM are it can help users make a quick decision and the availability of current technology (computer programming) which can put the large amount of data and update it.

We can see there are a lot of criteria to assess the MTTP and most of them use different units. With each element of MTTP using different unit such as percentage of teacher compare to students is integer and duration of course use months as unit, fuzzy can help us to combine the data and produce a result

that easy to understand. With fuzzy, flexibility of data entry is easier to add up together and produce the result faster. Thus using this concept, fuzzy multi-criteria decision making is implemented.

1.5 Expert system and its function in this research

We can understand the use of expert system in this research by learning the concept of its operation. An expert system is a computer program but it is different from the conventional software in few ways (Liebowitz, 1995):

- It is highly interactive and hence that quality is part of its development process
- It provides greater uncertainty throughout the process of achieving the final solution.
- It does not represent the waterfall model of traditional software. Requirements (input) are vague rather than functional.

Expert system represents thought process of a human expert (Yen and Davis, 1999) by imitate the expert's behavior within a well-defined, narrow domain of knowledge (Liebowitz 1995). It incorporate knowledge, algorithms and heuristics (rule of thumb) rules. It is program that is able to explain the decision made. This characteristic is important to allow user to understand how the result is arrived at and thus the possibility of challenging the decision (Liebowitz, 1995).

The two main components of an expert system are its knowledge base and the inference engine. The knowledge base contains the logic upon which a specific decision arrived at by the human expert is based. It contains a series of IF-THEN statements (rules). Each rule state that if certain facts (conditions) are true, then we can derive another fact called a conclusion. The inference engine processes the facts and rules contained in the knowledge base to arrive at a conclusion.

For example, fuzzy expert systems allow the use of variables whose values are specified as linguistic terms (e.g. “high”, “medium high”, “low”, “very low”) as opposed to specific numerical values. This is particularly appropriate for handling the ill-defined parameters associated with the problem specification. Each linguistic term is defined as fuzzy set by means of a membership function. This enables the confidence with which a variable belongs to this set, expressed as a number in the range 0-1, to be determined.

1.6 Problem Statement

The process of assess a training program is not user friendly, difficult to be done and take a long time. End user such as parent, student and even provider themselves find it difficult to assess training program. Currently only MQA and EAC are given responsibility to evaluate training program. Therefore, the needs of an improve tools to make assessment easier. Thus, this fuzzy expert system has been created to solve this problem.

1.7 Scope of Research

This study only covers assessment and criteria for degree level. It will use FORTRAN and Microsoft Excel as tool to aid the process.

1.8 Organization of Thesis

This thesis has been divided into six chapters. It started with Chapter 1: Introduction. Here the main issues are addressed like the problem statement, objective of the research and the expected outcome of this thesis. Next chapter is the Literature Review. In this chapter the all topics which are important to the research will be reviewed. The third chapter, Research Methodology, covered all methods used and activities performed towards achieving the objective of the research. The fourth chapter, Results, showed and discussed

the results of the research. In Chapter Five, Discussion, the results gained from the research were discussed thoroughly. Finally the conclusion of this thesis is presented in chapter six. This last chapter concludes with a few propositions for future study.