UNIVERSITI TEKNOLOGI MARA

AN IMPROVED INTUITIONISTIC FUZZY DEMATEL FOR FLOOD MITIGATION MEASURES

NORZANAH BINTI ABD RAHMAN

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ABSTRACT

The uncertainty, complexity, and conflicting criteria and sub-criteria has escalated the difficulties in the decision making problem process. In spite of this challenges, the connection between criteria cannot be overlooked for the environmental-based problems. Thus, the application of the intuitionistic fuzzy Decision Making Trial and Evaluation Laboratory (IF-DEMATEL) in solving these type of problems was successfully demonstrated by the previous researchers. Besides, the ability to visualize the interrelationship between elements of the system in the diagraph as well as to rank them accordingly, are the main advantages of this method. However, this method has a weaknesses in dealing with the uncertainty aspects since it uses the number of domain experts in calculating the average direct relation matrix and it requires another Multi Criteria Decision Making (MCDM) method to rank the available alternatives. Moreover, this method has a weakness in determining the significant criteria and sub-criteria in decision making process. In response to this problem, IF-DEMATEL is improved in terms of calculating the average direct relation matrix using the importance weights of domain experts, prioritizing the alternatives using the weighted expected value as well as in determining the significant criteria and sub-criteria using Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis. Here, four main objectives are planned. First objective is to improve the IF-DEMATEL procedure by constructing the average direct relation matrix using importance weights of domain experts and ranking the decision alternatives using weighted expected values. Second objective is to determine the significant criteria and sub-criteria of flood mitigation measures using SWOT analysis. Third objective is to implement the improved IF-DEMATEL on the case study of flood mitigation measures. Fourth objective is to validate the improved IF-DEMATEL using sensitivity analysis (SA). The prioritization of the flood mitigation measures in Padas River Basin area was selected as a case study involving domain experts from Department of Irrigation and Drainage Malaysia, Civil Defence Force, and local authority. Based on the results, the wet flood proofing is selected as the most suitable measures to be implemented, followed by elevation, barriers, and drainage improvement. By using SA, the improved IF-DEMATEL shows that it is a consistent and robust method in prioritizing the available alternatives.

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CHAPTER ONE
INTRODUCTION

1.1 Introduction

This chapter will present the introduction for this study. The background and problem identification of the research will be discussed in Section 1.2. Based on the problem identified, the problem statement is presented in Section 1.3. This is followed by the objectives of the research in Section 1.4. Then, the discussion continues with the significance of the research in Section 1.5. In order to ensure the research is focused on the relevant area, the description of the research scope and limitations is presented in Section 1.6. Last but not least, the organization of the research will be provided at the end of this chapter.

1.2 Background and Problem Identification

Multi-criteria Decision Making (MCDM) is a popular technique to acquire better solution in choosing the best alternatives for complex problems in the presence of multiple, conflicting, incomparable units, or design of both objective and attribute (Hwang & Yoon, 1981). Lu, Zhang, Ruan, and Wu (2007) categorized MCDM problems into Multi-Objective Decision Making (MODM) and Multi-Attribute Decision Making (MADM). The difference between these two methods depends on the involvement of the objective and attribute. The problem that involves multiple and divergence objectives is denoted as MODM. Meanwhile, the problem that involves multiple and conflicting criteria or attributes is known as MADM.

In the last decades, MCDM has been developed significantly and received a great attention from the researchers around the globe. MCDM is used to solve various dimensions of real world problem such as in business, engineering, industry, technology, environment, education, banking, and health. However, due to its different strengths and restrictions, MCDM solves the problems differently, thus produce distinct decision in similar preference decision (Aruldoss, Lakshmi, & Venkatesan, 2013). For instance, Görener (2012) found that there are important differences between