UNIVERSITI TEKNOLOGI MARA

A Z-NUMBER EXTENSION OF AN INTEGRATED ANALYTIC HIERARCHY PROCESS – FUZZY DATA ENVELOPMENT ANALYSIS FOR RISK ASSESSMENT

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AUTHOR'S DECLARATION

I declare that the work in this dissertation was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledged as referenced work. This dissertation has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

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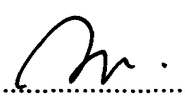
Signature of Student	:	
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ABSTRACT

Multiple Criteria Decision Making (MCDM) problems always involve uncertainty and vague values since human judgments are highly subjective. Fuzzy concept has been applied extensively in MCDM to cater for the vagueness involved. However, the reliability of information given by fuzzy numbers is questionable. Hence, Z-number was introduced to enhance the reliability of fuzzy numbers. Usage of Z-number is very limited due to its newly introduced concept. Thus, the effect of $\tilde{R}$ (reliability component) on solving MCDM problems has not been thoroughly explored and clearly explained. This is due to several available techniques on how $\tilde{R}$ (reliability component) could be integrated into $\tilde{A}$ (restriction component). The main objective of this study is to analyze the impact of introducing the concept of reliability of Z-number into a hybrid Analytic Hierarchy Process-Fuzzy Data Envelopment Analysis (AHP-FDEA) for risk assessment purposes. The Z-number extension to MCDM problem has been implemented to rank the risk priority of bridge structures. The criteria weights for decision criteria were determined using AHP. Next, two different types of multiplication relation operations were used to integrate $\tilde{R}$ into $\tilde{A}$ to deal with the linguistic decision making problems. Finally, a Z-number AHP-FDEA model is developed and used to rank the priority risk of the bridge structures. A numerical example has been explored to illustrate the applications of the proposed Analytic Hierarchy Process-Z-Number Data Envelopment Analysis (AHP-ZDEA) methodology in MCDM. Analysis on the feasibility of using AHP-ZDEA methodology was investigated and presented on comparisons between AHP-FDEA and AHP-ZDEA. Both FDEA and ZDEA are found to be suitable to be used in calculating risk priority of bridge structures. However, using ZDEA ensures the uncertainty of the data used is captured in the process of ranking. On top of overall ranking in MCDM, the proposed Z-number methods could also differentiate the risk priority ranking of each criteria used. This information is crucial in studying the characteristics of each decision alternatives with respect to each criterion. In other words, the strength and weaknesses of each decision alternatives could be identified. The discussion on the impact of Z-number in MCDM in particular risk assessment contributes to broaden the scope of Z-number related to solving MCDM problem. Furthermore, limitations and strength of Z-number when applied to solving MCDM problem can be identified in particular the differences in multiplication relation operations used to integrate $\tilde{R}$ into $\tilde{A}$. Thus, suitable steps to overcome limitations of Z-number in MCDM problem can be further explored.

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