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Multiple Attribute Decision Making using Simple Additive Weighting

N.Thinaharan[1], Dr.V.Thiagarasu[2]
Research Scholar, Manonmaniam Sundaranar University, Thirunelveli.[1]
Associate Professor of Computer Science, Gobi Arts & Science College, Gobichettipalayam.[2]

Abstract
This paper deals with the supplier selection problem based on SAW algorithm (Simple Additive Weighting) which is a multiple attributedecision making (MADM) approach with entropy method which gives the weights to indicators.The SAW algorithm deals with the conflicts between indicators based on certain way to sort thescheme and choose the best scheme. Decision-making support systems (DMSS) are computer based information systems designed to support some or all phases of the decision-making process.Decision-making support systems utilize creative, behavioral, and analytic foundations that drawon various disciplines. DMSS evolution has presented unique challenges and opportunities forinformation system professionals. These foundations give rise to various architectures that deliversupport to individual and group DMSS users.

1.Introduction

The architectures have been applied to variouspublic and private problems and opportunities, including the planning of large-scale housingdemand, strategic planning, urban transportation policy formulation, health care management,pharmaceutical decision making, banking management, entertainment industry management, andmilitary situations. Applications draw on advanced information technologies (IT), such asintelligent agents, knowledge-based and knowledge-managementprocedures, synthetic characters,and spatial decision support systems, among others. Mostsuggestions involve much more user involvement and a larger role for non-traditional specialistsduring the technical design, development, and implementation tasks. The expert opinion indicatesthat DMSS have been recognized as unique information systems. The SAW algorithm deals with the conflicts between indicators
based on certain way to sort the scheme and choose the best scheme. Some values of the multiattribute decision models are often subjective. The weights of the criteria and the scoring valuesof the alternatives against the subjective (judgmental) criteria contain always some uncertainties.It is therefore an important question how the final ranking or the ranking values of thealternatives is sensitive to the changes of some input parameters of the decision model. Thesimplest case is when the value of the weight of a single criterion is allowed to vary.In multiple attribute decision making (MADM) problem, a decision maker (DM) has to choosethe best alternative that satisfies the evaluation criteria among a set of candidate solutions. It isgenerally hard to find an alternative that meets all the criteria simultaneously, so a better solutionis preferred.

2.Application

Aproperly-designed DSS can play an important role in compiling useful

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information from raw data,documents, personal knowledge, and business models to solve problems. It allows decisionmakers to perform large numbers of computations very quickly. Therefore advanced models canbe supported by DSS to solve complex decision problems. As many business decision problemsinvolve large data sets stored in different databases, data warehouses, and even possibly atwebsites outside an organization, DSS can retrieve process and utilize data efficiently to assistdecision making. Decision makers' capabilities are extended through using DSS, particularly in ill-structured decision situations. In this case, a satisfied solution, instead of the optimal one, maybe the goal of decision making. Solving ill-structured problems often relies on repeatedinteractions between the decision maker and the DSS. Decision support systems are built uponvarious decision support techniques, including models, methods, algorithms and tools. [4] discussed about a method, Wireless sensor networks utilize large numbers of wireless sensor nodes to collect information from their sensing terrain. Wireless sensor nodes are battery-powered devices. Energy saving is always crucial to the lifetime of a wireless sensor network. Recently, many algorithms are proposed to tackle the energy saving problem in wireless sensor networks. There are strong needs to develop wireless sensor networks algorithms with optimization priorities biased to aspects besides energy saving. In this project, a delay-aware data collection network structure for wireless sensor networks is proposed based on Multi hop Cluster Network. The objective of the proposed network structure is to determine delays in the data collection processes. The path with minimized delay through which the data can be transmitted from source to destination is also determined. AODV protocol is used to route the data packets from the source to destination.

Acognition-based taxonomy for decision support techniques, including six basic classes as follows:

- Process models
- Choice models
- Information control techniques
- Analysis and reasoning techniques Representation aids
- Human judgment amplifying/refining techniques.

The Multicriteriadecision making and Multi-attribute decision making comes under the category of Choicemodels.

Some of the common Multi-Attribute Decision-Making (MADM) techniques are:

- ✓ Simple Additive Weighted (SAW)
- ✓ Weighted Product Method (WPM)
- ✓ Cooperative Game Theory (CGT)
- ✓ Technique for Order Preference by Similarity to Ideal Solution (TOPSIS)
- ✓ Elimination et Choice Translating Reality with complementary
- ✓ analysis(ELECTRE)
- ✓ Preference Ranking Organization Method for Enrichment Evaluation (PROMETHEE)
- ✓ Analytical Hierarchy Process (AHP)

3.SAW Method

Decision-making problem is the process of finding the best option from all of the feasible alternatives. In almost all such problems, the multiplicity of criteria for judging the alternatives ispervasive.

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Supplier Selection Problem with the Application of SAW Method & Sensitivity Analysis

SCM emphasizes on the strategic cooperative relationship between core enterprise and enterprise alliance. SCM includes managing supply and demand, sourcing raw materials andparts, manufacturing and assembly, warehousing and inventory tracking, order entry and ordermanagement, distribution across all channels, and delivery to the customer. Under theenvironment of globalization market competition and cooperation, SCM is an effective model of enterprise operation and management.In order to reduce the cost and risk of SCM, enterprises should makesound decisions on supplier selection and share benefits with them. Supplier management should include supplier's credit and reputation, product price, quality, delivery date etc. Supplier, as theobject of enterprise purchasing activities, directly determines the quality of the raw materials andparts purchased by the core enterprise, and the supplier greatly influences the competitivecompetence of the product produced by the core enterprise. Therefore, a good decision-makingmethod of supplier selection is quite necessary.Furthermore, a good decision-making method of supplier selection isquite necessary. Currently, these are many ways to solve multiple attribute decision makingproblems in supplier selection, such as SAW, TOPSIS, VIKOR, AHP/DEA, ELECTREalgorithms. When making decisions from the available suppliers, comparing, ranking orderpicking over all the supplies, they all involve uncertainty and imperfect information processing tosome extent, such as randomness, fuzzy, roughness. So in this work, we use SAW algorithm withentropy method to select suppliers.

The Step of Entropy Method to Determine the Weight of Each Indicators

Entropy was originally a thermodynamic concept, first introduced into information theory byShannon. It has been widely used in the engineering, socioeconomic and other fields.

Supplier Selection Problem–SAW Method:

Numerical Illustration with SensitivityAnalysis. We assume an MADM problem that has three alternatives and four attributes where inattributes C1, C4 are cost type and attributes C2,C3 are of profit type (the weight of attributesfound out from the methods of entropy, Eigen vector, linmap or weighted least square which aresuitable).

wt= (0.4,0.2,0.3,0.1)

METHOD-1: SAW METHOD

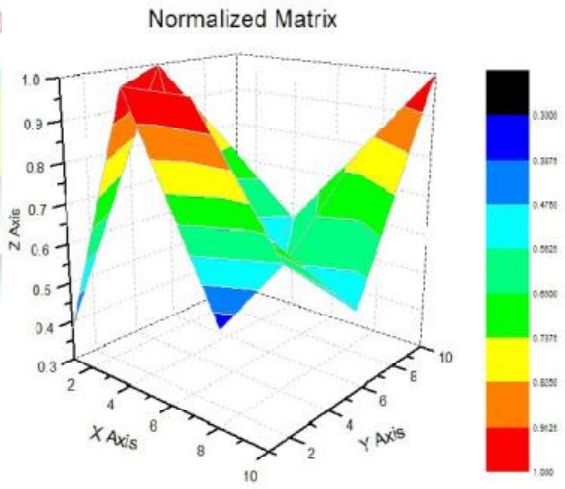

Fig : Normalized Matrix for the given Decision matrix

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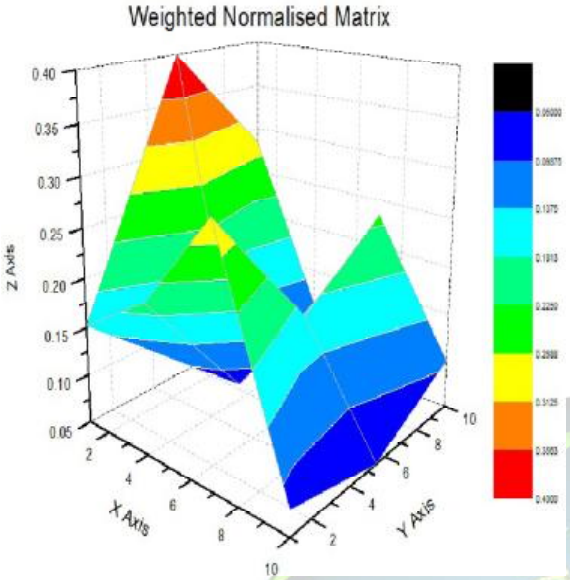

Fig : Weighted Normalized Matrix for the Normalized matrix

METHOD-2: SAW WITH SENSITIVITY ANALYSIS

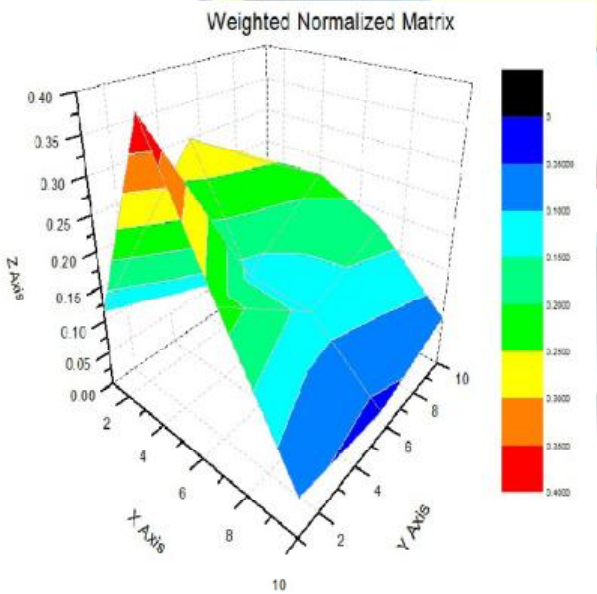

Fig: Weighted Normalized Matrix for Sensitivity Analysis

METHOD-3: SAW WITH ENTROPY METHOD

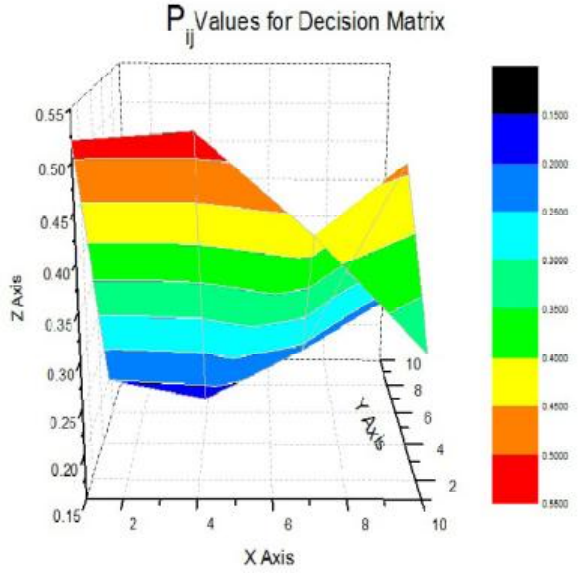

Fig :Pij Value Matrix

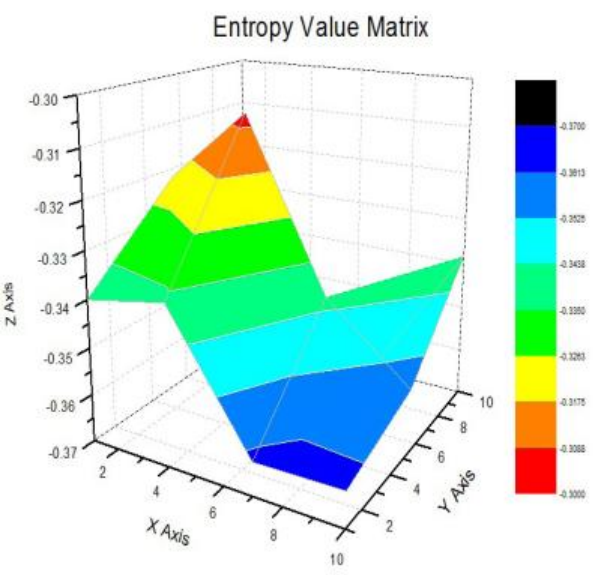

Fig: Entropy Value Matrix from Pij Value Matrix

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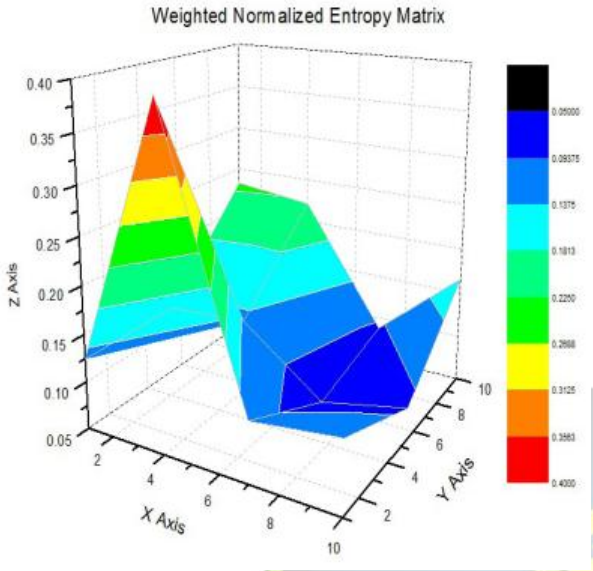

Fig : Weighted Normalized Entropy Value Matrix

4.Comparison of the three methods:

Method-1: Using SAW method
A3 >A1 >A2
Method-2: Using SAW method with Sensitivity analysis
A1 >A3 >A2
Method-3: Using SAW method with Entropy
A1 >A3 >A2

5. Conclusion

Thegeneral SAW method, Sensitivity analysis for SAW method was proposed and new algorithmwas proposed for Multiple Attribute Decision Making also with entropy method efficiently. Theprocedure for a general SAW method is discussed. A numerical illustration is presented utilizing the SAW method for supplierselection problem.

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