HARMONY IN PROGRESS:

INTEGRATING SCIENCE, TECHNOLOGY, AND SOCIAL INNOVATION FOR SUSTAINABLE DEVELOPMENT GOALS

e-Book of Extended Abstract

Negeri Sembilan International (NSIEx) & Research Symposium

2025

PST013 - A USER-FRIENDLY EXCEL TEMPLATE FOR MULTI-CRITERIA DECISION MAKING (MCDM) PROBLEMS USING THE ENTROPY-COPRAS METHOD

Nor Faradilah Mahad*, Mohamad Hajim Aqil Mohamad Nazri, Nur Anisha Roslan, and Ahmad Fakhri Ismail

Fakulti Sains Komputer dan Matematik (FSKM), Universiti Teknologi MARA Cawangan Negeri Sembilan, Kampus Seremban, 70300 Seremban, Negeri Sembilan, MALAYSIA

*Corresponding author: faradilah315@uitm.edu.my

ABSTRACT

Multi-criteria decision-making (MCDM) problems are about choosing the best alternative while considering multiple conflicting criteria. Various MCDM techniques can be implemented to solve the MCDM problems. In this project, Entropy-COPRAS is implemented to solve the problem. The Entropy method is used to compute the weights of the criteria, while the COPRAS method is used to choose the best alternative. Traditionally, the decisions are made based on the decision-makers' subjective preferences and past experiences, which will lead to bias in the process. However, with the help of a mathematical analysis, the bias may be reduced significantly, since the Entropy calculates the weights of the criteria objectively. The Entropy-COPRAS integrates into a Microsoft Excel-based template to help decision-makers make transparent and organized decisions. The template will also allow decision-makers without programming knowledge to apply the Entropy-COPRAS method effectively. As a result, decision-makers can make decisions more quickly and with guaranteed calculation transparency.

Keywords – Entropy, COPRAS, selection problem

INTRODUCTION

In the context of multi-criteria decision making (MCDM), the decision-making process normally involved choosing the best alternatives in the presence of multiple conflicting criteria. Traditionally, decision-makers may make decisions solely based on their subjective preferences and past experiences, which will lead to bias. Thus, a mathematical analysis is needed for the decision-makers choosing the best alternatives while reducing the subjectivity in the decision-making process. Numerous MCDM methods can be used to evaluate the alternatives based on the predetermined selection criteria. By incorporating objective data and systematic approaches, decision-makers can enhance the reliability and validity of their choices, ultimately leading to more informed and accurate outcomes.

In this project, an MCDM method, which is Entropy-COPRAS, is proposed to choose the best alternative. The COPRAS method was developed by Zavadskas and Kaklauskas, the Vilnius Gediminas Technical University scientists, in 1996 (Thakkar, 2021). The COPRAS method has the capability to consider maximum and minimum criteria individually, which aids in forecasting the effect of ideal and anti-ideal solutions on alternative selection (Goswami et al., 2022). Moreover, the relative importance in COPRAS allows the prioritization of the ideal solution that maximizes the benefit while minimizing the cost criteria, whereas the negative ideal solution maximizes the cost while minimizing the benefit criteria (Goswami et al., 2022). The advantages of COPRAS include its simplicity, lower computational time, and transparent computation process (Thakkar, 2021). The COPRAS method is also free from rank reversals and can generate more accurate results than methods like Simple Additive Weighting (SAW), Technique for Order Preference by Similarity to Ideal Solution (TOPSIS), Vlse Kriterijumska Optimizacija Kompromisno Resenje (VIKOR), Analytic Hierarchy Process (AHP), etc. (Goswami et al., 2022). In addition, decisions produced by the COPRAS method are more efficient and less biased than those provided by TOPSIS and SAW (Thakkar, 2021). The COPRAS method is one of the common MCDM methods that is implemented to rank the alternatives based on various criteria with the help of criteria weights and the utility degree of alternatives (Thakkar, 2021). The issue that arises with the implementation of this method lies in the weight determination. Many weighting methods can be used to compute the criteria weight and in this project, the Entropy method is employed to calculate the weights. The Entropy method is an objective weighting method introduced by Shannon in 1948. This method is free from the decision-makers' involvement and inconsistencies and thus does not need the consistency-checking procedure (Goswami et al., 2022).

To enhance the accessibility of the Entropy-COPRAS method, it is integrated with Microsoft Excel. An Excel-based template is designed to help the decision-makers assess and choose the best alternatives even without programming knowledge. This user-friendly tool offers a structured and transparent decision-making process. The template allows users to perform the Entropy-COPRAS method effectively by easily inputting and analyzing the collected data and thus reducing the calculation errors.

OBJECTIVE

The objectives of the research are:

i. To apply the Entropy–COPRAS method in solving the MCDM problems.
ii. To integrate the Entropy–COPRAS method into a Microsoft Excel-based template to facilitate the decision-making process.

DESCRIPTION OF THE PROJECT

The Entropy-COPRAS framework starts with the data collection. The initial data about the assessment of the alternatives based on predetermined selection criteria are collected. The data is then transformed into a decision matrix and keyed into an Excel-based template, as shown in Figure 1.

Objective	Select the best alternative				
	Criteria 1	Criteria 2	Criteria 3	Criteria 4	Criteria 5
	Benefit	Cost	Benefit	Benefit	Benefit
Alternative 1	5	3	5	3	5
Alternative 2	2	12	4	2	5
Alternative 3	2	5	4	5	3
Sum	9	20	13	10	13

Figure 1: The decision matrix

The criteria weights are calculated by using the Entropy method. The values are then used as input in the COPRAS framework. Entropy-COPRAS is employed to rank and choose the best alternatives. Figure 2 shows the values of the weights. Meanwhile, Figure 3 shows the degree of the utility of each alternative and its ranking.

Objective	Select the best alternative					
	Criteria 1	Criteria 2	Criteria 3	Criteria 4	Criteria 5	
	Benefit	Cost	Benefit	Benefit	Benefit	
Alternative 1	0.55556	0.15	0.38462	0.3	0.38462	
Alternative 2	0.22222	0.6	0.30769	0.2	0.38462	
Alternative 3	0.22222	0.25	0.30769	0.5	0.23077	
Sum	1	1	1	1	1	
Entropy	0.90571	0.85347	0.99474	0.93723	0.97705	
Degree of divergence	0.09429	0.14653	0.00526	0.06277	0.02295	0.3318
Criteria weight	0.28417	0.44161	0.01586	0.18918	0.06918	1
Ranking	2	1	5	3	4	

Figure 2: The weights of the criteria

Objective	Select the best alternative										
Criteria weight	0.28417	0.44161	0.01586	0.18918	0.06918						
	Criteria 1	Criteria 2	Criteria 3	Criteria 4	Criteria 5						
	Benefit	Cost	Benefit	Benefit	Benefit	Smax	Smin	Qi	U	%	Ranking
Alternative 1	0.15787	0.06624	0.0061	0.05675	0.02661	0.24733	0.06624	0.48604	1	100	1
Alternative 2	0.06315	0.26497	0.00488	0.03784	0.02661	0.13247	0.26497	0.19215	0.39534	39.5336	3
Alternative 3	0.06315	0.1104	0.00488	0.09459	0.01596	0.17858	0.1104	0.32181	0.6621	66.2099	2
						0.55839	0.44161	1			

Figure 3: The ranking of the alternatives

NOVELTY

The novelty of the project lies in the integration of Entropy-COPRAS with a Microsoft Excel-based template to ease the decision-making process.

CONCLUSION

The Entropy-COPRAS integrates into a Microsoft Excel-based template to help decision-makers make transparent and organized decisions. The template will also allow decision-makers without programming knowledge to apply the Entropy-COPRAS method effectively. As a result, decision-makers can make decisions more quickly and with guaranteed accuracy.

REFERENCES

Goswami, S. S., Behera, D. K., Mitra, S., Saleel, C. A., Saleh, B., Razak, A., Buradi, A., & Ketema, A. (2022). Development of entropy embedded COPRAS-ARAS hybrid MCDM model for optimizing EDM parameters while machining high carbon chromium steel plate. *Advances in Mechanical Engineering*, *14*(10), 1–17.

Thakkar, J. J. (2021). *Multi-Criteria Decision Making*. Springer Singapore.