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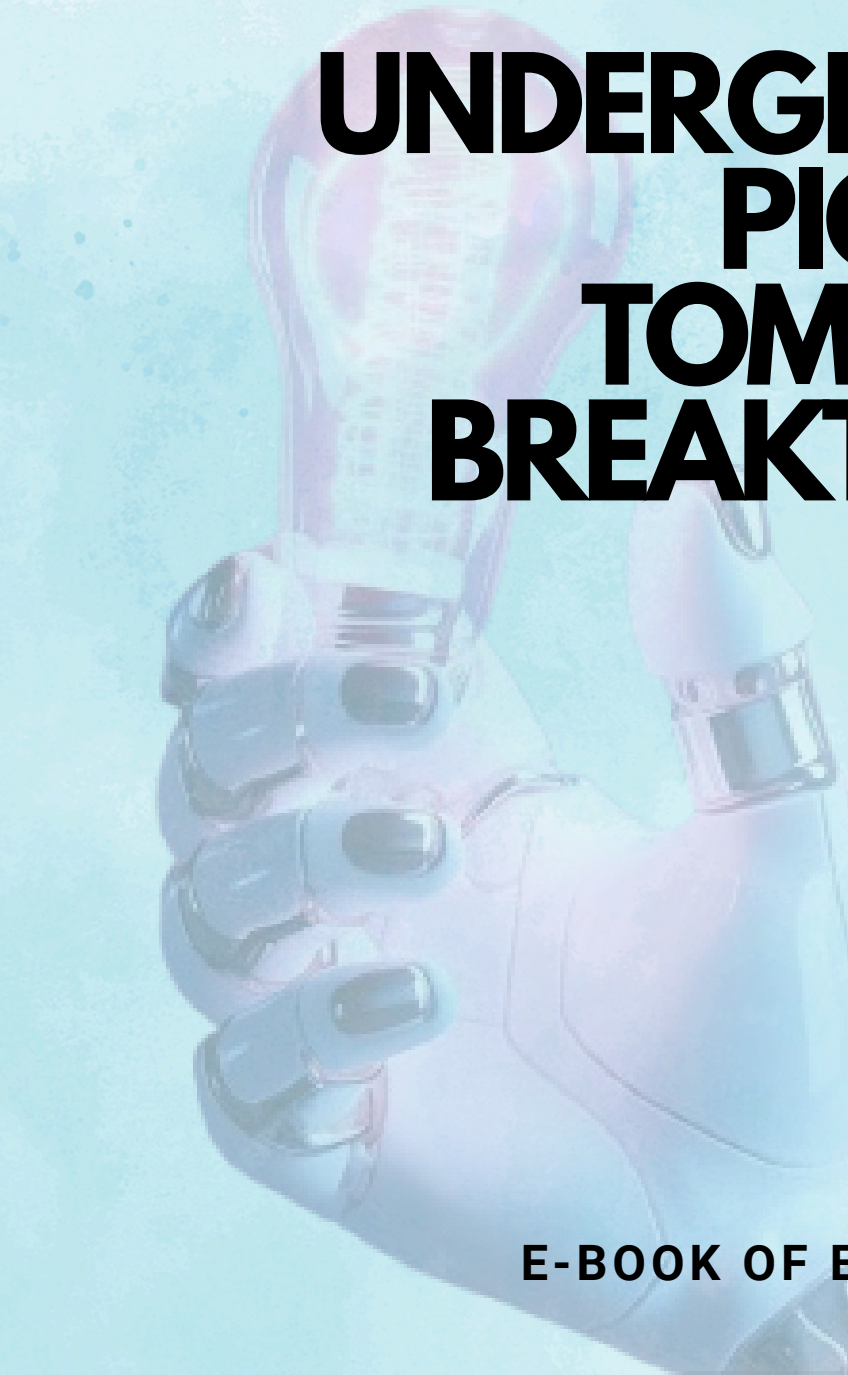

E-BOOK OF EXTENDED ABSTRACTS

EcoWise: WEB-BASED INTELLIGENT SUSTAINABILITY EVALUATION USING TOPSIS (WISE-T)

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ABSTRACT

EcoWise: WISE-T is a free web-based tool that helps users evaluate and rank sustainability projects by considering environmental, economic, and social factors. It is designed for students, researchers, policymakers, and organisations that may not have access to expensive commercial software. The system uses the Technique of Order Preference by Similarity to Ideal Solution (TOPSIS) method, a common approach in multi-criteria decision-making (MCDM). Users first set up a decision matrix with alternatives and criteria. EcoWise then normalizes the data, applies weights to each criterion, and calculates the distance of each alternative from the best and worst solutions. Based on this, the tool produces a ranked list of options. EcoWise's novelty lies in its lightweight, easy to use, and runs directly in a web browser without installation. It provides clear visual outputs such as weighted matrices and ranking charts, making the decision-making process more transparent, flexible, and aligned with the United Nations Sustainable Development Goals (SDGs).

Keywords: Sustainability Evaluation, Multi-Criteria Decision-Making (MCDM), TOPSIS, Decision Support System, Web-Based Tool

INTRODUCTION

The growing focus on sustainable development has increased the demand for transparent, data-driven tools to evaluate environmental, economic, and social initiatives. Yet, organisations, policymakers, and sustainability managers often face conflicting criteria, subjective judgments, and a lack of standardised frameworks, which hinder effective decision-making. These challenges frequently result in inconsistent or biased evaluations, especially in contexts where decisions rely on manual assessments rather than structured methods (Mardani et al., 2015).

Multi-Criteria Decision-Making (MCDM) techniques, such as the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS), offer a structured approach by ranking alternatives based on their distance to an ideal solution. Originally proposed by Hwang and Yoon in 1981, TOPSIS has since been widely applied in socioeconomic research, scientific studies, and policy analysis (Zhang et al., 2017). Its popularity stems from its simplicity, interpretability, and effectiveness in handling conflicting criteria (Behzadian et al., 2012). However, current sustainability assessment tools are limited in scope, often static, and lack interactivity or transparent visualization, reducing user trust and flexibility (Cinelli et al., 2014).

To overcome these gaps, this study presents EcoWise (WISE-T), a free, web-based platform that applies the TOPSIS method to rank sustainability alternatives. The system integrates MCDM principles with interactive web technologies to deliver a user-friendly, transparent, and scalable solution for multi-dimensional sustainability assessment.

The objectives of this project are to develop a decision framework using the TOPSIS method to evaluate sustainability performance across multiple criteria, compare and rank sustainability initiatives to identify the most sustainable alternatives, enhance transparency through step-by-step outputs and sensitivity

analysis, and support data-driven decisions aligned with the United Nations Sustainable Development Goals (SDGs).

RESULTS AND DISCUSSION

EcoWise (WISE-T) is an interactive web-based decision support tool designed to simplify sustainability decision-making through the TOPSIS method. Developed in Python and deployed via Streamlit, the system runs directly in a browser without installation, making it accessible to users across academic, corporate, and policy settings. The workflow in Figure 1 begins with dataset upload in Excel or CSV format, followed by definition of criteria as benefit or cost, assignment of weights, and automatic construction of the decision matrix. The system then performs normalisation, weighting, identification of benchmark solutions, Euclidean distance calculations, and closeness coefficient computations. These results are displayed step by step, ensuring full transparency. Figure 2 shows the integrated interface where users can view the uploaded dataset, intermediate calculations, and bar chart rankings in real time. This design allows dynamic weight adjustments, interactive outputs, and clear visualisation of sustainability rankings, making EcoWise a practical and user-friendly decision-support platform. The website is accessed through the link: https://ecowise-fiqhley.streamlit.app/.

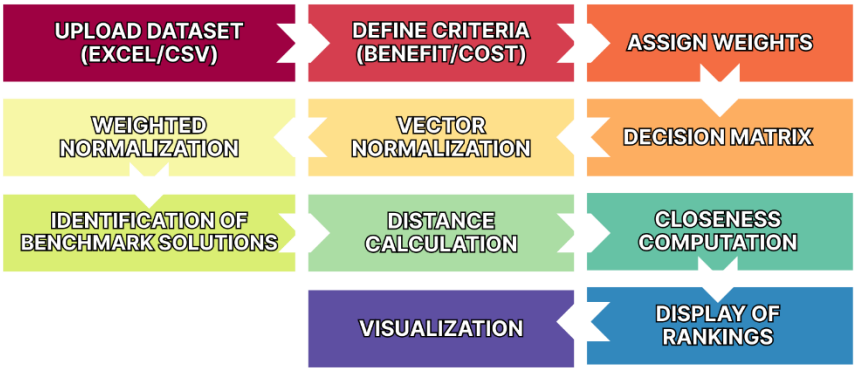

Figure 1: Flowchart of EcoWise: WISE-T.

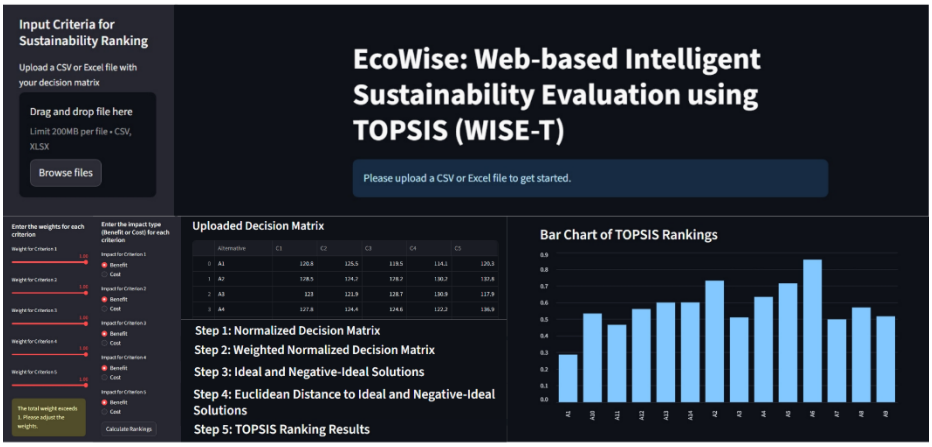

Figure 2: EcoWise: WISE-T input interface, output matrix and ranking chart.

The novelty of EcoWise lies in its ability to transform an academic MCDM method into a fully operational, transparent, and interactive web platform. Unlike manual TOPSIS calculations or static spreadsheet models, EcoWise provides an automated workflow that minimises errors and improves efficiency. Each stage of the TOPSIS process is visualized, fostering user trust and offering methodological clarity rarely found in conventional tools. Its adaptability to handle large datasets with multiple alternatives and criteria enhances scalability, while its browser-based design ensures accessibility without additional software costs. EcoWise also incorporates flexible weight adjustments, allowing users to test different decision scenarios instantly.

This level of interactivity and transparency distinguishes EcoWise from subscription-based tools such as D-Sight, making it an open and inclusive solution. By bridging scientific strictness with practical usability, EcoWise delivers value not only for sustainability consultants and policymakers but also as an educational tool for universities and training institutions.

CONCLUSION

EcoWise (WISE-T) transforms the TOPSIS method into a transparent, user-friendly, and adaptable web-based decision support tool for sustainability evaluation. By simplifying normalisation, weighting, benchmark identification, distance computation, and ranking, it eliminates the complexity and errors of manual calculations. Its interactive interface enables users to adjust weights dynamically, visualise intermediate steps, and generate clear ranking outputs, encouraging trust and adaptability in decision-making. Unlike conventional or subscription-based tools, EcoWise is freely accessible, lightweight, and capable of handling diverse datasets across corporate, governmental, and academic contexts. Aligned with the United Nations Sustainable Development Goals (SDGs), it empowers stakeholders to make data-driven, responsible choices that advance sustainable development. Future improvements may include integration of hybrid MCDM methods, expanded visualisation options, and exportable reports to further strengthen its practical and educational impact.

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