INTERNATIONAL EXHIBITION & SYMPOSIUM ON PRODUCTIVITY, INNOVATION, KNOWLEDGE & EDUCATION

E-PROCEEDING

EXTENDED ABSTRACT

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EXTENDED ABSTRACT

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Welcome Message

RECTOR, UITM KEDAH BRANCH

Assalamualaikum warahmatullahi wabarakatuh,

First and foremost, I would like to extend my deepest appreciation to the organising committee of i-SPiKE 2025 for their steadfast dedication and commitment in making this prestigious event a reality. My heartfelt congratulations to the committee for their tireless efforts in ensuring that i-SPiKE continues to grow as a meaningful and impactful platform for academics, researchers, students, and industry players worldwide.

The theme for this year, "Empowering Minds: Bridging Innovation, Knowledge and Education for a Sustainable Future," is both timely and significant. It reflects our shared responsibility to not only embrace creativity and technological advancement, but also to ensure that innovation directly contributes to sustainable development, equitable education, and the well-being of future generations.

i-SPiKE 2025 provides a dynamic platform for showcasing innovations that address real-world challenges while opening new avenues for collaboration, engagement, and inclusivity. By bridging knowledge, innovation, and education, this symposium strengthens our collective capacity to design solutions that empower communities and inspire positive change.
I am truly impressed by the diversity and calibre of participants in this year's event. The projects and ideas presented highlight the extraordinary creativity and determination of our innovators. I am confident that the insights and solutions shared here will pave the way for continuous advancement in teaching, learning, and innovation.

It is my sincere hope that you will find i-SPiKE 2025 an enriching experience, one that sparks new ideas, builds lasting collaborations, and strengthens our shared vision for a sustainable future. To all participants, I wish you every success, and to the winners, my warmest congratulations.
Once again, I thank the organising committee, partners, and contributors for their invaluable support. May i-SPiKE 2025 continue to inspire and empower minds for many years to come.

Professor Dr. Roshima Haji Said
Acting Rector
Universiti Teknologi MARA (UiTM) Kedah Branch

Welcome Message
(i-SPiKE 2025 CHAIR)

It is my great pleasure to welcome you to the 4th International Exhibition & Symposium on Productivity, Innovation, Knowledge, and Education 2025 (i-SPiKE 2025). This year's theme, "Empowering Minds: Bridging Innovation, Knowledge, and Education for a Sustainable Future," reflects our collective commitment to advancing innovation and fostering meaningful collaboration across academia, industry, and communities.

i-SPiKE 2025 provides a platform for scholars, researchers, students, and practitioners from diverse fields to showcase their ideas, share knowledge, and inspire new solutions to global challenges. We extend our sincere appreciation to all participants and contributors whose efforts and dedication have made this symposium possible.
We hope that this e-proceedings serves not only as a record of the innovations presented but also as a valuable resource that continues to inspire long after the event.

Thank you.

Dr Junaida Ismail
Chair
4th International Exhibition & Symposium on Productivity, Innovation, Knowledge, and Education 2025 (i-SPiKE 2025)

PREFACE

The 4th International Exhibition & Symposium on Productivity, Innovation, Knowledge, and Education (i-SPiKE 2025) marks yet another milestone in our ongoing commitment to fostering innovation, creativity, and collaboration across disciplines. Guided by this year's theme, "Empowering Minds: Bridging Innovation, Knowledge and Education for a Sustainable Future," the event provides a dynamic platform for students, educators, researchers, and professionals to share their ideas, showcase their innovations, and engage in meaningful knowledge exchange.

This year, we are pleased to report that i-SPiKE 2025 received approximately 50 initial submissions, with more than 35 projects successfully advancing to final presentation and exhibition. These projects reflect a rich diversity of innovation, ranging from educational technologies, digital applications, and gamified learning tools to sustainable materials, cultural heritage preservation, and community-focused solutions. Collectively, they embody the spirit of bridging innovation and education to address pressing societal and global challenges.

We sincerely thank all participants, reviewers, and committee members for their invaluable contributions in making i-SPiKE 2025 a success. It is our hope that this e-proceedings will not only serve as a record of the ideas and innovations presented, but also as an inspiration for future collaborations and advancements in the pursuit of sustainable knowledge and innovation.

Assoc. Prof. Dr. Azlyn Ahmad Zawawi
Editor-in-Chief, i-SPiKE 2025 Proceedings

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S&T (YOUNG)

AURA: STREAMLIT-BASED DECISION SUPPORT SOFTWARE FOR SUSTAINABLE MULTI-CRITERIA DECISION-MAKING

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ABSTRACT

The Adaptive Utility Ranking Algorithm (AURA) is a Python-based decision support system designed to overcome the constraints of classical Multi-Criteria Decision-Making (MCDM) techniques such as TOPSIS and VIKOR. AURA combines benefit, cost, and target-type criteria in a single adaptive, distance-based scoring system, unlike the conventional methods which require different formulations of benefit and cost criteria and do not consider all criteria whose desired value is in the middle. In the case of target-type criteria, normalization is achieved by measuring the distance to a user-defined target value, where a proximity reward is given and deviation on either side are punished. The system also utilizes a tri-benchmark methodology comprising of the Positive Ideal Solution (PIS), Negative Ideal Solution (NIS), and the Average Solution (AVG) with a correction factor to increase stability and discrimination in ranking, which gives balanced and interpretable outcomes. AURA is developed in Python and Streamlit and offers a convenient interface to upload Excel decision matrices, allocate weights, and define criteria such as benefit, cost, and target. The software performs normalization, weighting, benchmark computation, and final scoring automatically and provides tabular and graphical output with downloadable reports. This methodology and software combination can be used to make AURA applicable in education and industry decision support. The peculiarity of AURA is the

possibility to model situations of sustainability when trade-offs can often be achieved by fulfilling the desired goals instead of maximizing or minimizing extremes. AURA can be applied in the fields of business innovation, resource allocation, supply-chain analysis, and environmental management, allowing quick, transparent, and repeatable analyses. The system has high adaptability and commercialization capability, enabling eco-friendly, data-driven approaches and helping to achieve global sustainability objectives.

Keywords: multi-criteria decision-making, adaptive utility ranking algorithm, decision support system, sustainable innovation, streamlit

INTRODUCTION

Decision-making is now more complex, where there are a lot of alternatives, conflicting goals, and the issues of balancing economic, social, and environmental factors. TOPSIS and VIKOR are Multi-Criteria Decision-Making (MCDM) techniques that are popular among business, engineering, healthcare, and environmental management (Alrababah et al., 2017; Pandey et al., 2023). Although these classical approaches are very popular, they have significant flaws. They tend to be based on predetermined rules of normalization, to consider separately benefit and cost criteria, and to hardly take into account target-type criteria, when the desirable value is midway along the scale. These constraints decrease flexibility and the inability to address diverse and real-life decision contexts (Malefaki et al., 2025).

There are also limitations with the current decision support tools. Some of them are created with academic purposes in mind, and they cannot be used without the knowledge of technical skills (Kappen et al., 2020). They often do not have intuitive interfaces, automated reporting, and visualization capabilities, and this reduces their accessibility to practitioners and decision-makers in industry. This leads to the fact that the distance between the theoretical development and the practical application is still large.

Adaptive Utility Ranking Algorithm (AURA) deals with these problems by consolidating the benefit, cost, and target-type metrics into a single distance-based metric (Zaman et al., 2025). It includes a tri-benchmark approach and a correction factor to provide stable and discriminative rankings. More crucially, AURA has been used as a decision support software built using Streamlit where users can simply import Excel decision matrices, set parameters, assign the type of criteria, and produce the results with little work. AURA has the capacity to bridge the innovation, knowledge, and education divide by offering methodological strength with easy design, which facilitates sustainable decision-making both in academia and industry.

METHODOLOGY

AURA methodology has been implemented as an integrated model of managing the benefit, cost, and target-type criteria within one distance-based model (Zaman et al., 2025). In the research, AURA was implemented as a Streamlit-based decision support software, which is accessible online at https://aura-mcdm-zaharimdrodzi.streamlit.app/. Figure 1 describes the workflow of the system and outlines the entire process of data preparation through final reporting.

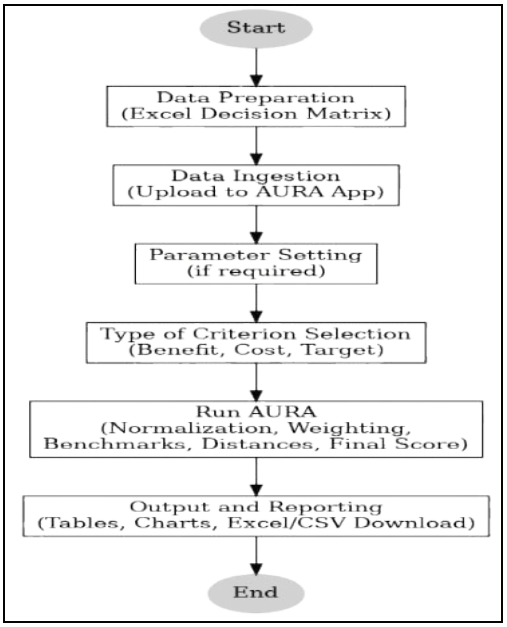

Figure 1. AURA Software Workflow

Practically, the process starts with the data preparation in Excel, where the next step is the data ingestion by uploading files to the software. Parameters like the distance order, or balancing factor can then be altered by users, and the nature of each criterion (benefit, cost, or target) is specified. After the execution of the RUN AURA button, the system will run normalization, weighting, benchmark identification (PIS, NIS, AVG), computation of distance with a correction, and final scoring. Lastly, the output and reporting phase displays the findings in table format and graphical format with the ability to download all the reports to analyse the findings further.

RESULTS / ILLUSTRATIVE EXAMPLE

To demonstrate the application of AURA, a sample decision matrix with four alternatives and four criteria was prepared. The input is shown in Table 1, which includes the criteria weights assigned according to their importance.

Table 1. Decision Matrix with weights

Alternative	*C1*	*C2*	*C3*	*C4*
Weight	*0.3*	*0.2*	*0.3*	*0.2*
A1	*80*	*50*	*75*	*90*
A2	*85*	*60*	*70*	*85*
A3	*78*	*40*	*60*	*88*
A4	*90*	*55*	*72*	*92*

After the matrix is uploaded, the software interface immediately exposes parameter controls which are the balancing factor α and distance order p and displays the raw data preview for verification. Users then proceed to assign the type of each criterion (Benefit/Cost/Target) normalization, applies weights, identifies benchmark vectors (PIS, NIS, AVG), computes distances with the built-in correction, and produces final scores with rankings. The results are summarized in Table 2

Table 2. Final AURA Ranking

Alternative	Score	Rank
A4	-0.0153	1
A1	0.0471	2
A2	0.0557	3
A3	0.0993	4

The ranking results are also visualized for quick interpretation in Figure 2.

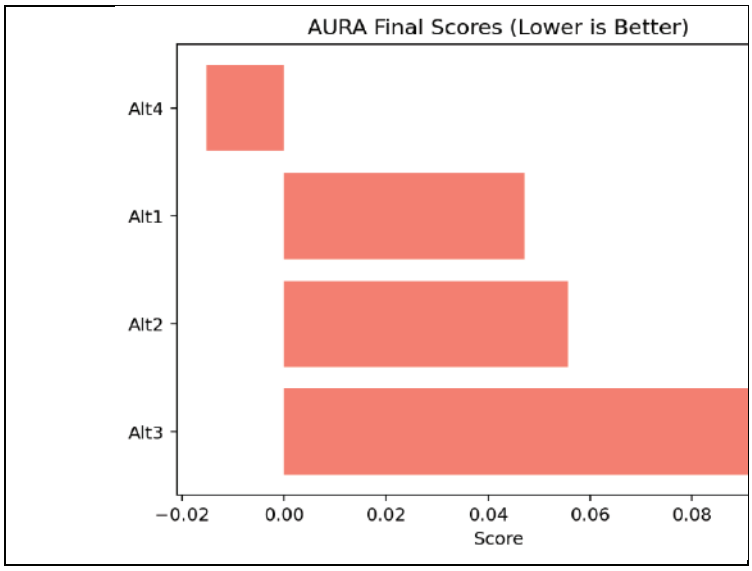

Figure 2. AURA Final Score

This sequence of uploading the decision matrix, configuring α and p specifying the criterion types, and running the algorithm demonstrates how the AURA software translates the established methodology into an intuitive and auditable workflow that produces transparent and reproducible decisions.

Impact and Significance of AURA

AURA contributes novelty in both methodology and software. By unifying benefit, cost, and target-type criteria within a single scoring model, it eliminates the need for separate formulations in classical methods such as TOPSIS and VIKOR. The tri-benchmark strategy with a correction factor enhances stability and discrimination, ensuring that rankings are both accurate and interpretable.

In addition to methodology, AURA provides the impact based on the implementation of Streamlit software. The system is embedded with parameter configuration, criterion typing, automatic normalization, and reporting under a single platform. This is to enable AURA to be accessible to

researchers, educators, and practitioners who might lack technical know-how to bridge the gap between the development of theoretical concepts and making decisions in practice.

The advantages are applicable to real-world situations in terms of selecting suppliers, allocating resources, business innovation, and environmental management. AURA is aligned with the goals of global sustainability by encouraging transparent and data-driven analyses. It has a high potential for commercialization because the software can be used as a single tool or even tailored to fit in certain industries or as a software-as-a-service (SaaS). These features position AURA as a versatile decision support solution with long-term relevance for both academic and industrial applications.

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