

To dream or not to dream in Havana: multi-criteria decision-making for material and energy recovery from municipal solid waste

Arael Alfonso-Cardero¹, Jhosané Pagés-Díaz², Efstratios Kalogirou³, Junior Lorenzo-Llanes⁴, Constantinos S. Psomopoulos^{5,6}

¹Departamento de Ingeniería Química, Universidad Tecnológica de La Habana "José Antonio Echeverría" (CUJAE), Marianao, La Habana, 11500, Cuba.

²Departamento de Ingeniería Química, Laboratorio de Biotecnología Ambiental, Facultad de Ingeniería, Universidad de Santiago de Chile, USACH, Casilla 40, Correo 33, Santiago, Chile.

³Waste-to-Energy International Expert, 15780 Athens, Greece

⁴ Department of Chemical Engineering and Bioprocesses, Pontificia Universidad Católica de Chile, Vicuña Mackenna 4860, Macul, Santiago, Chile

⁵ Department of Electrical & Electronics Engineering, University of West Attica, Campus Ancient Olive Grove, 250 Thivon str & P. Rali Ave, GR-12244, Egaleo, Greece.

Presenting author email: jhosane.pages@usach.cl Corresponding author: jlorenzo2@uc.cl, fjunior84@gmail.com

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FOLLOWING THE MOTIVATIONS

- Landfills are the main final disposal method for MSW in Cuba.
- Material recovery facilities (MRF) allows the recovery of marketable products, contributing to avoid the use of virgin resources with energy saving and lower emissions.
- Energy recovery facilities (ERF) offer a good solution for managing non-recyclable waste with the advantages of producing energy and reducing environmental pollution.
- Multi-Criteria Decision-Making (MCDM) allows decision-makers to evaluate and compare different technologies beyond environmental or cost-based choice. The Analytic Hierarchy Process (AHP) has shown to be the most popular MCDM tool for selecting waste management and renewable energy technologies



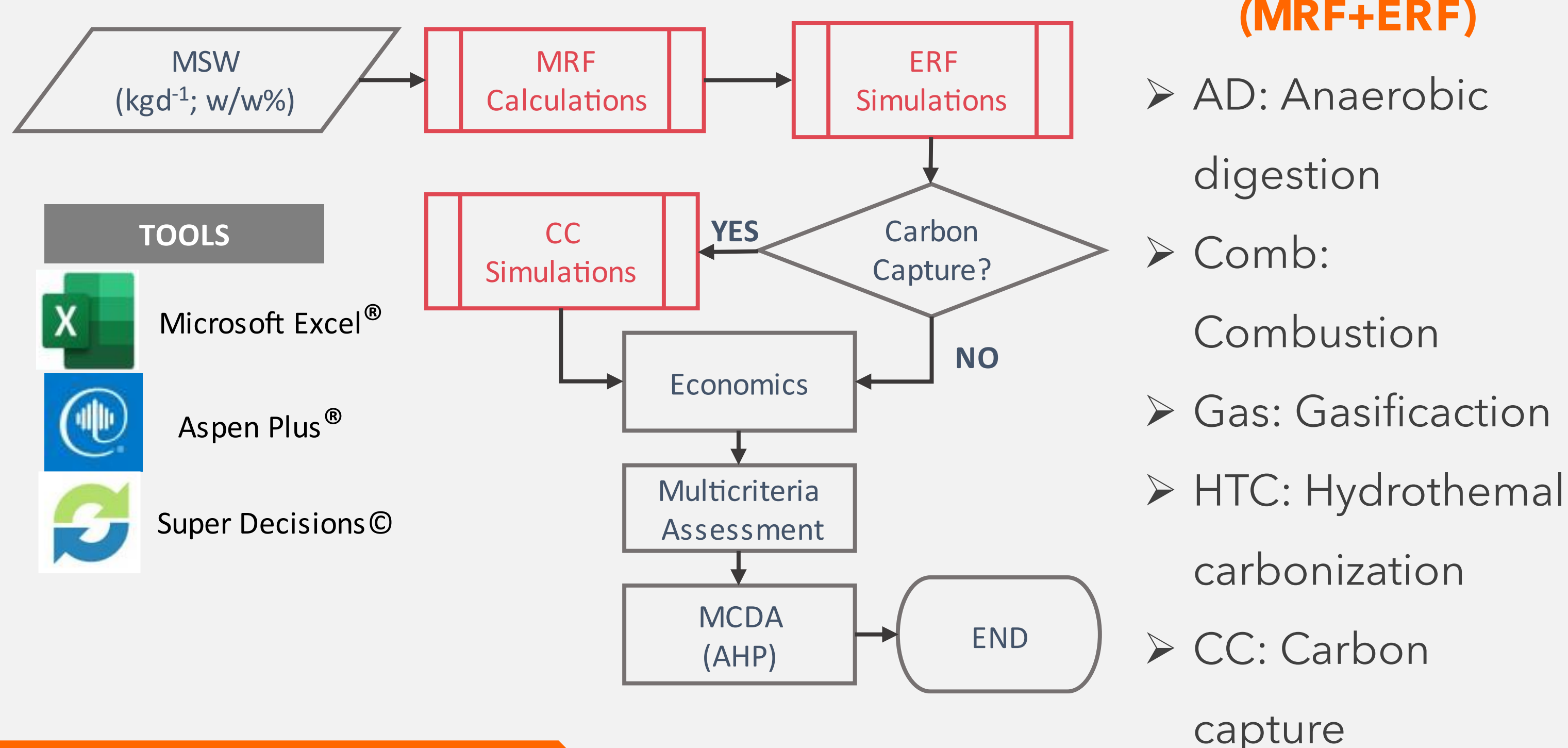
OUR TARGET

To select the most suitable alternative (MRF integrated with ERF) for material and energy recovery from MSW in Havana based on an AHP-MCDM analysis derived from experts' judgment and rigorous process simulation models of well-established and emerging waste treatment technologies.



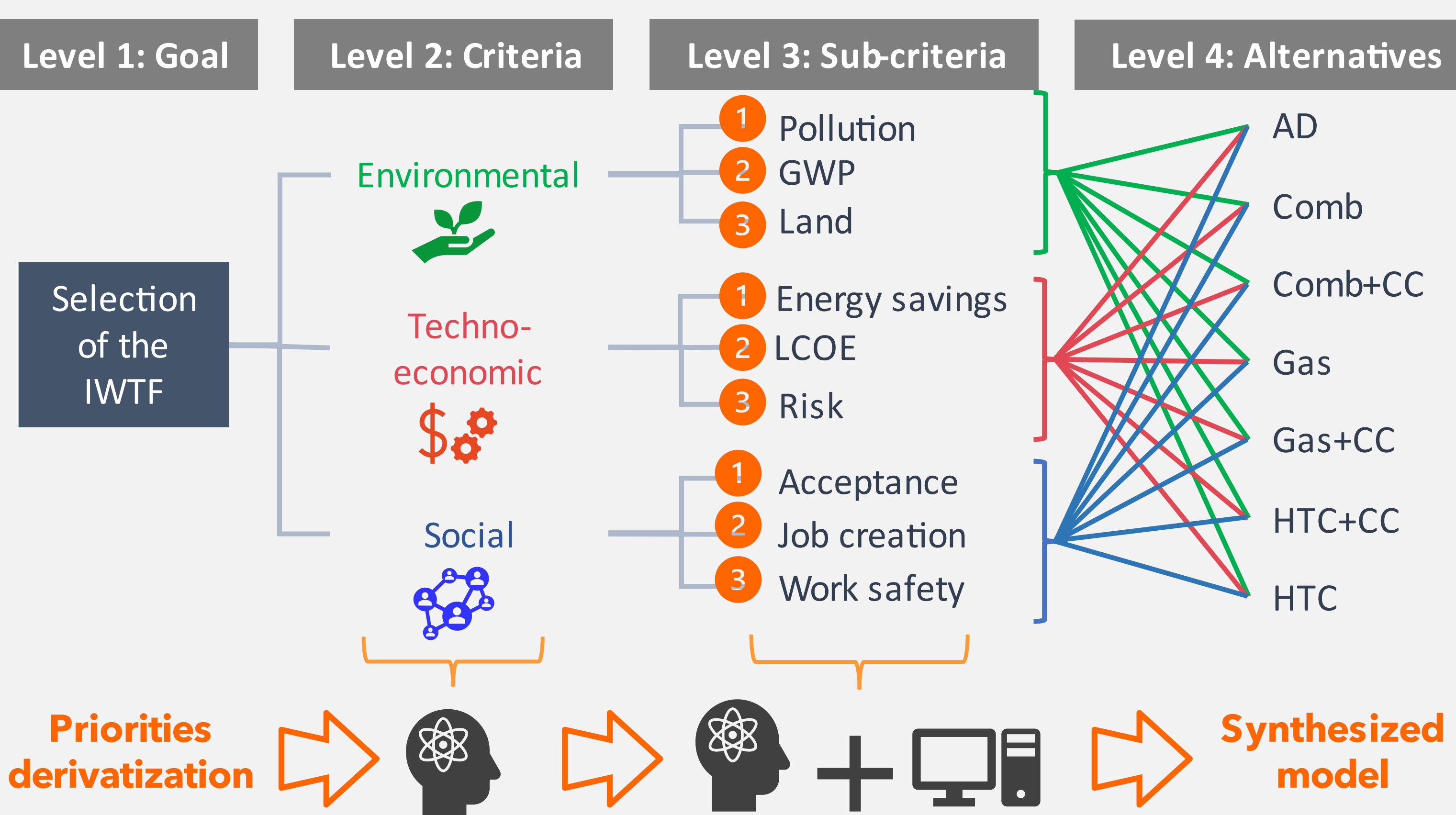
WORKING TIME... TASKS & TOOLS

APPLIED METHODOLOGY



- TOOLS**
- Microsoft Excel®
 - Aspen Plus®
 - Super Decisions®

THE AHP MODEL

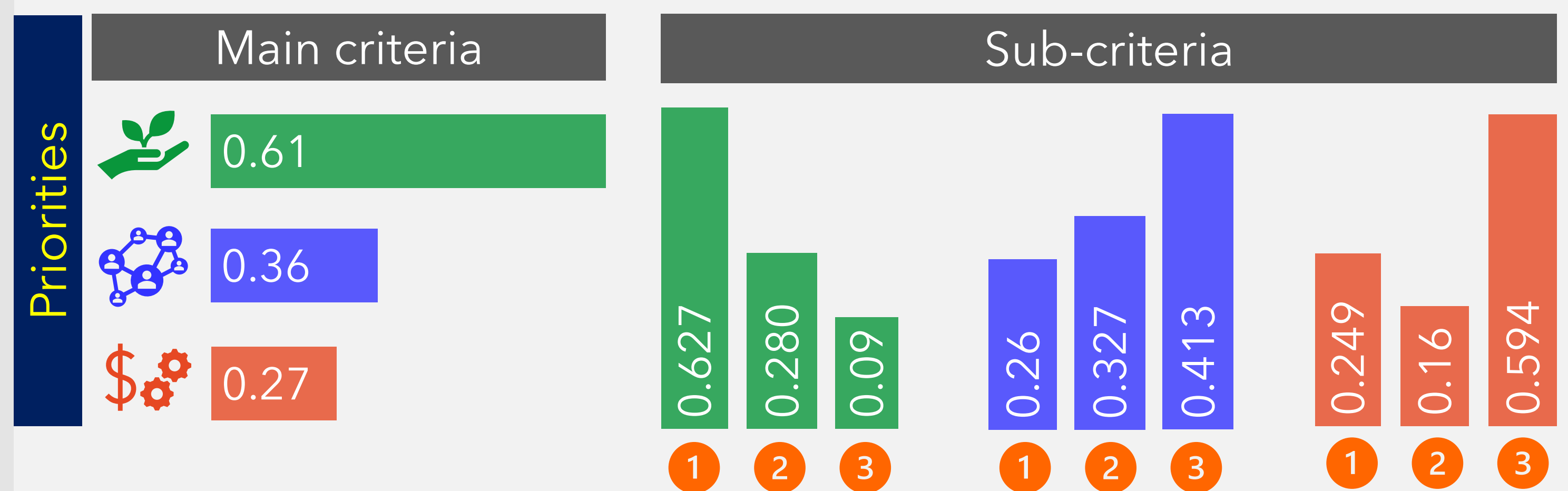


OUR FINDINGS

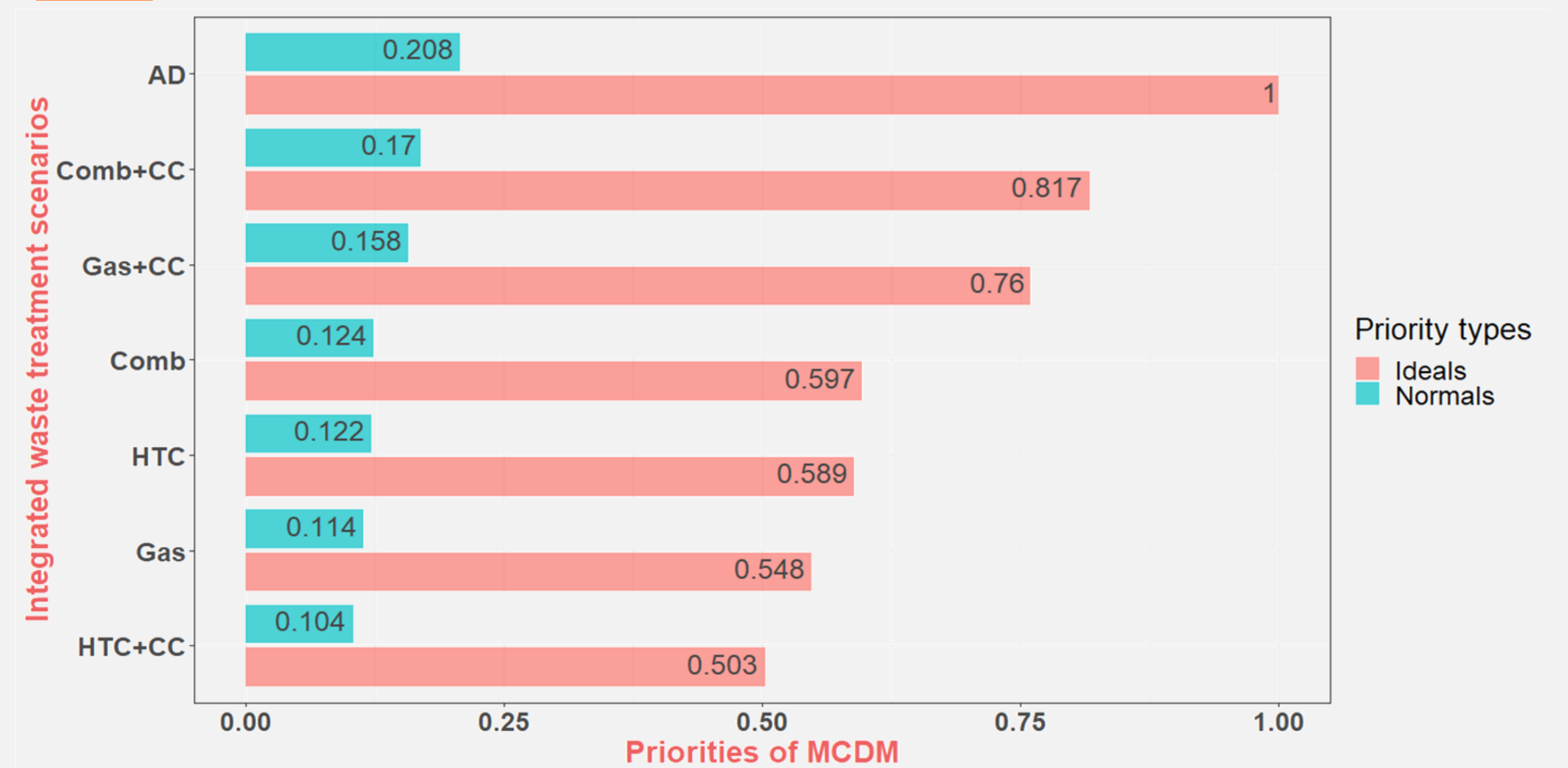
MULTICRITERIA ASSESSMENT



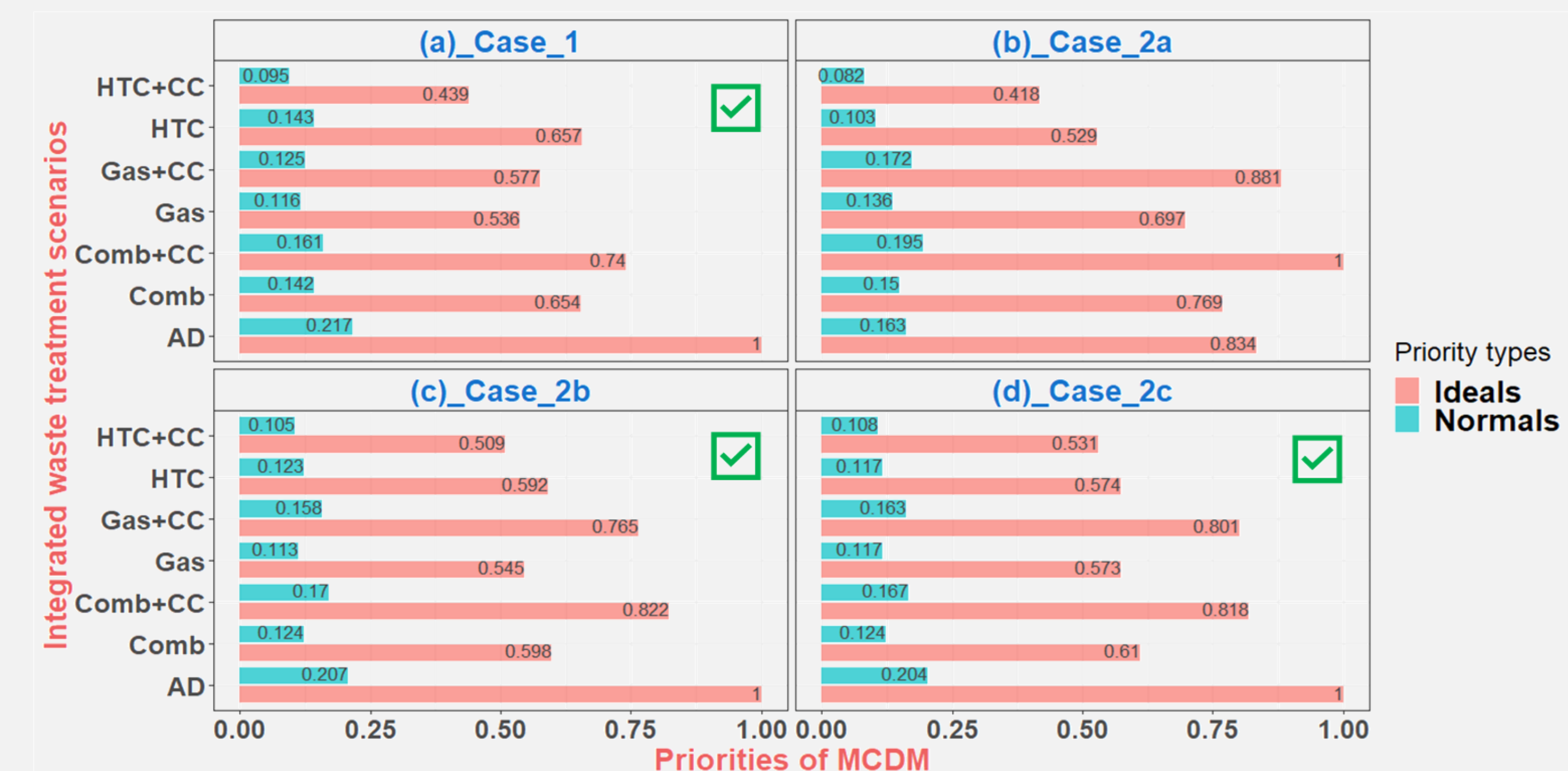
MCDM - AHP ANALYSIS



Overall synthesized priorities for the IWTF scenarios



Sensitivity analysis: (a) main criteria equally weighted, (b), (c), and (d) environmental, social and techno-economic sub-criteria equally weighted, respectively.



THE FINAL MESSAGE...

- Implementing an MCDM-AHP analysis comprising environmental, techno-economic, and social dimensions allowed selecting the most suitable scenario under Havana's conditions.
- The AHP's synthesized model showed that Havana's most appealing (~21% preference) scenario is an IWTF with anaerobic digestion as ERF (i.e., AD scenario).
- Further study needs to be undertaken to integrate cost-effective top-ranked scenarios (AD, Comb+CC, Comb).
- The general approach of the applied methodology can be used for decision-makers to boost sustainable waste management systems in Cuba and other emerging Latin American economies.

REFERENCES

- Ionescu et al.: Integrated municipal solid waste scenario model using advanced pretreatment and waste to energy processes. Energy Conversion and Management 76, 1083-1092 (2013).
- Kalogirou, N.E.: Waste-to-Energy Technologies and Global Applications. CRC Taylor & Francis Group, Boca Raton, (2018).