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POSTER

Challenges and Opportunities in S-LCA for Compliance Driven Innovation

*Authors: Julieta Díez, Hernández, Sonia Martel
Martín, Jesús Ibáñez, Ana García Moral, Israel
Carreira Barral , David Blanco Alcántara , Óscar
López de Foronda*



ICCRAM "International
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Advanced Industrial
Technologies"

Edificio I+D+i
Plaza Misael Bañuelos, s/n
09001 Burgos (SPAIN)



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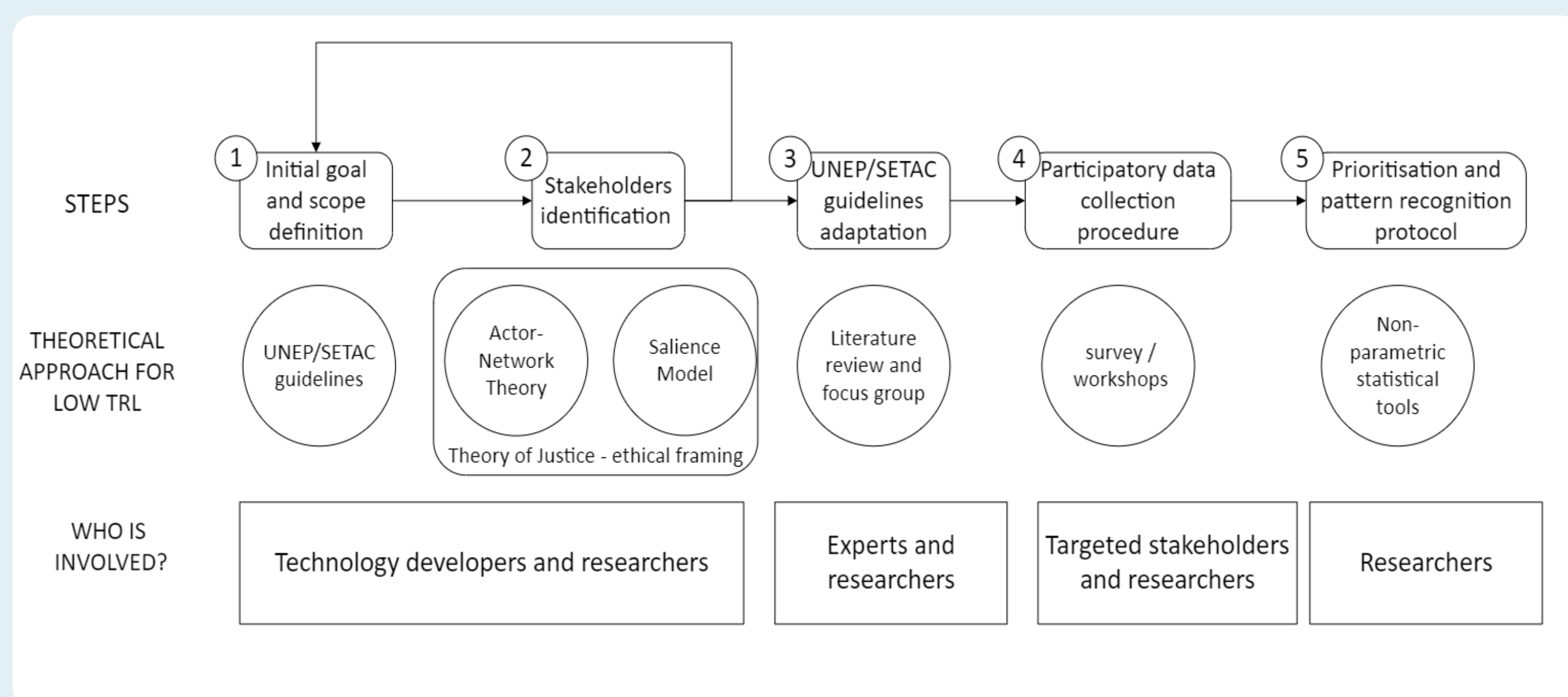
Challenges and Opportunities in S-LCA for Compliance-Driven Innovation

Julietta Díez-Hernández, Sonia Martel-Martín, Jesús Ibáñez, Ana García-Moral, Israel Carreira-Barral, David Blanco-Alcántara, Óscar López-de-Foronda

INTRODUCTION

As regulations such as CSRD and SSbD increasingly shape innovation, conventional S-LCA methods fall short when applied to early-stage technologies. This study explores these challenges and presents a justice-oriented, participatory S-LCA framework designed for compliance in uncertain, low-TRL settings. By integrating social theories and bottom-up stakeholder prioritisation, the approach transforms S-LCA into a proactive compliance tool. The method is tested on a smart textile prototype, revealing how ethical design can align with regulatory demands, especially when stakeholder inclusion is placed at the centre.

PROPOSED FRAMEWORK



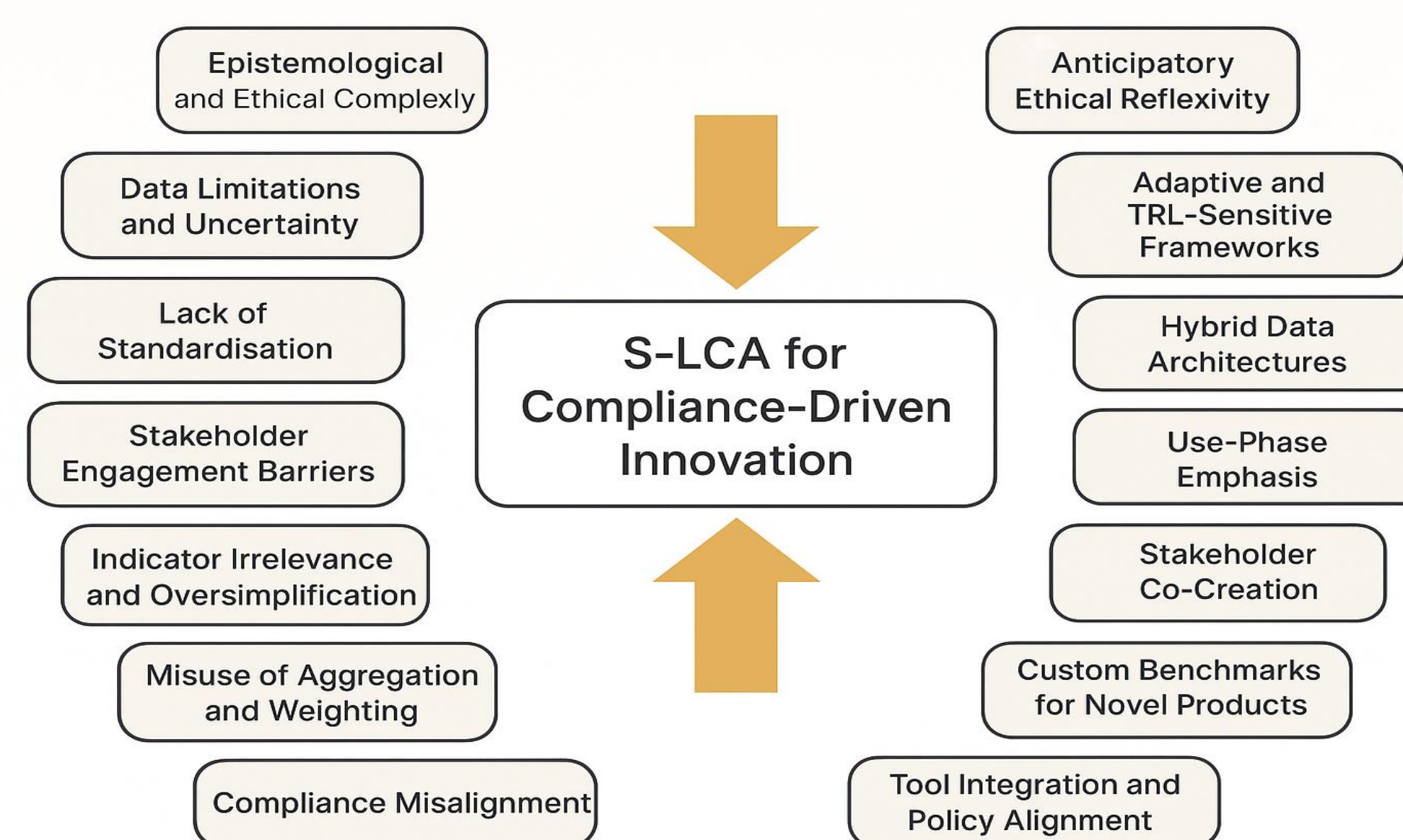
RESULTS

- Three clusters of potential end-users were identified through Actor-Network Mapping: Elder users, sport users, and normal users.
- Questionnaires were designed based on the TAM model created and the UNEP subcategories to understand differences in patterns in-between users. Results showed that elder users differ from the other clusters.
- Sport users value tech features more; elders prioritise usability and health connection.
- Regarding prioritisation, all groups showed strong agreement on consumer and child-related impacts indicating widespread concern for product safety, data privacy, and ethical responsibility toward vulnerable groups.
- Across user profiles, fair labour conditions, freedom of association, and absence of forced labour were consistently ranked highest for workers, highlighting the centrality of decent work in social compliance.
- Low agreement on general societal impacts suggests that macro-level concerns (e.g. social cohesion, corruption, unemployment) are less tangible for participants than stakeholder-specific issues.

CONCLUSIONS

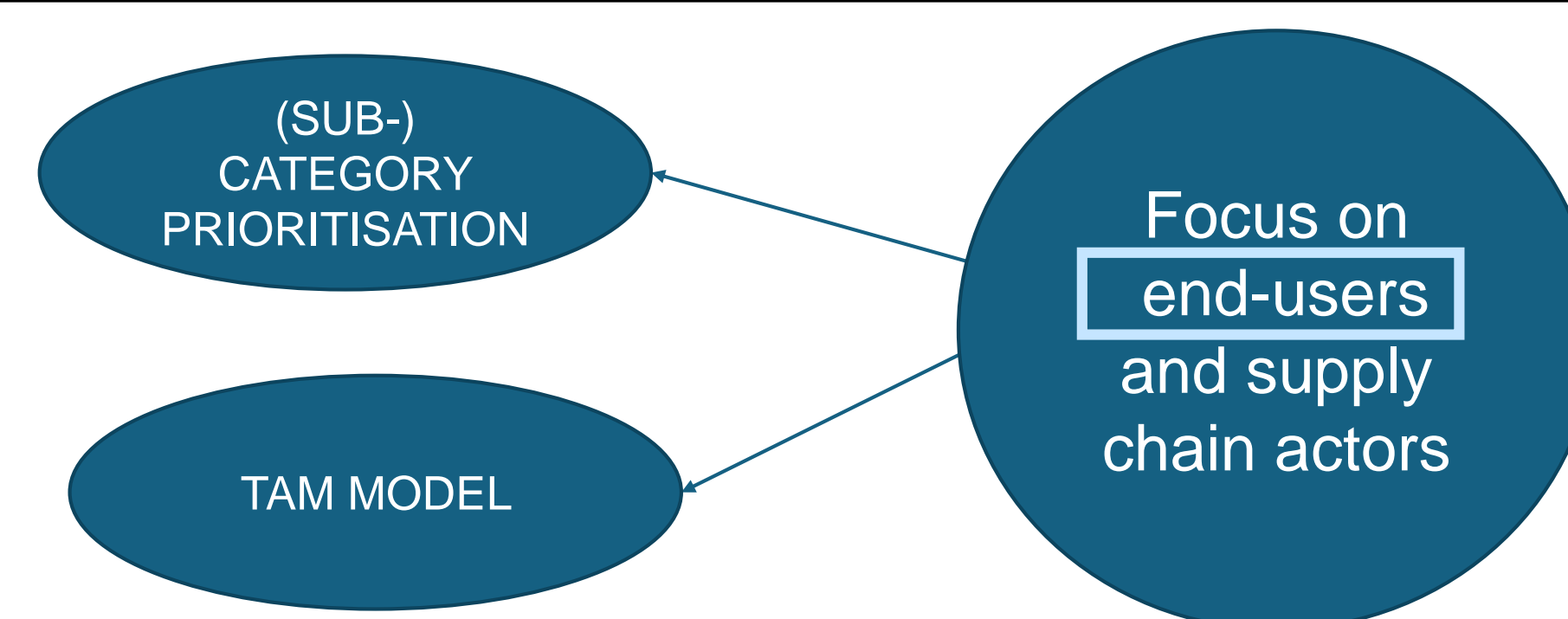
- This justice-based, participatory S-LCA method offers a robust pathway for aligning early-stage innovation with CSRD and SSbD requirements. By involving stakeholders in impact prioritisation, it enhances both the legitimacy and the compliance-readiness of social indicators.
- The approach transforms S-LCA from a retrospective reporting tool into a proactive design strategy for socially responsible innovation.

CHALLENGES AND OPPORTUNITIES



Stakeholder identification and salience

Stakeholder	Description	Salience Type
Developer	Company leading product R&D	Definitive
Consortium R&D Partners	Universities, companies and institutes in Convert2Green	Dominant
European Commission (Funding Body)	Horizon Europe program managers	Dominant
End Users (Wearers)	Consumers such as athletes or elders	Dependent
Healthcare Providers	Doctors, sports physicians, or trainers using data	Discretionary
Regulatory Authorities	Data Protection agencies, Medical device regulators	Dominant
Suppliers (Component Producers)	Sensor manufacturers, smart textile material suppliers	Dominant
Manufacturing Workers (Supply Chain Labour)	Workers assembling electronics or textiles	Dependent
End-of-Life Recyclers and E-waste Handlers	Organizations/workers handling disposal or recycling	Discretionary
Local Community & Government	Local authorities or communities hosting pilots or production facilities	Discretionary



Analyses performed for end-users

GENERAL DEMOGRAPHIC CHARACTERISATION: USER GROUP AND SUSTAINABILITY EXPERTISE CLUSTERING		
	Technology Acceptance Model	Prioritisation of social categories
Aim	Identify the attributes that the end-users value the most, and the least. Check any potential significant difference among user groups	Incorporate stakeholders perspectives into social impact categories' hierarchisation. Analyse the consistency of the ranking pattern among user group and expertise profiles.
Type of data	(LIKERT-LIKE) SCALE	ORDINAL
Family of methods	Parametric (General Linear Model)	Non parametric
Analysis performed and results obtained	Descriptive statistics Frequency distribution to see how the sample assess the attributes Repeated-measures one-way ANOVAS to identify attributes that were consider as significantly more relevant across the sample Mixed-design factorial ANOVAS to analyse whether the preferences were consistent among the different end-user groups	Friedman Test to analyse significant ranking differences Kendall's W To measure intragroup consensus Post-hoc pairwise test for robustness Kruskal-Wallis H For between-group comparison of ranks Spearman rank-order correlation to identify significantly different ranking patterns Mann-Whitney U-analysis to identify the items that cause diverging patterns



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