AN EXPLORATORY STUDY ON APPLYING DEMATEL TO CONSTRUCT AN ANALYTICAL FRAMEWORK FOR DIFFERENCES IN GREEN LABEL PERCEPTION AND CONSUMER BEHAVIOR: A TAIWAN-UK NET-ZERO TRANSITION STUDY

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Abstract: This study addresses a critical bottleneck in the global Net-Zero transition: the discrepancy between mature technical solutions and slow consumer market adoption. Focusing on green marketing within a circular economy framework, this research establishes a strategic collaboration between National Tsing Hua University and the Centre for Business, Climate Change, and Sustainability (B-CCaS) at the University of Edinburgh Business School. The study conducts a comprehensive comparative analysis of consumer decision-making pathways regarding Net-Zero products in Taiwan and the UK. A key methodological innovation of this research is the application of the Decision-Making Trial and Evaluation Laboratory (DEMATEL) method. By analyzing twelve critical factors across four primary dimensions—Market & Economics, Psychological Perception, Technical Functionality, and Social Policy—the study constructs an Network Relations Map (NRM) to identify the root causal factors driving green transitions. Through bilateral scholarly exchanges and young scholar circulation, this project develops a globally applicable green marketing strategic framework. The ultimate goal is to provide actionable insights that assist Net-Zero products in precisely aligning with international green supply chains.

Keywords: Circular Economy, Green Label, Consumer Behavior, DEMATEL, Net-Zero Transition, Cross-National Analysis.

I. INTRODUCTION

The global transition to Net-Zero emissions must transcend mere technological research and development; it necessitates a fundamental shift in consumer behavior driven by strategic market communication (Waiguny, & Rosengren, 2021). While various technical solutions currently exist, the primary contemporary challenge lies in bridging the "value-action gap" between eco-friendly innovation and mass-market consumer adoption. Under the severe challenges of global climate change, "Net-Zero" has evolved from a corporate social responsibility slogan into the foundational logic of the global economic and trade system. With the UK government's commitment to achieving Net-Zero by 2050, alongside the implementation of the EU's Carbon Border Adjustment Mechanism (CBAM) and the proposed UK-CBAM, the core of industrial competitiveness has shifted from being "cost-driven" to "green value-driven."

Despite the increasing maturity of green technologies and Circular Economy (CE) models, their market conversion efficiency remains significantly lagged. A profound "Green Gap" persists between consumer awareness and actual purchasing action. As a hub for global Information and Communication Technology (ICT) and precision manufacturing supply chains, Taiwan holds a distinct advantage on the technical supply side. However, establishing trust through "Green Labels" in transnational markets and converting environmental benefits into consumer purchasing momentum are the most pressing challenges for Taiwanese firms seeking to integrate into international green supply chains.

This bilateral collaboration under the Taiwan-UK University Consortium (TUKUC) framework enables a profound dialogue between policy leadership and manufacturing prowess. The UK was among the first nations to codify Net-Zero targets into law. Its market is governed by stringent legal and ethical frameworks for green labeling, such as the Green Claims Code published by the Competition and Markets Authority (CMA)—a global benchmark for combating "greenwashing."

II. LITERATURE REVIEW AND FACTOR DEFINITION

Prior research on green consumption has frequently relied on single-variable analysis, overlooking the complex causal interdependencies. To decode the decision black box and clarify causal directionality, this study defines 12 critical factors governing the adoption of Net-Zero products, categorized into four dimensions (Chattopadhyay, et. al., 2023; Koukoumaki, et al., 2024; Szaban, et al.,2025; Damberg, et al., 2024; McGuicken, et al., 2021; Pancer, et al., 2017; Fukushige, et al., 2025; Jaiswal, et al., 2021).

A. Market & Economic Dimension (D_1)

C_1 Perceived Price Premium: The consumer's sensitivity to the additional cost of Net-Zero products relative to conventional alternatives.

C_2 Long-term Economic Benefits: Life-cycle energy savings or tax incentives provided by the government.

C_3 Market Accessibility: Availability via retail or digital platforms, including supply chain stability and delivery efficiency.

B. Psychological & Cognitive Dimension (D_2)

C_4 Trust in Green Labels: Reliance on the authority and integrity of certification bodies (e.g., Carbon Trust) to mitigate information asymmetry.

C_5 Green Self-Efficacy: The extent to which consumers believe their individual purchases contribute substantially to global decarbonization.

C_6 Greenwashing Concerns: Skepticism regarding the authenticity of "Net-Zero" claims, acting as a primary psychological barrier.

C. Technical & Functional Dimension (D_3)

C_7 Functional Performance: The ability of Net-Zero products to compete with traditional products in core utility (e.g., EV range, appliance efficiency).

C_8 Durability & Recyclability: The ease of repair, upgrade, or end-of-life circularity, reflecting technical value in a circular economy.

C_9 Perceived Technology Maturity: Confidence in the stability of Net-Zero technologies, determining the shift from early adopters to the mainstream.

D. Social & Policy Dimension (D4)

C_{10} Social Norms & Peer Pressure: The influence of social circles and the resulting conformity toward sustainable lifestyles.

C_{11} Policy Steering & Regulation: Impact of mandatory standards (e.g., ICE vehicle bans) or proactive government incentives.

C_{12} Information Transparency: The integrity and readability of product carbon footprints, labels, and environmental disclosures.

III. METHODOLOGY: DEMATEL FRAMEWORK

The Decision-Making Trial and Evaluation Laboratory (DEMATEL) method is selected for its capacity to transform complex interdependencies within a system into a structured Cause-and-Effect Diagram (Ojha, 2023). This study follows five standardized steps to develop an Network Relation Map (NRM) as follow.

Step 1: Construct the Direct-Relation Matrix. Experts rate the direct influence of factor i on factor j using a scale of 0 (no influence) to 4 (extreme influence), constructing a non-negative direct relationship matrix

$$X = [x_{ij}]_{n\times n}. \quad (1)$$

Step 2: Normalize the Matrix. Calculate the normalized direct-relation matrix N based on the maximum row/column sums: The matrix

$$N = s \cdot X, \quad (2)$$

$$s = \frac{1}{\max_{1\le i\le n} \sum_{j=1}^{n} x_{ij}}. \quad (3)$$

where

Step 3: Generate the Total-Influence Matrix. Compute matrix T, capturing both direct and indirect effects:

$$T = N(I - N)^{-1}, \quad (4)$$

where I is the identity matrix.

Step 4: Calculate Prominence and Relation. The rows and columns of matrix T are summed separately toobtain the degree of influence dispatcher

$$D_i = \sum_{j=1}^{n} t_{ij} \quad (5)$$

(Total influence of criterion i on the system) and degree of influence,

$$R_i = \sum_{i=1}^{n} t_{ij} \quad (6)$$

(Criterion i is subject to the total influence of the system).

The value of (D_i+R_i) indicates the prominence (centrality) of the factor, while (D_i-R_i) classifies the factor into the "cause group" if positive, or "effect group" if negative.

Step 5: Develop the Network Relation Map (NRM). A scatter plot is generated with (D_i+R_i) as the horizontal axis and (D_i-R_i) as the vertical axis to map the complete influence network topology.

IV. EXPECTED OUTCOMES, INTELLECTUAL PROPERTY, AND FUTURE VISIONS

Intellectual Property generated during the project's execution will be jointly owned by National Tsing Hua University and the University of Edinburgh. Looking forward, this study establishes a foundational stepping stone towards a permanent virtual or physical Taiwan-UK Joint Research Centre for Sustainable Social Behavior, where advanced Multi-Criteria Decision-Making systems—integrating DANP (DEMATEL-based Analytic Network Process) and VIKOR—will be developed to solve global circular economy scaling bottlenecks.

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