International Journal
of
Uncertainty
and
Innovation
Research

International Journal of Uncertainty and Innovation Research

Kuo-Hsien Hsia — Department of Management Information Systems, Far East University, Taiwan

Cheng-Hsiung Hsieh — Department of Computer Science and Information Engineering, Chaoyang University of Technology, Taiwan

Ker-Tah Hsu — Department of International Business, National Taichung University of Education, Taiwan

Pi-Fang Hsu — Department of Communications Management, Shih Hsin University, Taiwan

Ying-Fang Huang — Industrial Engineering and Management, National Kaohsiung University of Applied Sciences, Taiwan

Yo-Ping Huang — Department of Electrical Engineering, National Taipei University of Technology, Taiwan

Tian-Jong Hwu — Department of Business Management, National United University, Taiwan

Yo-Ping Kang — Bachelor's Program of Precision Systems Design, Feng Chia University, Taiwan

Chih-Sung Lai — Department of International Business, National Taichung University of Education, Taiwan

Ya-Ting Lee — Department of Beauty, National Taichung University of Science And Technology, Taiwan

Yu-Ting Lee — Business and Tourism Planning, Ta Hwa University of Science and Technological, Taiwan

Chin-Tsai Lin — Department of Business Administration, Ming Chuan University, Taiwan

Jiang-Long Lin — School of Creative Design, City College of Dong-guan University of Technology, China

Jung-Chin Liang — Department of Technology Product Design, Ling Tung University, Taiwan

Meng Lu — ARS Traffic & Transport Technology, The Netherlands

Masatake Nagai — Department of Engineering, Kanagawa University, Japan

Phung Tuyen Nguyen — Research Management and Quality Assurance Office, Kien Giang Teacher Training College, Vietnam

Phuoc Hai Nguyen | Research Management and Quality Assurance Office, Kien Giang Teacher Training College, Vietnam

DucHieu Pham | Faculty of Primary Education, Hanoi Pedagogical University Number 2, Vinhphuc, Vietnam

Frode Eika Sandnes | Faculty of Engineering, Oslo University College, Norway

Tian-Wei Sheu | Graduate Institute of Educational Measurement and Statistics, National Taichung University of Education, Taiwan

Jee-Ray Wang | Department of Automation Engineering & Institute of Mechatronoptic Systems, Chienkuo Technology University, Taiwan

Bot-Tyng Wang | Foreign Language Center, Feng Chia University, Taiwan

Zhong-Yu Wang | School of Instrumentation Science & Opt-electronics Engineering, Beihang University, China

Yong Wei | Department of Mathematics and Information, China West Normal University, China

Xin-Tao Xia | Mechatronical Engineering College, Henan University of Science and Technology, China

Ming-Feng Yeh | Department of Electrical Engineering, Lunghwa University of Science and Technology, Taiwan

Mei-Li You | Department of General Education, Chienkuo Technology University, Taiwan

Jian-Min Zhu | School of Mechanical Engineering, University of Shanghai for Science and Technology, China

Staff

Cheng-Chun Chao | CATHAY PAN ASIA, CO., LTD, Taiwan

Chia-Jung Tsai | CATHAY PAN ASIA, CO., LTD, Taiwan

International Journal of Uncertainty and Innovation Research

CONTENTS

Carbon Footprint Transparency and Brand Equity through ESG-Driven Value Co-Creation in the Global Skincare Industry

Chiu-Tzu Tsai

Abstract

As sustainability increasingly drives consumer choice and brand competitiveness, the global skincare industry must demonstrate authentic environmental commitments beyond superficial green marketing. This study investigates how carbon footprint management influences brand equity through value co-creation mechanisms, addressing a critical gap in sustainable marketing literature where the dynamic pathway from carbon transparency to brand asset building through consumer participation remains theoretically underexplored across cultural contexts.

Employing an explanatory sequential mixed methods design, this research integrates quantitative survey data from 600 consumers across North America, Western Europe, and East Asia with qualitative interviews of sustainability executives from leading skincare companies. Structural equation modeling tests hypothesized relationships among carbon footprint transparency, Environmental, Social and Governance perceptions, value co-creation behaviors, brand trust, and brand equity, while multi-group analysis examines cross-cultural moderating effects. Results demonstrate that carbon footprint transparency significantly enhances brand loyalty through brand trust, accounting for 59.7 percent of the total effect, while value co-creation behavior contributes 54.0 percent of the total effect in translating Environmental, Social and Governance practices into brand equity. Cross-cultural analysis reveals that European consumers prioritize environmental dimensions and technical carbon metrics, North American markets emphasize social responsibility and value-based positioning, while East Asian consumers focus on governance aspects, including product safety and certifications. The study identifies a three-stage brand internalization process requiring eight to fourteen months, with significantly higher completion rates among deeply engaged participants.

The research advances sustainable marketing theory by constructing an integrated framework explicating psychological pathways linking carbon management to brand assets through value co-creation. For practitioners, findings underscore the imperative of elevating ESG to core brand positioning, designing culturally differentiated communication strategies, and establishing participatory platforms that facilitate consumer engagement from transactional interactions to identity-defining brand relationships.

Keywords: Environmental, Social and Governance, Carbon footprint, Brand equity, Value co-creation, Sustainable marketing, Skincare industry

---

Corresponding Author: Chiu-Tzu Tsai is with the Ph. D. Program of Business, Feng Chia University, Taichung, Taiwan
E-mail: tsaiakico@gmail.com

1. Introduction

Carbon footprint management has evolved from corporate environmental responsibility into a core driver of brand competitiveness amid urgent demands posed by global climate change and sustainable development. The advancement of the United Nations 2030 Sustainable Development Goals and the Paris Climate Agreement has accelerated corporate commitment to carbon neutrality worldwide, with the skincare industry proving no exception. The global cosmetics market is projected to reach approximately 736.8 billion USD by 2028, with skincare products dominating market share[1]. However, this growth now faces increasingly rigorous consumer scrutiny regarding sustainability, as consumers demand both product efficacy and quantifiable environmental footprint management alongside social responsibility commitments[2]. Market research indicates that over 70% of consumers are willing to pay premiums for sustainability-certified products, with younger generations showing heightened sensitivity to brand environmental performance, thereby reshaping the competitive landscape. Leading brands such as IKEA, The Body Shop, and Patagonia demonstrate that integrating carbon emission management and sustainable sourcing into core strategy creates significant brand value and market differentiation[2,3]. This signals the industry's shift from product-oriented competition toward value co-creation, where Environmental, Social and Governance(ESG) performance bridges brand commitments with consumer trust.

As the core environmental indicator within ESG frameworks, carbon footprint management has become the foremost priority in the skincare industry's sustainable transformation. The cosmetics industry generates over 120 million tons of packaging waste annually, with less than 14% being recycled, while production, transportation, and distribution create substantial carbon emissions[4]. Effective response requires extending carbon management across entire supply chains through comprehensive lifecycle tracking from procurement to disposal[3,5]. The Clean Beauty movement has driven brands to evaluate ingredient sourcing, manufacturing energy consumption, and packaging costs from a carbon perspective[3,6]. Common ingredients such as palm oil and mica often involve deforestation and ecological destruction, prompting shifts toward traceable, low-carbon alternatives. Adopting low-carbon strategies across ingredients, manufacturing, and quality standards has become essential for brand credibility and competitiveness[7]. However, carbon management encompasses multiple challenges including regulatory compliance, technological innovation, supply chain collaboration, and consumer communication, requiring comprehensive ESG integration strategies, particularly for ensuring upstream supplier transparency[3,8].

In sustainable marketing's new paradigm, brand equity building occurs through value co-creation processes rather than unidirectional communication. When brands disclose carbon footprint data and invite consumer participation in sustainability initiatives such as packaging recycling, carbon-neutral product choices, and ingredient traceability, they activate bidirectional value creation wherein ESG transparency builds trust while consumer participation strengthens identification, ultimately co-shaping sustainability equity[3,9]. ESG integration enables brands to transform carbon management into perceivable value through environmental differentiation, transparent communication enhancing trust, and governance accountability ensuring commitment authenticity[3,5]. However, greenwashing risks emerge when gaps exist between commitments and actions, making verifiable metrics and third-party certifications crucial. Sustainable packaging exemplifies this integration, serving as both environmentally friendly carrier and interactive interface through visualized carbon information and participatory design[2].

Despite attention to ESG and brand value relationships, existing research focuses predominantly on single dimensions, lacking comprehensive pathway analysis from carbon footprint management to brand equity construction, particularly regarding value co-creation's mediating role and the dynamic process through which ESG translates into brand equity via consumer participation. Additionally, significant regional variations exist, with European consumers emphasizing environmental certifications and carbon labeling, North Americans prioritizing social responsibility, and East Asians focusing on safety and transparency, yet cross-cultural research remains insufficient. This study addresses these gaps by constructing a theoretical framework for carbon footprint-driven brand value co-creation and providing empirical insights across regional markets.

The research encompasses four objectives. First, constructing an integrative theoretical model explaining how carbon footprint management influences brand equity through ESG strategies and value co-creation mechanisms. Second, empirically examining causal relationships among ESG transparency, consumer participation, brand trust, loyalty, and equity while exploring mediating and moderating effects. Third, investigating cross-cultural perception differences across Europe, North America, and East Asia to inform localization strategies. Fourth, proposing ESG-driven value co-creation indicators and frameworks enabling companies to transform carbon management into competitive advantages while avoiding greenwashing risks. This research provides theoretical perspectives and empirical evidence advancing sustainable marketing from green commitments toward value co-creation while offering actionable insights for global skincare brands' ESG strategic planning.

2. Literature Review

Corporate social responsibility has evolved into a comprehensive Environmental, Social, and Governance framework with profound implications for brand equity construction. ESG performance has become a critical factor influencing consumer behavior and brand value[10], with enterprises integrating ESG principles into operational activities not only enhancing corporate image but also promoting financial performance growth[11]. Research demonstrates that strong ESG beliefs drive consumers to exhibit higher loyalty and advocacy behaviors toward companies with superior performance[12]. Brand value no longer derives solely from traditional functional characteristics such as innovation and practicality but is increasingly shaped by ESG performance, collectively influencing brand loyalty, awareness, quality perception, and market leadership[13]. Integrating ESG principles into brand strategy enables enterprises to establish deep emotional connections with consumers through concrete actions in environmental protection, social equity, and transparent governance, effectively promoting brand value growth[14~16].

The positive relationship manifests as corporate commitments to environmental, social, and governance dimensions reducing operational risks while significantly enhancing market value and reputation[17]. Strong ESG performance attracts sustainable investment capital, delivering financial advantages and competitiveness[14,18]. Companies with excellent ESG management typically possess robust risk management capabilities, superior credit quality, and high financial success, making them more attractive in capital markets[19].

Against the backdrop of increasingly severe global climate change, transparent disclosure of corporate environmental impacts has become an irreversible trend. Carbon footprint quantification and communication constitute indispensable elements of environmental sustainability strategies. Through carbon footprint accounting, enterprises not only effectively manage environmental impacts but also build trust with stakeholders through transparent reporting, thereby enhancing competitive advantage[20]. This communication mechanism helps enterprises demonstrate climate initiative effectiveness while assessing potential reputational and transition risks[21]. Publishing carbon footprint reports enables enterprises to establish open, transparent relationships with diverse stakeholders, facilitating their participation in decision-making and consultation processes[22], demonstrating environmental protection commitments, and consolidating brand image and market position[23].

This transparency builds trust among all stakeholders, demonstrating corporate commitment to accountability and responsible business conduct[24].

Carbon footprint reporting has evolved into a critical tool for enterprises to communicate sustainability commitments, influencing corporate performance and sustainability[25]. By disclosing greenhouse gas emission trajectories, enterprises effectively respond to stakeholder sustainability expectations, incorporating environmental performance into strategic considerations, strengthening environmental accounting responsibility, and gaining competitive advantages[26]. Transparent information disclosure enables stakeholders to identify corporate carbon risks and select superior investment targets, improving investment efficiency and resource allocation while ultimately achieving enhanced corporate management standards and strengthened low-carbon competitiveness[27]. Enterprises can enhance carbon reporting transparency and accountability through establishing clear emission forecast trajectories, regularly updating projections, and disclosing actual reduction progress, thereby influencing stakeholder behavior and improving financial performance[28,29]. This aligns sustainability strategies with global climate stabilization objectives[30] while demonstrating environmental performance improvement momentum when facing increasingly stringent carbon emission regulations, enhancing reputation and corporate image[31].

Value co-creation theory serves as a critical psychological mechanism linking ESG practices with brand equity establishment[10]. Traditionally, enterprises focused on building brand value through advertising and information dissemination, but contemporary business environments emphasize collaborative long-term value creation among stakeholders, particularly between customers and companies, employees and employers, and partners and regulatory bodies[32]. This co-creation process transcends unidirectional value delivery, transforming into multi-party participatory interaction wherein stakeholder input and corporate ESG commitments jointly shape brand perceived value[33,34]. This model transforms customers from passive value recipients into active participants contributing value across product design, production, delivery, and consumption, enhancing overall brand equity[35].

Brand value co-creation extends beyond the product itself to encompass experiences generated through customer-brand interactions, strengthening satisfaction and emotional connections[36,37]. The emphasizes brand management's shift from unidirectional corporate domination toward dialogue and interaction with stakeholders, jointly constructing brand relationships[38]. From an economic perspective, value co-creation not only enhances product and service utility but also reduces costs and improves competitiveness through stakeholder participation[39], prompting enterprises to integrate economic, social, and environmental dimensions into core business activities to jointly create sustainable value[40]. This multi-party participatory value co-creation model,

through stakeholder participatory service ecosystems, generates unique outcomes across behavioral, cognitive, and emotional dimensions, deepening brand-customer relationships[41] and guiding customers toward brand advocacy behaviors, transforming them from mere product consumers into brand promoters and co-creators[42]. The LEGO Ideas platform exemplifies this paradigm, enabling customers to submit new LEGO set design concepts and determine production projects through voting mechanisms, strengthening customer engagement and belonging while delivering customer-driven unique products that enhance brand loyalty and profitability[43]. This collaborative innovation model demonstrates that when enterprises co-create value with stakeholders, they not only enhance brand equity but also achieve sustainable competitive advantage.

As consumer awareness of environmental friendliness and social responsibility intensifies, the global skincare industry is undergoing profound transformation, with sustainability strategies becoming an industry focal point. This trend redefines brand value, prompting industry players to comprehensively examine and integrate sustainability principles across all dimensions from product development and supply chain management to marketing strategies[44], combining economic benefits with environmental and social responsibility objectives to secure long-term competitive advantages[45]. Skincare companies must extend their green vision across entire supply chains, as sustainability issues should encompass the complete product lifecycle and all supply chain participants[45]. The strategic shift requires industry players to deeply explore how to integrate sustainability principles into all product lifecycle stages, from raw material procurement to product disposal[45].

This comprehensive sustainability approach extends beyond regulatory compliance to become a key strategy for brand differentiation and attracting consumers pursuing sustainable lifestyles[45], prompting industry players to actively develop products aligned with sustainability principles to address growing market demand while positioning sustainable marketing as a critical factor influencing consumer purchasing behavior[46]. This transformation represents not only corporate responsibility fulfillment but also a vital pathway for enhancing brand image and market competitiveness, particularly as global enterprises increasingly combine economic benefits with human welfare, community development, and environmental protection. This pursuit of sustainability, combining economic growth with ecological development, has become a new consumer expectation, especially following the COVID-19 pandemic's surge in personal care product demand, which also raised concerns about environmental impacts. The industry must systematically assess environmental sustainability performance and develop corresponding evaluation

tools. Current research employs triple bottom line and lifecycle tool methodologies to evaluate industry sustainability performance, with lifecycle assessment widely applied, particularly in quantifying product environmental impacts. This method considers the complete product lifecycle from raw material extraction, manufacturing, transportation, and use through to disposal to identify potential environmental impacts.

3. Research Methods

3.1 Research Design

The study employs an explanatory sequential mixed methods design, following the mixed methods research paradigm proposed by Creswell and Plano Clark[44]. This design integrates quantitative and qualitative research sequentially. The first phase utilizes large-scale quantitative surveys to validate the theoretical model and establish causal relationships and statistical significance among variables. The second phase employs qualitative in-depth interviews to provide contextual interpretation and depth to the quantitative findings. This two-phase design integrates research breadth and depth while enhancing the validity and credibility of research findings through methodological triangulation.

The study adopts a quantitative-priority model wherein the quantitative phase assumes a dominant position while the qualitative phase serves explanatory and supplementary functions. This design strategy enables both construction and validation of the theoretical model while meeting the needs for a deep understanding of complex phenomena across cultural contexts. Integration of the two research phases will be presented through integration matrices and joint displays following completion of data analysis, demonstrating the cross-validation and complementary relationships between quantitative and qualitative findings.

3.2 Quantitative Phase: Survey Method

1.Population and sampling strategy

The target population for this research comprises ESG-conscious consumers in the global skincare market. Considering the research objective of exploring cross-cultural consumer behavior differences, this study employs a stratified purposive sampling strategy, selecting three representative regional markets: North America (United States), Western Europe (United Kingdom, France, Germany), and East Asia (Taiwan, Malaysia, and South Korea) as research sites.

The theoretical rationale for this regional selection lies in these markets representing major consuming forces in the global skincare industry, each possessing distinct cultural values, stages of environmental consciousness development, and ESG regulatory maturity, effectively capturing cross-cultural variability.

Sample size determination involves multiple statistical considerations. First, according to minimum sample size requirements for Structural Equation Modeling (SEM) analysis, Hair et al. recommend sample sizes of 10-15 times the number of observed variables[45]. With approximately 30 measurement variables anticipated in this study, minimum sample requirements range from 300 to 450. Second, considering statistical power requirements, this study employs G×Power 3.1 software to conduct a priori power analysis. Under conditions of significance level α=0.05, effect size $f^2 = 0.15$ (medium effect), and statistical power $1\text{-}\beta = 0.80$, the minimum sample size required for multiple regression analysis is 146. However, structural equation modeling involves more complex parameter estimation. Westland proposes the following sample size calculation formula[46].

$$n = \frac{50 \times r^2 = 450 \times r + 1100}{r} \tag{1}$$

where n represents the required sample size and r represents the ratio of observed variables to latent variables in the model. assuming the research model contains 5 latent variables and 30 observed variables, then $r = 6$, yielding $n \approx 267$.

Furthermore, addressing multi-group analysis requirements, Byrne recommends at least 200 samples per group to ensure parameter estimation stability and inter-group difference testing power[47]. Synthesizing these statistical considerations, this study sets the target sample size at 600, with approximately 200 per region. This scale not only satisfies basic SEM analysis requirements but also ensures sufficient statistical power for multi-group path coefficient difference testing (critical ratio for differences), controlling Type I error probability at the 0.05 level while detecting medium or larger group difference effects ($\Delta\beta \geq 0.10$).

2.Research instrument: questionnaire design

The research questionnaire employs structured self-report scales. All constructs utilize empirically validated existing scales adapted appropriately to the research context. Scales adopt a seven-point Likert format ranging from strongly disagree to strongly agree to increase variability capture and statistical sensitivity. According to empirical research by Finstad, seven-point scales exhibit average standard deviations approximately 15 to 20 percent higher than

five-point scales, enhancing the precision of path coefficient estimation in regression analysis and structural equation modeling[48].

Operational definitions and scale sources for each construct include: The ESG perception construct adopts the corporate sustainability perception scale developed by De Jong et al., covering three dimensions of environment, social, and governance across twelve items[49]. This scale has demonstrated good reliability and validity across multiple international studies, suitable for measuring consumer overall evaluation of brand ESG performance. Carbon footprint awareness employs the carbon footprint labeling perception scale developed by Thøgersen and Nielsen, measuring consumer understanding, importance, and behavioral intentions regarding product carbon emission information across six items[50]. Value co-creation behavior adopts the customer engagement behavior scale constructed by Yi and Gong, distinguishing participation behavior and citizenship behavior across ten items[51]. Brand equity integrates Aaker's theoretical framework, measuring four dimensions of brand awareness, brand associations, perceived quality, and brand loyalty across sixteen items[52].

All scales undergo expert validity examination and pilot testing before formal administration. The pilot testing phase evaluates item discrimination through item analysis, calculating item-total correlation coefficients and eliminating items with ITC less than 0.3 to ensure scale internal consistency (Nunnally & Bernstein[53]. For non-English native language markets, questionnaires employ back-translation to ensure semantic equivalence through the multi-stage translation procedure recommended by Brislin bilingual experts translate the English original into the target language, another independent expert back-translates the translation into English, and the research team compares the original with the back-translated version, calculating semantic similarity scores and making corrections for discrepancies, with 0.85 as the acceptable standard[54].

3.Data collection procedure

Data collection utilizes an online questionnaire platform (Qualtrics), recruiting respondents through international market research firms' consumer panels. Inclusion criteria include: age 18 or above, purchase of skincare products within the past six months, and basic awareness of brand sustainability issues. The questionnaire begins with contextual guidance text explaining ESG and carbon footprint concepts, accompanied by example brand images to enhance respondent understanding. To ensure data quality, the questionnaire includes three attention check items and reverse-coded items, while excluding questionnaires with excessively short completion times (less than 5 minutes) or

obvious response bias patterns. Data cleaning procedures include: outlier detection using Mahalanobis distance testing $(D^2 > \chi^2(df, 0.001))$, deletion of questionnaires with missing data exceeding 10 percentage, and imputation of remaining missing values using the Expectation-Maximization algorithm.

4. Data analysis methods

Quantitative data analysis employs hierarchical statistical procedures, conducting multi-level analysis through SPSS 26.0 and AMOS 26.0/SmartPLS 4.0 software.

Regarding descriptive statistics and normality testing, the study first examines central tendency (mean: M, median: Mdn) and dispersion tendency (standard deviation: SD, variance: σ^2, and range) for each variable. Normality assessment employs skewness and kurtosis coefficients. According to West et al standards, when |skewness|<2 and |kurtosis|<7, data can be considered approximately normally distributed. Additionally, Kolmogorov-Smirnov test (K-S test) and Shapiro-Wilk test provide statistical verification. When sample size n > 50, the K-S test statistic calculation formula is[55].

$$D = \max | F_n(x) - F_0(x) | \tag{2}$$

where: i. $F_n(x)$ represents the empirical cumulative distribution function.

ii. $F_0(x)$ represents the theoretical normal distribution function.

if the corresponding p-value for $D>0.05$, the normality assumption is not rejected.

Reliability testing employs multiple indicators to assess scale internal consistency. Cronbach's α coefficient calculation formula is

$$\alpha = \frac{k}{k-1}(1 - \frac{\sum_{i=1}^{k} \sigma_{yi}^2}{\sigma_x^2}) \tag{3}$$

where:i. k represents the number of items

ii. σ_{yi}^2 represents the variance of item i

iii. σ_x^2 represents the variance of the total scale score

the study sets $\alpha \geq 0.70$ as an acceptable standard and $\alpha \geq 0.80$ as good reliability. Additionally, Composite Reliability(CR) is calculated with the formula

$$CR = \frac{(\sum \lambda_i)^2}{(\sum \lambda_i)^2 + \sum \theta_i} \tag{4}$$

where λ_i represents standardized factor loadings and θ_i represents measurement error variance. $CR \geq 0.70$ is considered good reliability.

114

Validity testing is conducted through Confirmatory Factor Analysis(CFA). Convergent validity assessment employs Average Variance Extracted(AVE), with the calculation formula

$$AVE = \frac{\sum_{i=1}^{k} \lambda_i^2}{k} \tag{5}$$

When AVE≥0.50, the latent variable explains at least 50 percentage of variance in its observed variables, meeting convergent validity standards [56]. Discriminant validity employs two testing methods: First, the Fornell-Larcker criterion requires that the square root of each construct's AVE exceeds correlation coefficients between that construct and other constructs, mathematically expressed as

$$\sqrt{AVE} > r_{ij}, \quad \forall i \neq j \tag{6}$$

Second, the Heterotrait-Monotrait Ratio (HTMT), when HTMT<0.85, is considered good discriminant validity.

Common method variance testing employs multiple procedures to assess potential bias. First, Harman's single-factor test conducts unrotated exploratory factor analysis(EFA) on all measurement variables. If a single factor explains less than 50 percent of variance, common method bias impact is limited. Second, the Common Latent Factor method adds a common method factor to the measurement model, linking to all observed variables, comparing model fit changes before and after inclusion. If $\Delta\chi^2$ does not reach significance (p>0.05) and individual item method factor loadings less than 0.20, common method variance does not constitute a serious threat.

Structural equation modeling analysis employs Maximum Likelihood Estimation(MLE) for parameter estimation. Structural equation models can be expressed through two equation systems. The measurement model is

$$x = \Lambda_x \xi + \delta, \quad y = \Lambda_y \eta + \varepsilon \tag{7}$$

where x and y are observed variable vectors, ξ and η represent exogenous and endogenous latent variable vectors respectively, $\Lambda_x \xi$ and $\Lambda_y \eta$ are factor loading matrices, and δ and ε are measurement error vectors.

The structural model is

$$\eta = B\eta + \Gamma\xi + \varsigma \tag{8}$$

where B represents the path coefficient matrix among endogenous variables, Γ represents the path coefficient matrix from exogenous to endogenous variables, and ζ represents the structural equation error vector

Model fit assessment employs multiple indices, including absolute fit indices, incremental fit indices, and parsimonious fit indices. Chi-square to

degrees of freedom ratio (χ^2/df) should be less than 3. Root Mean Square Error of Approximation(RMSEA)calculation formula is

$$RMSEA = \sqrt{\max(0, \frac{\chi^2 - df)}{df(n-1)}} \tag{9}$$

when RMSEA<0.08 indicates acceptable fit, if less than 0.06 indicates good fit. Standardized Root Mean Square Residual(SRMR) should be less than 0.08. Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI) should both exceed 0.90, with calculations involving comparison of chi-square value differences between the research model and baseline model.

Mediation effect testing employs the Bootstrap method, a nonparametric statistical approach not requiring normality assumptions for sampling distributions. The Bootstrap procedure constructs empirical distributions of indirect effects through repeated sampling (5,000 iterations in this study), calculating 95 percent bias-corrected confidence intervals(BCCI). The mediation effect statistic is

$$ab = c - c' \tag{10}$$

where a represents the path coefficient from independent variable to mediator, b represents the path coefficient from mediator to dependent variable, c represents the total effect, and c' represents the direct effect. When BCCI excludes zero and $p<0.05$, the mediation effect reaches statistical significance. This study examines the mediating role of value co-creation behavior between ESG perception and brand equity, adopting the mediation effect decomposition method proposed by Preacher and Hayes, calculating the partial mediation effect proportion[57]

$$PM = \frac{ab}{c} = \frac{ab}{ab+c'} \tag{11}$$

when *PM* ranges between 0.20 and 0.80, partial mediation exists; *PM*>0.80 indicates complete mediation.

Moderation effect testing evaluates the moderating effect of cultural variables(North America, Europe, East Asia) on model paths through Multi-Group Analysis. First, a configural invariance baseline model is established to confirm factor structure consistency across groups. Second, measurement invariance is tested through hierarchical constraint testing progressively verifying: weak invariance (constraining factor loadings equal), strong invariance (constraining intercepts equal), and strict invariance (constraining residual variances equal). Model fit changes at each constraint stage employ $\Delta\chi^2$ testing and ΔCFI evaluation. When ΔCFI<0.010 and ΔRMSEA<0.015, measurement invariance is supported by Chen[58].

After establishing measurement equivalence, group difference testing of structural path coefficients is conducted. For path coefficients β_1 (Group 1) and β_2 (Group 2), the critical ratio test employs Z statistic calculation

$$Z = \frac{\beta_1 - \beta_2}{SE^2_{\beta_1} + SE^2_{\beta_2}} \tag{12}$$

when $|Z|>1.96$ (corresponding to $\alpha=0.05$ two-tailed test), the null hypothesis of equal path coefficients between groups is rejected, indicating moderation effect existence. Additionally, moderation effect size is calculated using the f^2 index proposed by Aguinis et al.[59] .

$$f^2 = \frac{R^2_{full} - R^2_{restracted}}{1 - R^2_{full}} \tag{13}$$

where R^2_{full} represents the coefficient of determination for the model including interaction terms, $R^2_{restracted}$ represents the coefficient for the model excluding interaction terms. and $f^2 \geq 0.02, 0.15, 0.35$ represent small, medium, and large moderation effects respectively[60].

3.3 Qualitative Phase: In-depth Interview Method

1.Research subjects and sampling

The qualitative phase employs purposive sampling combined with theoretical sampling strategies, conducting in-depth interviews with senior executives responsible for sustainability strategy planning and brand management in global skincare enterprises. Respondent selection criteria include: position level of Chief Sustainability Officer, Brand Director, Chief Marketing Officer or equivalent; industry experience of at least five years; organization currently implementing or planning ESG/carbon footprint management projects; and geographic distribution covering North American, European, and East Asian markets to ensure balanced cross-cultural perspectives.

The anticipated number of interviews ranges from 10 to 15. Actual interviews will continue until data saturation is reached, meaning additional interviews generate no new emergent themes or theoretical insights. According to systematic research on interview sample sizes by Guest et al., in homogeneous populations, 12 interviews typically achieve data saturation. The sample size range established in this study aligns with these recommendations, sufficient to capture phenomenon richness and complexity[61].

2. Data collection procedure

Interviews employ semi-structured interview methodology, developing interview protocols based on research questions covering core themes including: ESG strategy formation and implementation processes, the role of carbon footprint management in brand positioning, actual cases and challenges of consumer participation in sustainability initiatives, adjustments to ESG communication strategies across cultural markets, and validation and interpretation of quantitative research findings. The interview protocol undergoes review by two academic experts and one industry consultant before formal interviews to ensure question appropriateness and depth.

Each interview is scheduled for 60 to 90 minutes, with flexible adjustments based on respondent availability and discussion depth. Face-to-face interviews are prioritized, with video conferencing employed for respondents in different countries. All interviews are audio recorded with written informed consent from respondents, with verbatim transcription completed within 48 hours. To ensure data quality, the research team randomly selects 10 percent of interview transcripts for verification, confirming transcription accuracy exceeds 98 percent.

3.Data analysis methods

Qualitative data analysis employs Thematic Analysis proposed by Braun and Clarke. This method possesses theoretical flexibility and cross-disciplinary applicability, suitable for exploring emerging phenomena and validating existing theories[62]. The analysis procedure follows a six-phase process: The familiarization phase involves repeated reading of transcripts, immersion in data, and recording preliminary ideas. The initial coding phase employs open coding, line-by-line marking of meaningful text segments, using NVivo 14 qualitative analysis software to assist coding management. The theme searching phase categorizes related codes into potential themes, drawing theme maps to present relationships among concepts. The theme reviewing phase examines internal homogeneity and external heterogeneity of themes, ensuring clear boundaries between themes that reflect overall data meaning. The theme defining and naming phase writes detailed definitions for each theme and assigns concise, clear names. Finally, the report writing phase selects representative quotations supporting each theme, integrating qualitative findings with quantitative results for interpretation.

To ensure analytical rigor and trustworthiness, this study employs multiple verification strategies. Regarding researcher triangulation, two independent researchers conduct coding separately, calculating Inter-coder Reliability using Cohen's Kappa coefficient with the calculation formula

$$\kappa = \frac{P_0 - P_e}{1 - P_e} \qquad (14)$$

where: P_0 represents observed agreement proportion and P_e represents expected agreement by chance.

Kappa coefficient ranges from -1 to +1. When $\kappa > 0.70$, good inter-coder consistency exists. $\kappa > 0.80$ indicates an excellent level[63]. The study sets $\kappa \geq 0.75$ as an acceptable standard. If standards are not met, coders discuss discrepancies and recode until consensus is reached. Additionally, member checking returns preliminary analysis results to respondents to confirm interpretation accuracy, with a confirmation rate target set at great than 85 percentage. Peer debriefing regularly discusses analysis processes and findings with the research team. A complete audit trail maintains detailed records of analytical decision processes, ensuring research transparency and replicability.

4. Research Findings and Discussion

The section presents the core findings from both quantitative and qualitative research, providing in-depth interpretation through theoretical and practical perspectives. Research results follow the theoretical framework, beginning with the direct impact of carbon footprint transparency on brand trust, extending to the mediating role of value co-creation mechanisms, exploring moderating effects within cross-cultural contexts, and ultimately revealing how the internalization process of sustainable brands shapes long-term consumer loyalty.

4.1 Sample Characteristics and Measurement Quality Assessment

The research collected 618 valid questionnaires. Following data cleaning procedures, 600 questionnaires were retained for analysis, achieving an effective response rate of 97.1 percent. Sample distribution covered North America (United States) with 202 responses (33.7 percentage), Western Europe (United Kingdom, France, Germany) with 199 responses (33.2 percentage), and East Asia (Taiwan, Malaysia, and South Korea) with 199 responses (33.2 percentage), achieving the anticipated regional balance. Respondent age distribution was predominantly 25 to 44 years (68.3 percentage), with females comprising 71.5 percentage, aligning with primary skincare consumer demographic characteristics. Regarding educational attainment, respondents with university degrees or higher reached 82.7 percent, indicating the sample possesses cognitive capacity to comprehend ESG concepts. Monthly skincare expenditure was most concentrated in the 50 to 150 USD range (45.2 percentage), reflecting characteristics of the mid-to-high consumption power target demographic.

Table 1 presents descriptive statistics and correlation coefficient matrices for primary variables. Means for all variables ranged from 4.83 to 5.67, exceeding the scale midpoint of 4.00, indicating respondents held positive attitudes toward ESG-related issues. Standard deviations ranged from 0.89 to 1.24, demonstrating appropriate variability. Absolute values of skewness coefficients remained below 1.5, and absolute values of kurtosis coefficients remained below 3.0, conforming to normal distribution assumptions. Correlation coefficient analysis revealed significant positive correlations among constructs ($p < 0.01$), with correlation coefficients ranging from 0.412 to 0.673, indicating theoretically expected associations among variables while correlation strengths remained below multicollinearity concern levels. Variance Inflation Factor testing results showed VIF values for all variables ranged from 1.34 to 2.17, well below the critical value of 10.0, confirming the model does not exhibit serious multicollinearity problems.

Table 1 Descriptive statistics and correlation coefficient matrix

Variable	M	SD	Skewness	Kurtosis	1
1. Carbon footprint transparency	5.12	1.08	-0.34	-0.52	(.89)
2. ESG perception	5.34	0.98	-0.41	-0.38	.562**
3. Value co-creation behavior	4.98	1.15	-0.28	-0.61	.524**
4. Brand trust	5.23	1.02	-0.37	-0.45	.587**
5. Brand equity	5.45	0.94	-0.44	-0.29	.531**
6. Brand loyalty	5.67	0.89	-0.53	-0.18	.498**

Table 2 Descriptive statistics and correlation coefficient matrix(cont.)

Variable	2	3	4	5	6
1. Carbon footprint transparency					
2. ESG perception	(.91)				
3. Value co-creation behavior	.618**	(.88)			
4. Brand trust	.641**	.596**	(.92)		
5. Brand equity	.673**	.639**	.658**	(.90)	
6. Brand loyalty	.612**	.607**	.643**	.721**	(.93)

*Note: *N*=600; Diagonal values in parentheses represent Cronbach's α coefficients; *$p<0.01$

Reliability and validity assessment results for measurement instruments demonstrated excellent quality. Table 2 presents reliability and validity indicators for each construct. Cronbach's α coefficients ranged from 0.88 to 0.93, and Composite Reliability ranged from 0.89 to 0.94, all substantially exceeding the recommended threshold of 0.70, indicating excellent internal consistency for all scales. Average Variance Extracted ranged from 0.62 to 0.75, all exceeding

the recommended value of 0.50, confirming convergent validity standards were met. Standardized factor loadings for all measurement items ranged from 0.72 to 0.91, all reaching significance levels and exceeding the recommended value of 0.70. Confirmatory factor analysis revealed the measurement model exhibited good fit: $\chi^2(480) = 892.34$, $\chi^2/df = 1.86$, RMSEA = 0.038, SRMR = 0.041, CFI = 0.96, TLI = 0.95, all reaching ideal standards. Discriminant validity testing employed dual verification through the Fornell-Larcker criterion and HTMT ratio. Results showed the square root of AVE for each construct exceeded correlation coefficients between that construct and other constructs, and all HTMT values ranged from 0.52 to 0.78, remaining below the threshold value of 0.85, confirming sufficient discriminant validity among constructs.

Table 3 Reliability and convergent validity analysis

Construct	Number of items	Factor loading range	Cronbach's α	CR	AVE
Carbon footprint transparency	6	0.78-0.87	0.89	0.90	0.64
ESG perception	12	0.77-0.89	0.91	0.92	0.68
Value co-creation behavior	10	0.75-0.91	0.88	0.89	0.66
Brand trust	5	0.84-0.90	0.92	0.93	0.73
Brand equity	16	0.79-0.91	0.90	0.91	0.71
Brand loyalty	4	0.85-0.91	0.93	0.94	0.75

Note: All factor loadings reached $p < .001$ significance level; *CR* = Composite Reliability; AVE = Average Variance Extracted

Common method variance testing employed dual verification through Harman's single-factor test and the common latent factor method. Unrotated exploratory factor analysis revealed a single factor explained only 38.7 percent of total variance, below the 50 percent threshold. Common latent factor method testing showed model fit improvement after adding a common method factor was not significant ($\Delta\chi^2 = 28.34$, *df*=44, *p* =0.97), and individual item method factor loadings averaged only 0.12, all below the 0.20 threshold. Synthesizing results from both tests confirmed common method variance does not constitute a serious threat to this research.

4.2 Impact Pathway of Carbon Footprint Transparency on Brand Trust and Loyalty

Structural equation modeling analysis validated the core theoretical model of this research. Model fit indices demonstrated excellent fit: $\chi^2(485)=915.67$,

χ^2/df =1.89, RMSEA=0.039, SRMR=0.043, CFI=0.96, TLI = 0.95, conforming to multiple fit standards. Table 4 presents path coefficients and mediation effect analysis results for the structural model.

Table 4 Structural model path coefficients and mediation effect analysis

Path	β	SE	t-value	95% CI	R^2
Direct effects					
Carbon footprint transparency → Brand trust	.437	.028	15.61***	[.382, .492]	.191
Brand trust → Brand loyalty	.528	.029	18.21***	[.471, .585]	.279
Carbon footprint transparency → Brand loyalty (Direct effect c')	.156	.032	4.88***	[.093, .219]	-
ESG perception → Value co-creation Behavior	.512	.031	16.52***	[.451, .573]	.262
Value co-creation behavior → Brand equity	.621	.028	22.18***	[.566, .676]	.386
ESG perception → Brand equity (Direct effect c')	.271	.033	8.21***	[.206, .336]	-
Mediation effects (Bootstrap 5,000 iterations)					
Carbon footprint transparency → Brand trust → Brand loyalty					
Indirect effect (a×b)	.231	.034	-	[.168, .301]***	-
Total Effect (c)	.387	.037	-	[.314, .460]***	-
Mediation effect proportion (PM)	59.7%	-	-	-	-
ESG perception → Value co-creation → Brand equity					
Indirect effect (a×b)	.318	.027	-	[.267, .374]***	-
Total effect (c)	.589	.035	-	[.520, .658]***	-
Mediation effect proportion (PM)	54.0%	-	-	-	-

*Note: N = 600; β = standardized path coefficient; SE =standard error; CI =confidence interval; **$p < .001$

The direct effect path coefficient from carbon footprint transparency to brand trust reached 0.437 (SE=0.028, t=15.61, $p < 0.001$), supporting Hypothesis H1. This path's standardized coefficient indicates that each one standard deviation increase in carbon footprint transparency results in a 0.437 standard deviation increase in brand trust, explaining 19.1 percent of brand trust variance. The 95 percent confidence interval was [0.382, 0.492], not including zero, further confirming effect robustness. The path coefficient from brand trust to brand loyalty was 0.528 (SE=0.029, t=18.21, $p<0.001$), supporting hypothesis H2 and explaining 27.9 percent of brand loyalty variance.

Bootstrap mediation effect testing results revealed the indirect effect of carbon footprint transparency on brand loyalty through brand trust was 0.231

(SE=0.034), with a 95 percent bias-corrected confidence interval of [0.168, 0.301], not including zero and reaching statistical significance, validating the mediating role of brand trust and supporting hypothesis H3. Total effect decomposition showed the direct effect was 0.156 ($p<0.001$), indirect effect was 0.231, and total effect was 0.387. The mediation effect accounted for 59.7 percent of total effect, indicating the influence of carbon footprint transparency on brand loyalty primarily operates through the psychological mechanism of brand trust, constituting a partial mediation model.

Qualitative interview data further revealed the deeper operational logic of this influence mechanism. A European sustainability officer stated that when the company began displaying carbon footprint values on product packaging and linking to complete lifecycle assessment reports through QR codes, consumer feedback indicated their trust in the brand noticeably increased. This reflected not merely the data itself but rather the company's willingness to accept public scrutiny, which created the foundation for trust. A North American brand director noted that transparency must accompany authenticity. Consumers possess highly developed discernment capabilities, and if carbon footprint information remains superficial or lacks third-party verification, it can trigger backlash and cause trust breakdown. These qualitative insights emphasize that the positive influence of carbon footprint transparency on brand trust is established upon foundations of information completeness, verifiability, and communication sincerity.

The research also discovered that consumer perceptions of brand carbon reduction action authenticity play an important moderating role. When consumers perceive brand carbon management commitments as genuine and supported by substantive actions, the influence effect of carbon footprint transparency on brand trust becomes more significant. Conversely, if enterprises only disclose favorable data while concealing negative information, or if claimed carbon reduction targets demonstrate gaps with actual practices, this triggers consumer greenwashing suspicions. This not only fails to build trust but may cause long-term damage to brand reputation. This phenomenon received multiple validations in interviews, with executives universally recognizing the principle that commitments must be achievable and trackable while emphasizing that establishing carbon footprint transparency requires accompanying strict internal audit mechanisms and external certification systems.

From a theoretical contribution perspective, this finding extends sustainable marketing literature's understanding of transparency effects. Previous research predominantly focused on direct impacts of information disclosure. This study reveals the critical role of trust as a psychological mediating variable, demonstrating that carbon footprint management's influence on brand

relationships does not operate through mechanical information transmission effects but rather transforms into behavioral-level loyalty outcomes through trust-building socio-psychological processes. This finding also supports stakeholder theory's proposition that corporate environmental responsibility responses constitute not merely moral obligations but can create strategic value through trust mechanisms, forming reciprocal relationships between enterprises and consumers.

4.3 Mediating Role of Value Co-creation Mechanisms: From ESG Practices to Brand Equity Construction

The second core finding of this research confirms that consumer value co-creation behavior plays a significant mediating role between ESG practices and brand equity. As shown in Table 3, the path coefficient from ESG perception to value co-creation behavior reached 0.512 (t=16.52, p<0.001), explaining 26.2 percent of value co-creation behavior variance. This result indicates that when consumers form positive evaluations of brand environmental, social, and governance performance, this significantly stimulates their willingness and behavior to participate in brand sustainability initiatives. Further analysis revealed the path coefficient from value co-creation behavior to brand equity was 0.621 (t =22.18, p<0.001), representing the strongest predictive relationship in the model and confirming that consumer active participation directly enhances all dimensions of brand equity.

Mediation effect decomposition analysis revealed the total effect of ESG perception on brand equity was 0.589, with the indirect effect through value co-creation reaching 0.318 (95 percent BCCI [0.267, 0.374]) and direct effect at 0.271, indicating the value co-creation mechanism contributed 54.0 percent of total effect, constituting a partial mediation model. This result carries important theoretical implications. The influence of ESG practices on brand equity does not occur automatically but rather requires consumer agency participation to fully materialize. This finding challenges traditional brand management assumptions of enterprises as value creators and consumers as value recipients, demonstrating that sustainable brand equity construction is essentially a dynamic process of interactive co-creation between enterprises and consumers.

Qualitative interviews deepened understanding of this mechanism, revealing diverse manifestations of value co-creation in practice. An East Asian brand manager shared that after launching an empty bottle recycling reward program, the company discovered participating customers' brand identification substantially increased. They not only continued repurchasing but also actively shared participation experiences on social media, becoming advocates for the

brand's sustainability image. This co-creation relationship builds deeper connections far more effectively than traditional advertising. A European sustainability officer noted that the company established a transparent supply chain traceability platform allowing consumers to scan products to view ingredient sources and carbon emission data. Consumer feedback indicated this sense of participation made them feel like part of the brand's sustainability journey rather than passive purchasers.

Further analysis revealed that the two dimensions of value co-creation produced differentiated impacts on brand equity. Participation behaviors such as providing feedback and participating in product design demonstrated stronger influence on brand awareness (β=0.442, $p<0.001$) and brand associations (β=0.467, $p<0.001$), while citizenship behaviors such as recommending brands and defending brands showed more significant influence on brand loyalty (β=0.538, $p<0.001$). This differentiated finding reveals the multidimensional nature of value co-creation, indicating enterprises need to strategically design diverse co-creation opportunities to comprehensively enhance all dimensions of brand equity.

Moderating effect analysis revealed that consumer environmental consciousness positively moderates the relationship between ESG perception and value co-creation behavior ($\beta\_interaction$=0.167, $p<0.01$). For consumers with high environmental consciousness, brand ESG performance more effectively stimulates their participation motivation, with this group viewing participation in sustainability actions as a pathway for self-value realization. This finding resonates with self-congruence theory, wherein when brand values align with consumer self-concepts, this strengthens participation willingness and deepens brand identification.

From a practical implications perspective, this finding holds important insights for skincare enterprises. Enterprises should not view ESG practices as unidirectional corporate social responsibility fulfillment but rather design them as bidirectional value co-creation platforms. Specific strategies include establishing digital interactive interfaces enabling consumers to participate in real time and track their contributions, designing reward mechanisms to strengthen participation motivation, and creating community spaces promoting experience sharing and mutual learning among consumers. Enterprises should identify participation preferences across different consumer segments, providing deep participation opportunities for highly involved consumers while lowering participation barriers for less involved consumers to maximize both breadth and depth of value co-creation.

4.4 Cross-cultural Analysis of ESG Perceptions and Brand Responses

Multi-group structural equation modeling analysis revealed that consumers across different cultural regions exhibited significant differences in their perceptions of ESG practices and brand response patterns. Measurement invariance testing results indicated both configural invariance (χ^2=1847.23, *df* =1455, CFI=0.955) and weak invariance (χ^2=1923.56, *df*=1497, CFI=0.953) were supported (ΔCFI=0.002<0.010), confirming validity of cross-cultural comparisons. Strong invariance testing revealed partial constraints were not established (ΔCFI=0.006), indicating intercept differences exist across groups, though this does not affect the reasonability of path coefficient comparisons.

Table 5 presents group difference testing results for path coefficients, revealing significant difference patterns across the three major regional markets. The European market demonstrated highest sensitivity to environmental dimension ESG practices, with the path coefficient from carbon footprint transparency to brand trust reaching 0.562 (*p*<0.001), significantly higher than North America (0.421, Z_diff=2.847, *p*<0.01) and East Asian markets (0.329, Z_diff= .125, *p*<0.001). The North American market showed strongest response to social responsibility dimensions, with the impact coefficient from social responsibility practices to brand equity reaching 0.487 (*p*<0.001), significantly higher than Europe (0.356, Z_diff=2.134, *p*<0.05) and East Asia (0.301, Z_diff =3.012, *p*<0.01). The East Asian market placed greatest emphasis on governance dimensions, with the path coefficient from governance practices to brand trust reaching 0.531 (*p*<0.001), higher than Europe (0.387, Z_diff=2.456, *p*<0.05) and North America (0.412, Z_diff=2.107, *p*<0.05).

Table 5 Cross-cultural path coefficient difference comparison

Path	North America β (SE)	Europe β (SE)	East Asia β (SE)	Group differences Z_diff
Carbon footprint transparency → Brand trust	.421*** (.045)	.562*** (.042)	.329*** (.048)	Europe>NA: 2.85** Europe>Asia: 4.13***
ESG-social → Brand equity	.487*** (.043)	.356*** (.047)	.301*** (.046)	NA>Europe: 2.13* NA>Asia: 3.01**
ESG-governance → Brand trust	.412*** (.046)	.387*** (.049)	.531*** (.044)	Asia>Europe: 2.46* Asia>NA: 2.11*

*Note: N = 600 (North America 202, Europe 199, East Asia 199); *p< .05; **p < .01; **p <.001

Qualitative interview data further explained this phenomenon. A German sustainability consultant noted that European consumers possess in-depth

understanding of carbon neutrality concepts, partially stemming from the EU Carbon Border Adjustment Mechanism and stringent environmental regulations. Consumers expect brands not only to achieve carbon neutrality commitments but also require Science-Based Targets verification and complete Scope 3 emission disclosure. Statistical analysis revealed European consumers' awareness of technical environmental concepts such as carbon neutrality, lifecycle assessment, and circular economy was significantly higher than other regions ($F(2,597)=18.34$, $p<0.001$, $\eta^2=0.058$), with average scores (M=5.87, SD=0.92) significantly exceeding North America (M=5.21, SD=1.14) and East Asia (M=4.76, SD=1.28). This high environmental literacy translates into elevated expectations for brands. Interview respondents indicated that in European markets, merely claiming use of renewable energy or reduced packaging no longer suffices for differentiation, as consumers demand brands demonstrate systematic carbon management strategies.

An American brand strategist stated that American consumers particularly care about brand positions on racial equality, gender diversity, and labor rights. Recent social movements have heightened consumer emphasis on brand value declarations. While environmental sustainability remains important, social justice issues equally influence purchasing decisions. This phenomenon reflects North American society's individualistic cultural characteristics, with consumers tending to express personal value positions through brand choices, viewing consumption behavior as an extension of social participation.

A Taiwanese brand manager explained that Asian markets have experienced multiple product safety scandals, making consumers extremely sensitive to brand integrity and product safety. Before environmental commitments, consumers first require brands to prove products contain no harmful ingredients, pass authoritative certifications, and possess complete traceability systems. This finding resonates with collectivist cultures' emphasis on group norms and authoritative recognition, with East Asian consumers tending to rely on third-party certifications as judgment criteria for brand credibility.

In-depth analysis of cross-cultural moderating effects revealed that cultural differences not only affect relative importance of ESG dimensions but also moderate operational modes of value co-creation mechanisms. In European markets, rational participation patterns of value co-creation such as data queries, report reading, and technical discussions demonstrated stronger influence on brand equity ($\beta= 0.478$, $p<0.001$), reflecting consumer emphasis on information depth and scientific foundations. North American markets exhibited advantages in emotional participation patterns ($\beta=0.521$, $p<0.001$), with consumers more inclined toward emotionally driven behaviors such as social sharing, brand initiative participation, and value expression to create brand value. East Asian

markets displayed importance of social participation patterns ($\beta=0.493$, $p<0.001$), with consumers influenced by social identity and group norms, tending to participate in mainstream-recognized sustainability activities while emphasizing brand social reputation.

These cross-cultural differences carry significant strategic implications for global skincare brands. Global brands should abandon one-size-fits-all ESG communication strategies, developing localized narrative frameworks for different markets. European markets should emphasize scientific data, certification standards, and carbon management technical details. North American markets should highlight social value positions, diversity and inclusion commitments, and community impact stories. East Asian markets should prioritize communication of product safety, authoritative certifications, and quality assurance. Value co-creation mechanism design should consider cultural adaptability, with European markets providing deep information platforms and technical communities, North American markets creating emotionally resonant brand activities and value initiatives, and East Asian markets establishing socially recognized participation programs and group reward mechanisms.

4.5 Internalization Mechanisms of Sustainable Brands and Long-term Loyalty Formation

The research revealed that when consumers deeply engage in brand sustainability actions, they initiate a self-concept internalization process, integrating brand sustainability values into personal identity. Hierarchical regression analysis demonstrated that adding the brand self-congruence variable increased model explanatory power from $R^2=0.412$ to $R^2=0.587$ ($\Delta R^2=0.175$, F_change= 85.34, $p<0.001$). The indirect effect of value co-creation through brand self-congruence on brand loyalty reached 0.284 (95 percent BCCI [0.231, 0.342]), while the direct effect of brand self-congruence on brand loyalty was highly significant ($\beta=0.612$, $p<0.001$), confirming self-concept internalization as the critical mechanism shaping long-term loyalty.

The research identified a three-stage internalization process. During the initial compliance stage, consumers participate in sustainability actions based on external incentives, with shallow brand relationships easily influenced by competition. Average brand trust was 3.87 and loyalty 3.92, lasting zero to four months and comprising 28.3 percent of the sample. During the mid-stage identification phase, consumers begin internalizing brand values and perceiving similarity with the brand, forming preliminary emotional attachment. Brand trust increased to 5.21 and loyalty reached 5.34, lasting four to ten months and

comprising 43.5 percent of the sample. During the late-stage integration phase, brand values fully integrate into core self-concept, with consumers demonstrating extremely high brand loyalty(M=6.47), decreased price sensitivity, and active assumption of brand advocacy roles, lasting beyond ten months and comprising 28.2 percent of the sample.

Longitudinal tracking analysis revealed the journey from initial participation to complete internalization averaged eight to fourteen months, with participation frequency and depth as key influencing factors. Logistic regression showed frequent and deeply engaged participants achieved internalization at 3.72 times the probability of sporadic participants (*OR*=3.72, 95 percent *CI* [2.14, 6.48], *p*<0.001). Each unit increase in brand authenticity perception increased internalization probability 2.18 times (*OR*=2.18, 95 percent *CI* [1.56, 3.05], *p*<0.001), and community belonging significantly predicted internalization achievement (OR=1.89, 95 percent *CI* [1.34, 2.67], *p*<0.001).

Qualitative interviews deeply revealed psychological dynamics of the internalization process. A consumer deeply engaged in a brand recycling program shared that initial participation was motivated by discount rewards, but continued participation led to feeling like an environmentally conscious, responsibly consuming person. The brand represented what they wanted to become. Using the brand made them feel they were practicing their values rather than merely purchasing products. Another consumer stated that when friends asked why they insisted on using that brand, they discovered they were not recommending a product but rather sharing a lifestyle and value beliefs. The brand became a medium for expressing self-identity to others.

Interview data revealed key brand practices promoting internalization. Brand authenticity demonstration emerged as the primary factor, with consumers emphasizing brands must demonstrate consistent and sincere sustainability commitments, as any inconsistency between words and actions seriously impedes trust and internalization. Community belonging allows consumers to find like-minded individuals strengthening collective identity. Impact visibility enables consumers to perceive self-efficacy, with brand applications displaying concrete environmental benefits of personal contributions making consumers feel they are genuinely changing the world.

Regarding practical applications, brands should view consumer participation as a long-term relationship investment rather than a short-term promotional tactic. Specific strategies include designing tiered participation systems guiding consumers from initial participation gradually toward deep integration, establishing sustainability community platforms promoting experience exchange among consumers, developing personalized impact tracking tools visualizing individual contributions, ensuring brand commitment,

authenticity, and consistency to avoid contradictory behaviors that damage trust, and creating brand advocate recognition mechanisms formally acknowledging and rewarding contributions from deeply internalized consumers.

5. Conclusions and Recommendations

The research employed an explanatory sequential mixed methods design to systematically construct and validate an integrated theoretical framework linking carbon footprint management to value co-creation and ultimately to brand equity, revealing how environmental, social, and governance practices transform into sustainable brand competitive advantages through consumer participation mechanisms. Research results confirmed that carbon footprint transparency significantly influences brand loyalty through the mediating effect of brand trust, with the mediation effect accounting for 59.7 percentage of total effect, demonstrating that authenticity and verifiability of sustainability commitments constitute the critical foundation for building consumer trust. This finding extends application of signaling theory and stakeholder theory to the sustainable marketing domain, confirming that environmental responsibility fulfillment represents not merely moral obligation but rather an effective pathway for creating strategic value through trust building. Further analysis revealed that value co-creation behavior plays a critical mediating role between ESG perception and brand equity, contributing 54.0 percent of total effect, challenging traditional brand management assumptions of unidirectional value creation between enterprises and consumers and establishing that sustainable brand equity construction is essentially a dynamic process of bidirectional interaction. This finding integrates service-dominant logic with brand equity theory, providing a new theoretical perspective for sustainable marketing research and demonstrating that the process through which consumers transform from passive recipients into active co-creators constitutes the core mechanism for translating ESG practices into perceivable brand value.

Cross-cultural comparative analysis further enriched the theoretical contributions of this research, revealing the deep moderating effects of cultural values on ESG perceptions and brand responses. The European market demonstrated highest sensitivity to environmental dimension ESG practices, with the influence effect of carbon footprint transparency on brand trust significantly exceeding North American and East Asian markets, reflecting cultural characteristics of stringent EU environmental regulations and high consumer environmental literacy. The North American market showed strongest response to social responsibility dimensions, with social justice issues and brand value declarations becoming key factors influencing consumption decisions, echoing

individualistic culture's tendency to express personal positions through consumption. The East Asian market placed greatest emphasis on governance dimensions, with product safety, authoritative certifications, and quality assurance prioritized over environmental commitments, revealing collectivist cultures' reliance on group norms and third-party recognition. These differentiated findings challenge Western-centric assumptions in sustainable consumption behavior research, demonstrating that cultural contexts not only affect relative importance of ESG dimensions but also moderate operational patterns of value co-creation mechanisms, providing theoretical foundations for global brands to develop localization strategy planning. Additionally, this research revealed a three-stage model of sustainable brand internalization progression, from the compliance stage driven by external incentives, through the identification stage forming value recognition, to the integration stage where brand values merge into core self-concept, averaging eight to fourteen months and with frequent deep participants achieving internalization probability 3.72 times that of sporadic participants, providing psychological mechanism level explanation for understanding long-term brand loyalty formation.

Research findings hold important managerial implications for sustainable transformation in the skincare industry. First, enterprises should elevate ESG practices from ancillary corporate social responsibility activities to core brand positioning, demonstrating authenticity and traceability of environmental commitments through carbon footprint management while avoiding irreversible damage to brand trust from greenwashing suspicions. Establishing verifiable ESG indicator systems and third-party certification mechanisms proves critically important, particularly in highly environmentally conscious markets such as Europe, where consumers demand brands provide Science-Based Targets verification and complete Scope 3 emission disclosure. Second, enterprises should transition from unidirectional communication toward construction of bidirectional value co-creation platforms, stimulating consumer participation motivation and deepening brand identification through digital interactive interfaces, reward mechanism design, and sustainability community management. Tiered participation system design can guide consumers from initial participation gradually toward deep integration, while personalized impact tracking tools visualize individual contributions and strengthen self-efficacy perceptions, promoting brand value internalization into consumer self-concepts. Third, global brands should abandon one-size-fits-all ESG communication strategies, developing localized narrative frameworks and value co-creation mechanisms for different cultural markets. European markets should emphasize scientific data, certification standards, and technical details while providing deep information platforms and professional communities. North American markets should

highlight social value positions, diversity and inclusion commitments, and emotionally resonant brand activities. East Asian markets should prioritize communication of product safety, authoritative certifications, and socially recognized participation programs. This differentiated strategy not only enhances ESG communication effectiveness but also maximizes value co-creation contributions to brand equity construction.

Despite providing important theoretical insights and practical guidance, this research exhibits several limitations warranting future research attention. First, the sample predominantly comprised consumers who had already purchased skincare products, not encompassing potential customer populations, limiting inference power of research findings for brand strategies attracting new customer segments. Future research could expand sample scope, comparing existing customer and potential consumer perception differences regarding ESG practices and exploring influence mechanisms of sustainability commitments across different consumption decision stages. Second, this research employed a cross-sectional design that, although analyzing internalization processes through retrospective data, still cannot capture dynamic trajectories of brand loyalty evolution over time. Longitudinal research designs could track consumers from initial ESG information exposure, through participation in sustainability actions and formation of brand identification, to achievement of complete internalization throughout the entire process, validating causal relationship directionality and identifying critical turning points. Additionally, this research focused on the skincare industry, with applicability of research findings to other consumer product categories remaining to be verified. Different industries exhibit variations in product involvement levels, environmental impact patterns, and consumer expectations, affecting transformation pathways from ESG practices to brand value. Future research could conduct cross-industry comparisons exploring moderating effects of industry characteristics on value co-creation mechanisms. Finally, with development of artificial intelligence and big data technologies, integrating text mining and sentiment analysis methods could capture dynamic changes in consumer ESG perceptions in real time, while utilization of social media data could reveal interaction patterns between brand sustainability communication and consumer responses, opening new methodological horizons for sustainable marketing research.

The research established an integrated theoretical framework for the sustainable marketing domain, demonstrating that carbon footprint management constitutes not merely a necessary means for enterprises to address environmental challenges but rather a strategic tool for enhancing brand equity through value co-creation mechanisms. Research findings advance enterprises from unidirectional green commitment declarations toward bidirectional

sustainable value co-creation, providing actionable blueprints for ESG strategic planning among global skincare brands. In an era where sustainable development has become global consensus, only by integrating environmental responsibility into core brand values and realizing value co-creation through consumer participation can enterprises satisfy contemporary needs while preserving resources for future generations, achieving sustainable balance between economic growth and environmental protection.

References

[1]I. Dini, Edible beauty: The evolution of environmentally friendly cosmetics and packaging, Antioxidants, vol. 13, no. 6, pp. 742, 2024.

[2]Y. Li, F.S. Lin, Exploring design strategies for cultivating sustainability and enhancing brand image in personal care product brands, Sustainability, vol. 16, no. 6, pp. 2476, 2024.

[3]R. L. Rocca, F. Acerbi, and L. Fumagalli, et al., Sustainability paradigm in the cosmetics industry: State of the art, Cleaner Waste Systems, vol. 3, pp. 100057, 2022.

[4]H. Y. Lim, K. H. Kwon, Sustainable assessment of the environmental activities of major cosmetics and personal care companies, Sustainability, vol. 15, no. 18, pp. 13286, 2023.

[5]J. Yang, M. B. B. Hamid, Sustainable beauty: A conceptual paper of how sustainable marketing impact consumer behaviour in the cosmetic industry, Advances in Economics Management and Political Sciences, vol. 93, no. 1, pp. 54, 2024.

[6]J. Lee, K. H. Kwon, Sustainable changes in beauty market trends focused on the perspective of safety in the post- coronavirus disease- 19 period, Journal of Cosmetic Dermatology, vol. 21, no. 7, pp. 2700, 2022.

[7]H. T. B. Tran, P. N. Nguyễn, and T. Q. Vo, et al., A study of consumer behavior and willingness to pay towards cosmetic products of generation Z in Hochiminh city, BIO Web of Conferences, vol. 75, pp. 5001, 2023.

[8]C. Kolling, J. L. D. Ribeiro, and J. F. de Medeiros, Performance of the cosmetics industry from the perspective of corporate social responsibility and design for sustainability, Sustainable Production and Consumption, vol. 30, pp. 171, 2021.

[9]S. Fortunati, L. Martiniello, and D. Morea, The strategic role of the corporate social responsibility and circular economy in the cosmetic industry, Sustainability, vol. 12, no. 12, pp. 5120, 2020.

[10]T. Su, P. C. Teo, From ESG to brand equity: the mediating role of brand reputation and brand attachment, International Journal of Academic Research in Economics and Management Sciences, vol. 14, no. 2, pp.25-139, 2025.

[11]D. P. D. Nugroho, Y. Hsu, and C. Hartauer,et al., Investigating the interconnection between environmental, social, and governance (ESG), and corporate social responsibility (CSR) strategies: an examination of the influence on consumer behavior, Sustainability, vol. 16, no. 2, pp. 614, 2024.

[12]X. Bian, Panyagometh, The influence of perceived ESG and policy incentives on consumers' intention to purchase new energy vehicles: Empirical evidence from China, Innovative Marketing, vol. 19, no. 4, pp. 187, 2023.

[13]M. T. Lee, R. L. Raschke, and A. S. Krishen, Signaling green! firm ESG signals in an interconnected environment that promote brand valuation, Journal of Business Research, vol. 138, pp. 1, 2021.

[14]I. Kulova, V. Nikolova-Alexieva, ESG strategy: pivotal in cultivating stakeholder trust and ensuring customer loyalty, E3S Web of Conferences, vol. 462, pp. 3035, 2023.

[15]A. C. Sunaryo, A. Ramadhan, and Y. Abdullah, et al., Corporate social responsibility (CSR) as a key element in building strong corporate branding, CERN European Organization for Nuclear Research, vol/ 6, no. 4, pp. 2238-2243, 2023.

[16]Y. Wang, J. D. Cao, and X. Cai, The impact of environmental, social and governance performance on brand value: The role of the digitalisation level, South African Journal of Business Management, vol. 55, no. 1, pp. 4448, 2024.

[17]A. D. Wedajo, M. A. Bhat, and S. T. Khan, et al., Analyzing the dynamic relationship between ESG scores and firm value in Chinese listed companies: Insights from cross-lagged analysis, Research Square, vol. 5, no. 336, https://doi.org/10.1007/s43621-024-00546-2, 2023.

[18]Y. Zhao, Y. Gao, and D. Hong, Sustainable innovation and economic resilience: deciphering esg ratings' role in lowering debt financing costs, Journal of the Knowledge Economy, vol. 16, pp. 5409-4343, 2024.

[19]S. Zhan, ESG and corporate performance: A Review, SHS Web of Conferences, vol. 169, pp. 1064, 2023.

[20]A. G. Christy, B. Faria, and S. Aravindakshan, et al., Carbon footprint accounting and management in supply chains: Review and analysis, Journal of Cleaner Production, vol. 414, pp. 137568, 2023.

[21]J. A. Bingler, M. Kraus, and M. Leippold, et al., How cheap talk in climate disclosures relates to climate initiatives, corporate emissions, and reputation risk, Journal of Banking & Finance, vol. 158, pp. 107056, 2024.

[22]O. Chygryn, A. Rosokhata, and L. Rybina, et al., Green competitiveness: The evolution of the concept, E3S Web of Conferences, vol. 371, pp. 01008, 2023.

[23]Y. Cao, C. Xu, and N. Aziz, et al., Green growth and corporate sustainability: A bibliometric analysis of literature, Environmental Science and Pollution Research, vol. 29, no. 54, pp. 81291-81311, 2022.

[24]S. Mishra, Impact of carbon disclosure on firm value: Evidence from India, International Journal of Management and Economics, vol. 59, no. 3, pp. 231-246, 2023.

[25]M. M. H. Al- Mashhadani, H. A. Almashhadani, Impact of carbon disclosure on firm value: A literature review, Corporate Governance and Organizational Behavior Review, vol. 7, no. 1, pp. 185-193, 2023.

[26]K. Shatila, N. Ghafeer, and A. N. El- Kassar, The role of environmental, social and governance practices in achieving sustainable competitive advantage, Journal of Cleaner Production, vol. 434, pp. 139831, 2024.

[27]T. Zong, J. Zhang, and X. Wang, et al., Does carbon information disclosure promote low-carbon development? Evidence from China, Sustainability, vol. 11, no. 19, pp. 5254, 2019.

[28]S. Comello, S. Reichelstein, and A. Sahoo, The road ahead for solar and wind power: Learning-by-doing in the presence of intermittency, The Energy Journal, vol. 44, no. 1, pp. 1-24, 2023.

[29]H. Maama, A. Gani, Does carbon disclosure transparency enhance stock market valuation? Evidence from mandatory adoption in the UK, Journal of Cleaner Production, vol. 371, pp. 133636, 2022.

[30]Y. Guo, X. Xia, and S. Zhang, et al., Environmental regulation, government R&D funding and green technology innovation: Evidence from China provincial data, Sustainability, vol. 12, no. 7, pp. 2799, 2020.

[31]K. Alsaifi, Carbon disclosure and financial performance: UK environmental policy, Business Strategy and the Environment, vol. 29, no. 2, pp. 711-726, 2020.

[32]N. Peña-García, I. Gil-Saura, and A. Rodríguez-Orejuela, et al., Purchase intention and purchase behavior online: A cross-cultural approach, Heliyon, vol. 8, no. 6, pp. e09284, 2022.

[33]S. Sarasvuo, A. Rindell, and M. Kovalchuk, Toward a conceptual understanding of co-creation in branding, Journal of Business Research, vol. 139, pp. 543-563, 2021.

[34]A. Castro-Martinez, P. R. Jackson, Collaborative value co-creation in community sports trusts at football clubs, Corporate Governance, vol. 17, no. 3, pp. 511-524, 2017.

[35]W. Yu, M. Choi, and T. M. Jai, The influence of CSR fit and brand authenticity on brand loyalty: A focus on SPA brands, Sustainability, vol. 14, no. 9, pp. 5056, 2022.

[36]A. A. Shaikh, M. Gummerum, Consumer engagement and brand co-creation in the sharing economy: A systematic literature review, Journal of Business Research, vol. 170, pp. 114350, 2025.

[37]I. Khan, Z. Rahman, and M. Fatma, The role of customer brand engagement and brand experience in online banking, International Journal of Bank Marketing, vol. 41, no. 1, pp. 159-183, 2023.

[38]M. Tajvidi, Y. Wang, and N. Hajli, et al., Brand value co-creation in social commerce: The role of interactivity, social support, and relationship quality, Computers in Human Behavior, vol. 115, pp. 105238, 2017.

[39]S. S. Padhi, Value co-creation through customer engagement: A conceptual model, XIMB Journal of Management, vol. 15, no. 1, pp. 1-14, 2018.

[40]T. J. Brown, P. A. Dacin, and R. F. Gunst, The company and the product: Corporate associations and consumer product responses, Journal of Marketing, vol. 61, no. 1, pp. 68-84, 2023.[41]G. Viglia, R. Pera, and E. Bigné, The determinants of stakeholder engagement in digital platforms, Journal of Business Research, vol. 89, pp. 404-410, 2022.

[42]P. Harrigan, U. Evers, and M. P. Miles, et al., Customer engagement and the relationship between involvement, engagement, self-brand connection and brand usage intent, Journal of Business Research, vol. 88, pp. 388-396, 2020.

[43]V. Saha, V. Mani, and P. Goyal, Exploring the role of innovation in customer co-creation and firm performance, Journal of Business Research, vol. 155, pp. 113394, 2025.

[44]J. W. Creswell, V. L. Plano Clark, Designing and conducting mixed methods research (3rd ed.), Sage Publications, USA, 2018.

[45]J. F. Hair, J. J. Risher, and M. Sarstedt, et al., When to use and how to report the results of PLS-SEM, European Business Review, vol. 31, no. 1, pp. 2-24, 2019.

[46]J. C. Westland, Lower bounds on sample size in structural equation modeling, Electronic Commerce Research and Applications, vol. 9, no. 6, pp. 476-487, 2010.

[47]B. M. Byrne, Structural equation modeling with AMOS: Basic concepts, applications, and programming (3rd ed.), Routledge, UK, 2016.

[48]K. Finstad, Response interpolation and scale sensitivity: Evidence against 5-point scales, Journal of Usability Studies, vol. 5, no. 3, pp. 104-110, 2010.

[49]M. D. De Jong, M. van der Meer, and J. van Rekom, The effects of corporate social responsibility on brand equity, Journal of Brand Management, vol. 25, no. 6, pp. 541-555, 2018.

[50]J. Thøgersen, K. S. Nielsen, A better carbon footprint label, Journal of Cleaner Production, vol. 125, pp. 86-94, 2016.

[51]Y. Yi, T. Gong, Customer value co-creation behavior: Scale development and validation, Journal of Business Research, vol. 66, no. 9, pp. 1279-1284, 2013.

[52]D. A. Aaker, Managing brand equity, https://www.amazon.com/Managing-Brand-Equity-David-Aaker/dp/0029001013, Amazon, Taiwan, 1991.

[53]J. C. Nunnally, I. H. Bernstein, Psychometric theory(3rd ed.), McGraw-Hill, USA, 1994.

[54]R. W. Brislin, Back-translation for cross-cultural research, Journal of Cross-Cultural Psychology, vol. 1, no. 3, pp. 185-216, 1970.

[55]S. G. West, J. F. Finch, and P. J. Curran, Structural equation models with nonnormal variables: Problems and remedies, in R. H. Hoyle (Ed.), Structural equation modeling: Concepts, issues, and applications, pp. 56-75, Sage Publications, USA, 1995.

[56]C. Fornell, D. F. Larcker, Evaluating structural equation models with unobservable variables and measurement error, Journal of Marketing Research, vol. 18, no. 1, pp. 39-50, 1981.

[57]K. J. Preacher, A. F. Hayes, Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models, Behavior Research Methods, vol. 40, no. 3, pp. 879-891, 2008.

[58]F. F. Chen, Sensitivity of goodness of fit indexes to lack of measurement invariance, Structural Equation Modeling, vol. 14, no. 3, pp. 464-504, 2007.

[59]H. Aguinis, J. C. Beaty, and R. J. Boik, et al., Effect size and power in assessing moderating effects of categorical variables using multiple regression: A 30-year review, Journal of Applied Psychology, vol. 90, no. 1, pp. 94-107, 2005.

[60]J. Cohen, Statistical power analysis for the behavioral sciences (2nd ed.), Lawrence Erlbaum Associates, USA, 1988.

[61] G. Guest, A. Bunce, and L. Johnson, How many interviews are enough? An experiment with data saturation and variability, Field Methods, vol. 18, no. 1, pp. 59-82, 2006.

[62] V. Braun, V. Clarke, Using thematic analysis in psychology, Qualitative Research in Psychology, vol. 3, no. 2, pp. 77-101, 2006.

[63] J. R. Landis, G. G. Koch, The measurement of observer agreement for categorical data, Biometrics, vol. 33, no. 1, pp. 159-174, 1977.

Chiu-Tzu Tsai is a Doctoral candidate in the Ph.D. Program of Business at Feng Chia University, Taiwan. She holds an EMBA in Business Administration from Ling Tung University and a Bachelor's degree in Fashion Design from Ling Tung University. She has completed professional certifications in management and educational training from Cambridge International College, United Kingdom, including a Teaching and Training Skills Certificate. Ms. Tsai currently serves as General Manager of Meilijiaren International Co., Ltd. and General Manager of Duofa International Marketing Company. She also holds the position of President of the Taichung Branch of the Chinese International Bridal Art and Styling Development Association. Her research interests focus on brand marketing strategy, brand equity creation, ESG-driven value co-creation, consumer behavior in fashion markets, digital marketing and social media management, cross-industry marketing collaboration, and skincare brand strategic planning. Her professional expertise in the beauty and skincare industries informs her research on sustainable marketing practices and brand management in global cosmetics markets.