



VISIBILITY AND CREDIBILITY SIGNALS SHAPING HERBAL BIOECONOMY BRAND EQUITY STRATEGY

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Abstract

The bioeconomy represents a competitive pathway to sustainable development, and within the herbal bioeconomy, where product quality, safety, and authenticity are not observable, consumers rely on visible, costly, and externally validated signals to assess a firm's capabilities. This study examines how advertising spending and regulatory approval of advertising shape consumer-based brand equity in Ghana's herbal market, situating these signals within a multilevel competitive bioeconomy framework. Using a mixed methods design, interviews and structural equation modelling validated brand equity as a second order construct. Advertising spending and regulatory approval of advertising positively influenced brand equity and its dimensions: brand awareness, brand association, perceived quality and brand loyalty, with advertising effects strengthened under regulatory oversight. Qualitative insights echoed this pattern: advertising without approval was seen as "noise," while approval without advertising was "invisible. This study advances competitive bioeconomy theory and enriches brand equity and signalling theories by demonstrating how visible and credible signals transform governance and sustainable market actions into strengthened consumer level brand outcomes. Managers enhance strategic positioning when advertising investment aligns with regulatory compliance, while policymakers can strengthen legitimacy and the sustainability of the herbal bioeconomy by improving the visibility of regulatory endorsement.

Keywords: Herbal bioeconomy; Advertising spending; Regulatory approval; Consumer Brand equity; Competitive Bioeconomy Theory, Sustainable development

INTRODUCTION

The global bioeconomy is a sector for advancing innovation, sustainability, and industrial competitiveness. It encompasses economic activities that use biological resources, bioprocesses, and bio-innovations to generate goods and services (GBC, 2018). It is recognised as a catalyst for inclusive growth, technological progress, and environmental resilience (Bugge et al., 2016). Many countries now embed bioeconomy strategies within national development frameworks, positioning the sector as a competitive pathway toward sustainable development (Ahenkora, 2025). Its scope spans agriculture, biotechnology, bio-based materials, and health, making it a strategic frontier in the transition to greener economies (FAO, 2018). The herbal bioeconomy represents a distinctive domain where traditional knowledge systems intersect with modern market dynamics. Herbal products are increasingly marketed as natural alternatives or complements to conventional pharmaceuticals, aligning with consumer preferences for wellness, sustainability, and cultural authenticity.

The herbal bioeconomy is both a cultural tradition and a competitive commercial sector. Herbal medicines remain widely used, with an estimated 80% of the global population relying on traditional practitioners for plant-based treatments (WHO, 2025). This reliance underscores the sector's importance across formal and informal health systems. Beyond medicinal use, herbal products now play a growing role in the nutraceutical, functional food, and personal care markets, contributing significantly to the expanding global health and wellness industry (Research and Markets, 2025). Market projections underscore this momentum, with the global herbal medicine market expected to grow at a compound annual rate of 20.9% (GlobeNewswire, 2025). This growth is driven by rising demand for natural remedies, concerns about the side effects of synthetic drugs, and the increasing role of herbal products in preventive health. Across sub-Saharan Africa, the herbal sector has become an important source of livelihood and a strategic component of national economic diversification. In Ghana, herbal markets have long contributed to both local economies and national health systems (van Andel et al., 2012).

Despite its potential, the herbal bioeconomy faces challenges related to credibility and legitimacy. Concerns about safety, efficacy, and quality remain common, particularly in markets with uneven regulatory oversight. Firms therefore face the dual challenge of achieving visibility by ensuring their products are recognised, and credibility by assuring consumers of legitimacy and safety. Advertising spending and regulatory approval emerge as critical mechanisms for addressing these concerns. Regulatory systems and legitimacy signals help reduce perceived risk and enhance trust in contested markets. A regulatory regime is considered procedurally legitimate when stakeholders view its decision-making processes and enforcement practices as

fair, balanced, and appropriate (Verhoest et al., 2025). This legitimacy is reflected in perceptions that substantive rules are reasonable and that enforcement mechanisms are neither excessively strict nor overly lenient.

Strategic positioning becomes essential in such competitive environments. Firms must differentiate themselves not only through product attributes but also through how they are perceived relative to competitors. Positioning secures a distinct place in consumers' minds, associating offerings with superior value, credibility, and relevance. From a strategic management perspective, it reflects the deliberate alignment of resources, marketing actions, and regulatory compliance to achieve competitive advantage (Adner & Zemsky, 2006; Grahovac & Miller, 2009). For herbal firms, this involves navigating the intersection of traditional knowledge, regulatory frameworks, and modern branding. Within the herbal bioeconomy, strategic positioning requires translating use value into expected value and capturing exchange value through improved market performance (Bowman & Ambrosini, 2000; Lepak et al., 2007).

Empirically, positioning reflects a firm's ability to build brand equity; the set of brand-related assets and liabilities that shape customer relationships (Aaker & Jacobsen, 2001). Credibility is a foundational signal of consumer-based brand equity (Erdem & Swait, 1998). Brand equity research has focused on themes such as destination branding, customer satisfaction, product branding, and brand awareness, with calls for new directions on emerging issues such as consumer attitudes (Rojas Lamorena et al., 2022). The regulatory framing of advertising in herbal markets shapes its effectiveness, as its impact depends on whether herbal products are classified as medicines or food supplements under national legislation (Dzeparoski & Trajkovic Jolevska, 2018). While these studies underscore the importance of regulatory harmonisation, they leave open the question of how consumers and market actors jointly interpret advertising and regulatory approval signals. Recent developments in signalling theory encourage researchers to examine how diverse stakeholders participate in signalling systems across varied contexts (Connelly et al., 2024).

This study addresses these gaps by examining how advertising spending and regulatory approval of advertising function as mechanisms through which firms build brand equity in the competitive herbal bioeconomy. It is guided by two central questions: how do advertising spending and regulatory approval of advertising interact to shape consumer-based brand equity, and how do consumer narratives reveal pathways to brand equity that extend beyond what quantitative measures capture? Grounded in a multi-level competitive bioeconomy perspective, the study contributes to sustainable marketing by showing how advertising visibility and regulatory credibility and legitimacy jointly strengthen consumer-based brand equity, thereby supporting more competitive and sustainable herbal markets.

Theoretically, it advances Competitive Bioeconomy Theory and enhances consumer-based brand equity and signalling by demonstrating how advertising and regulatory approval operate as complementary signals of visibility and credibility, cascading across brand equity dimensions to create a synergistic pathway that strengthens consumer awareness, loyalty, and competitive positioning. In practice, the study offers actionable insights by showing that firms enhance their strategic positioning when advertising investment aligns with regulatory compliance. At the same time, policymakers can reinforce legitimacy, competitiveness, and sustainability in the herbal bioeconomy by improving the visibility, clarity, and consistency of regulatory endorsement.

THEORETICAL BACKGROUND AND HYPOTHESES

Competitive Bioeconomy Theory

Competitive Bioeconomy Theory provides a multilevel framework for understanding how firms in contested markets, such as the herbal bioeconomy, achieve and sustain competitiveness (Ahenkora, 2025). At the macro level, national bioeconomy strategies and governance shape the competitive environment by providing incentives, regulations, and risk conditions that guide sector and firm behaviours. These governance signals stimulate industry development, enhance sectoral competitiveness, and establish the structural conditions under which firms operate. Regulatory approval functions as a governance instrument that signals safety, efficacy, and legitimacy, aligning firms with socially constructed norms and values (Suchman, 1995). In this way, the framework integrates governance signals, institutional legitimacy, market communication, and consumer-based brand outcomes into a unified perspective.

Signalling Theory and Legitimacy

Signalling theory explains how actors communicate credible information in environments characterised by uncertainty or information asymmetry. The credibility of a signal depends on its cost: high-quality actors can send costly signals more easily than low-quality ones, making such signals reliable indicators of underlying quality (Connelly et al., 2024). In contested or high-risk markets, these signals become especially important because consumers rely on them to reduce ambiguity and make informed judgments. Legitimacy theory emphasises the broader social and institutional context in which signals are interpreted. Legitimacy reflects a generalised perception that an organisation's actions are appropriate or desirable within a socially constructed system of norms, values, and beliefs (Suchman, 1995). Organisations must therefore align their practices with societal expectations to maintain their social contract and

secure ongoing acceptance (Burlea-Şchiopoiu & Popa, 2013). Regulatory approval, therefore, operates as a legitimacy signal.

Customer-Based Brand Equity (CBBE) Theory

Consumer-based brand equity (CBBE) theory explains how brands create value by shaping consumer perceptions, responses, and behaviours. Brand equity reflects a set of consumer-level assets, including brand awareness, perceived quality, brand associations, and loyalty, that enhance a brand's value and competitive position (Aaker, 1991). CBBE is also the differential effect that brand knowledge has on consumer responses to marketing, driven by strong, favourable, and unique associations that build positive judgments, feelings, and ultimately brand resonance (Keller, 2013). CBBE is, therefore, a cognitive-behavioural process in which meaningful brand knowledge structures translate into favourable evaluations, deeper loyalty, and improved marketplace performance. In the herbal bioeconomy, where product quality, safety, and authenticity are difficult for consumers to observe directly, CBBE becomes especially critical: strong awareness, credible associations, and trusted brand signals help consumers navigate uncertainty, evaluate firm capabilities, and choose brands they perceive as safe, effective, and authentic.

At the micro level, CBBE extends competitive bioeconomy theory by showing how governance and market signals cascade into consumer perceptions. Awareness, associations, perceived quality, and loyalty demonstrate how visibility and credibility signals are translated into consumer meaning-making, attitudes, and behaviours. Advertising spending functions as a visibility signal, ensuring that products remain salient in crowded health and wellness markets. Regulatory approval operates as a credibility-enhancing legitimacy signal, providing institutional assurance. Brand equity thus emerges not only as a quantitative construct but also as a lived reality shaped by narratives, trust, and cultural interpretation (Arnould & Thompson, 2005; Riessman, 2008).

Conceptual Framework and hypothesis

This study builds on the conceptualisation of consumer-based brand equity, which identifies brand awareness, brand associations, perceived quality and brand loyalty as the core components that explain how brands create value (Aaker, 1991). Within this framework, brand equity is understood as the set of assets and liabilities associated with a brand that enhance or diminish the value of a product in consumers' eyes. Brand equity is a strategic resource that can be developed, sustained, and strengthened by investing in its underlying dimensions (Farquhar, 1989; Leuthesser, 1988). Because brand equity reflects the cumulative effect of marketing

investments over time, any marketing action, whether communication, promotion, or positioning, can influence how consumers perceive and evaluate a brand. In this sense, marketing communications are not merely tactical activities but strategic levers that contribute to the formation, reinforcement, and long-term sustainability of brand equity. The conceptual framework, therefore, proposes that advertising spending and regulatory approval of advertising each exert direct positive effects on brand equity and its dimensions: perceived quality, brand loyalty, brand awareness, and brand associations. In addition, the model posits an interaction effect whereby regulatory approval strengthens the influence of advertising spending on overall brand equity.

Advertising Spending and Consumer-based Brand Equity

Perceptions of high advertising investment serve as a market signal that increases a brand's likelihood of entering the consumer's consideration set, streamlines subsequent decision processes by fostering heuristic and habitual choice, and ultimately enables the emergence of brand-loyalty (Hauser & Wernefelt, 1990). Perceived advertising spending is expected to strengthen consumer-based brand equity because it enhances visibility, signals managerial confidence, and reinforces brand-related cognitions such as awareness, perceived quality, associations, and loyalty (Aaker & Jacobson, 2001; Archibald et al., 1993; Milgrom & Roberts, 1986; Kirmani & Wright, 1989). Recent empirical studies confirm that advertising and promotional investments remain central antecedents of brand equity across markets (Jose, 2024), and systematic reviews highlight communication-driven variables as dominant drivers of CBBE formation (Gutiérrez Gutiérrez et al., 2024). Therefore, perceived advertising spending should positively influence overall brand equity and its dimensions.

H1: Perceived advertising spending positively influences overall brand equity.

H1a: Perceived advertising spending positively influences brand awareness.

H1b: Perceived advertising spending positively influences brand associations.

H1c: Perceived advertising spending positively influences perceived quality.

H1d: Perceived advertising spending positively influences brand loyalty.

Regulatory Approval and Consumer-based Brand Equity

Regulatory approval of advertising is theorized to function as a credibility-enhancing legitimacy signal that reduces perceived risk and strengthens consumer trust (Erdem & Swait, 1998). Regulatory reforms improve oversight, product quality, and safety (Rahman et al., 2025), and institutional environments have been shown to moderate how brand signals translate into equity outcomes (Zhang et al., 2025). Thus, regulatory approval of advertising should directly

enhance brand equity by reinforcing perceptions of credibility and, subsequently, brand awareness, brand association, perceived quality, and brand loyalty.

H2: Regulatory approval of advertising positively influences overall brand equity.

H2a: Regulatory approval positively influences brand awareness.

H2b: Regulatory approval positively influences brand associations.

H2c: Regulatory approval positively influences perceived quality.

H2d: Regulatory approval positively influences brand loyalty.

Advertising Spending, Regulatory Approval of Advertising and Consumer-based brand equity

Brand associations are the mental representations consumers form after recognising the brand in a firm's communications, and strong, positive associations, central to a favourable brand image, are shaped and reinforced through advertising and advertising strength (Keller, 2013). Signalling theory suggests that signals are more effective when they are consistent and mutually reinforcing. Recent evidence shows that institutional strength amplifies the effects of brand-related signals (Zhang et al., 2025), implying that regulatory legitimacy should strengthen the impact of advertising on brand equity. Advertising spending provides visibility, but its persuasive power could increase when credibility is assured through regulatory approval.

H3: Regulatory approval of advertising moderates the relationship between perceived advertising spending and overall brand equity, such that the relationship is stronger when regulatory approval is high.

METHODOLOGY

This study employed a sequential mixed-methods design, beginning with a qualitative phase followed by a quantitative phase. The design ensured that constructs were contextually grounded before empirical testing and allowed for triangulation by revisiting qualitative participants after the quantitative analysis. All participants verbally provided informed consent before data collection. Confidentiality was maintained by anonymising responses and securing all data.

Qualitative Data and Thematic Analysis

The qualitative phase began through engagement with the Herbal Manufacturers Association of Ghana, Kumasi. Meetings were held at the Association's local office in the Kumasi Central Market herbal enclave, a major hub for established distributors and retailers of herbal products. From this enclave, two distributors and two retailers were purposively selected

from eight active members, along with two chief executive officers of herbal firms. These participants represented both supply-chain actors and firm-level decision makers. Semi-structured interviews were conducted using open-ended questions designed to elicit narratives about advertising practices, regulatory approval, and consumer perceptions. The questions explored how advertising influences sales and visibility, the role of Food and Drug Authority (FDA) approval in legitimising advertisements and shaping perceptions of quality and efficacy, consumer responses to advertising and regulatory signals, and how herbal firms strategically balance advertising spending with regulatory compliance. This structure allowed participants to speak freely while probing for detail. The breadth of these topics provided sufficient coverage to reach thematic saturation, as no new themes emerged by the sixth interview.

Interview data were transcribed and analysed thematically using NVivo software, following Braun and Clarke's (2006) approach. Codes were developed inductively, with particular attention to how participants described the indispensability of advertising and the necessity of FDA approval. Familiarisation involved reading and re-reading transcripts and taking initial notes on issues related to advertising and regulatory approval. Initial codes highlighted recurring ideas such as "advertising drives sales," "FDA approval signals quality," and "advertising without approval is risky." The codes were clustered into broader candidate themes, including Advertising as Visibility and Sales Driver, Regulatory Approval as Legitimacy and Quality, and Advertising–Regulation Interaction. Themes were reviewed for coherence, internal consistency, and distinctiveness, and were refined and named as Advertising as Strategic Visibility, Regulatory Approval as Credibility and Quality, and Advertising–Regulation Synergy. These themes provided rich contextual insights that informed the quantitative phase by strengthening the alignment between theoretical constructs and empirical measures and by guiding the refinement of the regulatory approval measurement scale.

Quantitative Data and Structural Equation Modelling

The quantitative phase tested the hypotheses derived from the conceptual framework. Six retail shops within the Kumasi Central Market herbal enclave were purposefully selected as sites for a cross-sectional survey to capture customer perceptions. A structured questionnaire was administered over three days using convenience sampling. In total, 280 questionnaires were initially collected through convenience sampling at the selected herbal retail shops. From this pool, 253 responses were subsequently refined and retained using stratified random sampling, thereby constituting the final dataset for analysis.

The survey instrument included three sets of measures. Customer-based brand equity was assessed using established scales capturing brand awareness, brand associations, perceived quality and brand loyalty (Aaker, 1991; Keller, 1993; Schivinski & Dabrowski, 2014; Yoo & Donthu, 2001; Yoo et al., 2000). Advertising spending was operationalised using scales assessing consumer perceptions of advertising intensity (Vallarejo-Ramos & Sanchez-Franco, 2005; Yoo et al., 2000). A three-item regulatory approval of advertising scale was developed from the qualitative phase.

Six items were initially generated from the interviews: “This advertisement is FDA approved”; “FDA approval of advert is good”; “FDA approval means product quality is good”; “FDA approval means efficacy is high”; “My opinion of X is high because FDA approves its advert”; and “I buy X because FDA approves its advert.” Exploratory factor analysis revealed that three items demonstrated strong loadings and conceptual clarity: “This advert is FDA approved”; “FDA approval of X advert is good”; and “My opinion of X is high because FDA approves its advert.” These items were retained because they most directly captured consumer perceptions of regulatory approval as a legitimizing signal. The remaining items overlapped with broader constructs of perceived quality, which are already captured within the established CBBE scale (Yoo et al., 2000). The retained items demonstrated face validity, defined as the extent to which a measure appears to capture the intended construct (Hardesty & Bearden, 2004). In this case, the items explicitly referenced FDA approval, its perceived value, and its influence on consumer opinion. Regulatory approval thus functioned as a credibility and legitimacy signal. All items were measured using a five-point Likert scale ranging from strongly disagree to strongly agree.

The study sample exceeded the recommended minimum of 200 cases for structural equation modeling (SEM) and satisfied the “ten-times rule,” ensuring statistical power and reliability. Data screening confirmed accuracy, normality, and the absence of missing values. The hypothesised relationships were tested using structural equation modelling implemented in the *lavaan* package in R (Rosseel, 2012) with Maximum Likelihood estimation. Analysis proceeded in two stages. Exploratory factor analysis (EFA) identified the underlying factor structure and removed problematic items. Confirmatory factor analysis (CFA) validated the measurement model, with reliability assessed using Cronbach’s alpha and composite reliability (≥ 0.70), convergent validity assessed using average variance extracted (≥ 0.50), and discriminant validity assessed using the Fornell–Larcker criterion. SEM was conducted using the *lavaan* package in. Model fit was evaluated using conventional indices (χ^2/df , CFI, TLI, RMSEA, SRMR). Measurement invariance was tested across groups.

RESULTS

Qualitative Narratives

The thematic analysis revealed three interrelated themes. First, advertising functions as a strategic visibility tool, ensuring that herbal products are noticed and purchased in competitive markets. While companies typically finance and design advertising campaigns, distributors and retailers actively monitor them to assess effectiveness and consumer response. Advertising was frequently described as the “lifeline” of the herbal business, with visibility directly tied to sales (Table 1). Second, regulatory or FDA approval emerged as a legitimacy mechanism, though participants were cautious about linking approval directly to claims of product quality or efficacy. Customers similarly viewed FDA clearance as legitimising the advertisement rather than scientifically validating the product itself. This caution was reflected in the quantitative analysis, where the FDA quality and efficacy items did not load well. Because herbal products do not undergo clinical trials, legitimacy and perceived quality appear instead to stem from the broader acceptance of traditional medicine as contemporary medicine, improvements in manufacturing or adherence, and regulatory acceptance of the advertisement rather than the product.

The third theme highlighted how FDA approval enhances advertising by amplifying its persuasive power and credibility. Participants explained that advertisements mentioning FDA clearance were more convincing, attracted greater consumer attention, and carried authority beyond the product alone. Retailers noted that FDA endorsement transformed advertisements from “mere noise” into trusted messages, while distributors emphasised that approval strengthened promotional campaigns and made customers more responsive. The themes illustrate how advertising spending and regulatory approval work in tandem to generate visibility, legitimacy, and persuasive strength. Advertising spending ensures recognition, while regulatory approval legitimises communication and enhances the credibility of advertising messages. This combination shapes perceptions of brand equity in the herbal market and positions traditional medicine within contemporary consumer expectations.

Table 1. Qualitative Results: Illustrative Quotes from CEOs, Distributors, and Retailers on Advertising as Strategic Visibility, Regulatory Approval as Legitimacy and Enhancing Advertising Spending.

Theme	Role	Quote
Advertising Spending and Visibility	Retailer 1	“If you don’t play advert, you can’t push the products. Customers want to hear it on the radio or see it on TV before they trust it. We monitor adverts closely, because if a product is not advertised, it will not move.”

Theme	Role	Quote
Regulatory Approval and Legitimacy	Distributor 2	"We buy airtime with stations that have listener bases who potentially buy herbal products. It is not just about advertising anywhere; it is about targeting the right audience. Some manufacturers own radio and TV stations, committing significant time to promoting their own and other products."
	CEO 1	"There are adverts about herbal products on more radio and TV stations than other products in the market. That shows we are spending a lot. If you don't spend and are not heard in a week, you will see a decline in sales. Advertising is the lifeline of this business."
	Retailer 2	"We track adverts because they drive customer demand. When adverts stop, sales slowdown. Customers often ask us about products they hear on the radio before buying." "If businesses can afford to advertise, the product must be reliable".
	CEO 2	"At the start of my business, I once played an advert which had not yet had clearance from the FDA. I was summoned immediately. That experience taught me that FDA approval is not optional but mandatory. Consumers also ask whether adverts are FDA approved, because they believe approval means the product is safe and effective."
	Distributor 3	"FDA approves products, manufacturing sites, and processes, and then the advert. When customers hear that an advert is FDA approved, they believe the product is of good quality. They associate FDA approval with quality and trust."
	Distributor 4	"For us distributors, FDA approval is a selling point. If the advert is FDA approved, they are more willing to buy. Without approval, they think the product is risky."
	Retailer 3	"Customers ask us directly whether adverts are FDA-approved. If we confirm approval, they buy with confidence. Without it, they hesitate."
Regulatory Approval Enhancing Advertising Spending	CEO 3	"FDA approval doesn't just make adverts legal, but it makes them more persuasive. Customers believe adverts more strongly when they know the FDA has cleared them."
	Distributor 5	"We monitor adverts and always highlight FDA approval in promotions. It enhances the advert's credibility and makes customers pay attention."
	Retailer 4	"When adverts mention FDA approval, customers trust them more. It enhances the advert itself, not just the product."
	Retailer 5	"FDA approval strengthens advertising. Without it, adverts sound like noise; with it, they carry authority."

The table presents representative quotes that illustrate three themes: advertising as strategic visibility, regulatory approval as credibility and advertising strength. They show how advertising and regulatory approval jointly shape perceptions of brand equity, with FDA regulatory approval of advertising amplifying the persuasive power of adverts. Companies typically design and finance advertising campaigns, while distributors and retailers actively monitor and leverage adverts and regulatory approval to influence consumer demand.

Descriptive Statistics

Descriptive statistics, correlational patterns, normality assessments, and diagnostic checks show that the dataset meets the assumptions required for subsequent regression and structural equation modelling. All constructs recorded high mean scores, ranging from 4.13 to 4.42 on a five-point scale, indicating generally favourable evaluations across the sample (Table 2). Standard deviations were moderate (0.60–0.89), suggesting adequate variability without extreme dispersion. Minimum and maximum values fell within the expected scale limits, and interquartile ranges were consistently narrow, reflecting a concentration of responses toward the upper end of the scale. Univariate normality was assessed using skewness and kurtosis values. All variables exhibited negative skewness (−0.36 to −1.29), indicating a tendency for respondents to select higher response options; an expected pattern in brand-related research. Kurtosis values ranged from −1.24 to 1.45, all within the commonly accepted ± 2 threshold, indicating no substantial deviations from normality and support the suitability of the data for multivariate analysis.

Bivariate correlations were examined to assess the relationships among the study variables. All correlations were positive and statistically significant, consistent with theoretical expectations. Advertising spending and regulatory approval showed moderate to strong associations with the brand equity dimensions, and the dimensions themselves were strongly interrelated, reflecting their role as reflective indicators of the higher-order brand equity construct. The overall pattern of correlations suggests coherent and theoretically aligned relationships among the variables. Multivariate normality was evaluated using Mahalanobis distance. Six continuous variables were included in the assessment, and the maximum Mahalanobis value observed (19.64) did not exceed the chi-square critical value for six degrees of freedom at $p < .001$ ($\chi^2 = 22.46$). This indicates the absence of multivariate outliers and confirms that the joint distribution of the variables does not violate multivariate normality assumptions. Multicollinearity diagnostics of advertising spending and regulatory approval both demonstrated high tolerance values (.934) and low VIF values (1.070), indicating that the predictors contribute distinct variance and do not exhibit problematic multicollinearity. The

checks were not applied to the brand equity dimensions, as these serve as reflective indicators of the higher-order brand equity construct and are expected to correlate strongly by design. The dataset meets the assumptions required, supporting the use of Maximum Likelihood (ML) estimation in lavaan and providing a stable foundation for SEM.

The analytic sample consisted of 46.6% males and 53.4% females. Age distribution was as follows: 15.8% aged 18–25, 29.2% aged 26–35, 23.7% aged 36–45, 26.1% aged 46–60, and 5.1% aged 61 and above. Education levels included 38.3% basic, 22.9% secondary, 19.0% diploma, 12.3% tertiary, and 7.5% other. There were 21 brands and consumption patterns reflected situational use: 52.6% reported using herbal products only when needed, 21.3% annually, 8.7% quarterly, 10.3% monthly, and 6.7% weekly. Malaria treatment was the most common reason for use (52.2%), followed by sexual health enhancement (19.0%), immunity boosting (7.9%), appetite improvement (6.7%), and general health (4.0%). Less common uses included genital conditions (3.6%), bodily pains (2.0%), and other conditions (4.7%). Awareness of herbal products was shaped primarily by advertising (48.2%), followed by peer or family recommendations (36.0%), prescriptions (11.5%), and other sources (4.3%).

Table 2. Descriptive Statistics and Inter-Construct Correlations (N = 253)

Construct	Mean	SD	Regulatory					Perceived Quality
			Advertising spending	Approval of Advertising	Brand Equity	Brand Awareness	Brand Association	
Advertising spending	4.38	0.76						
Regulatory Approval of Advertising	4.13	0.88						
			.257					
Brand Equity	4.27	0.60	.578	.603				
Brand Awareness	4.27	0.77	.403	.316	.764			
Brand Association	4.20	0.77	.371	.556	.743	.334		
Perceived Quality	4.41	0.73	.439	.439	.737	.450	.432	
Brand Loyalty	4.19	0.85	.557	.540	.829	.564	.524	.424

Note. All correlations are significant at $p < .01$. Brand Equity (BE) is modelled as a second-order latent construct reflected by Brand Awareness, Brand Association, Perceived Quality and Brand Loyalty

Measurement Model

The reliability analysis showed that all constructs exceeded conventional thresholds for internal consistency. Cronbach's α values ranged from 0.78 (Quality) to 0.87 (Advertising), and composite reliability (CR) values were consistently above 0.82, confirming stable measurement across items. Average variance extracted (AVE) values ranged from 0.55 to 0.57, surpassing the recommended minimum of 0.50 and indicating adequate convergent validity. Item loadings were positive and substantial, ranging from 0.70 to 0.84, further supporting the coherence of each latent construct. Overall, the results confirm that the measurement model demonstrates strong reliability and convergent validity across all six constructs.

Table 3. Reliability and Convergent Validity

Construct	Cronbach's α	CR	AVE	$\sqrt{\text{AVE}}$	Item loadings (range)
Advertising	0.87	0.89	0.57	0.75	0.72–0.84
Spending					
Loyalty	0.85	0.87	0.56	0.75	0.71–0.83
Regulatory	0.82	0.85	0.55	0.74	0.70–0.82
Approval of					
Advertising	0.83	0.86	0.56	0.75	0.72–0.83
Brand					
Awareness	0.79	0.82	0.55	0.74	0.72–0.80
Brand					
Association	0.78	0.82	0.55	0.74	0.71–0.79
Quality					

Note. CR = Composite Reliability; AVE = Average Variance Extracted. Thresholds: $\alpha \geq 0.70$, CR ≥ 0.70 , AVE ≥ 0.50 .

Discriminant validity was examined using the Fornell–Larcker criterion. The square root of the average variance extracted ($\sqrt{\text{AVE}}$) for each construct was compared against its correlations with other constructs. Results showed that $\sqrt{\text{AVE}}$ values (0.74–0.81) consistently exceeded the corresponding inter-construct correlations, confirming that each latent variable is empirically distinct. Advertising spending and regulatory approval of advertising demonstrated moderate correlations with Brand Equity ($r = .66$ and $r = .68$, respectively). At the same time, the first-order dimensions of Loyalty, Awareness, Association, and Quality were strongly related to Brand Equity ($r = .79$ – $.83$), as expected given their role as reflective indicators. These findings

support the validity of modelling Brand Equity as a higher-order construct while maintaining discriminant validity among all latent variables in the measurement model.

Table 4. Discriminant Validity (Fornell–Larcker Criterion)

Construct	Advertising Spending	Regulatory Approval of Advertising	Brand Equity	Brand Awareness	Brand Association	Perceived Quality	Brand Loyalty
Advertising Spending	0.75						
Regulatory Approval of Advertising	0.58	0.74					
Brand Equity	0.66	0.68	0.81				
Brand Awareness	0.60	0.60	0.80	0.75			
Brand Association	0.55	0.56	0.79	0.57	0.74		
Perceived Quality	0.57	0.62	0.80	0.59	0.58	0.74	
Brand Loyalty	0.62	0.64	0.82	0.61	0.59	0.63	0.75

Note. Discriminant validity is supported when $\sqrt{\text{AVE}}$ (diagonals) for each construct exceeds its correlations with other constructs. Brand Equity (BE) is modelled as a second-order latent construct reflected by Brand Awareness, Brand Association, Perceived Quality, and Brand Loyalty.

Multiple fit indices were used to assess the adequacy of the measurement model (Table 5). The first-order model, comprising advertising spending, regulatory approval of advertising, brand awareness, brand association, perceived quality and brand loyalty, demonstrated a strong fit, with χ^2/df below the recommended threshold of 3, comparative fit indices (CFI and TLI) exceeding 0.94, and error indices (RMSEA and SRMR) within acceptable ranges. To validate the conceptualisation of brand equity as a higher-order construct, a second-order model was tested in which brand awareness, brand association, perceived quality and brand loyalty loaded onto the overarching Brand Equity factor. Fit indices for this second-order specification were nearly identical to those of the first-order model, confirming that the higher-order structure did not compromise model performance. These results support the robustness of the

measurement structure and justify the inclusion of Brand Equity as a composite latent variable in subsequent analyses.

Table 5. Measurement Model Fit Indices

Model	χ^2/df	CFI	TLI	RMSEA [90% CI]	SRMR
First-order measurement model	2.14	0.95	0.94	0.052 [0.048–0.056]	0.046
Second-order Brand Equity measurement model	2.19	0.95	0.94	0.053 [0.049–0.057]	0.048

Note. Benchmarks: $\chi^2/df < 3$, CFI/TLI ≥ 0.90 , RMSEA ≤ 0.06 – 0.08 , SRMR ≤ 0.08 . Both first-order and second-order models demonstrate acceptable fit, supporting the validity of modelling Brand Equity as a higher-order latent construct.

Common Method Bias and Measurement Invariance

To assess potential common method bias, Harman's single-factor test was conducted. An unrotated exploratory factor analysis showed that the largest single factor accounted for only 28% of the variance, well below the critical 50% threshold, indicating that common method bias was not a significant concern. In addition, a confirmatory factor analysis (CFA) single-factor model was estimated, in which all items were constrained to load onto a single latent factor. This model demonstrated poor fit ($\chi^2/df = 6.42$, CFI = 0.62, TLI = 0.58, RMSEA = 0.142, SRMR = 0.121), substantially worse than the hypothesized measurement model. Together, these results further confirm that common method bias is unlikely to threaten the validity of the findings. Measurement invariance was then examined across demographic subgroups (gender, age, and education). Configural invariance confirmed that the factor structure was stable across groups. Metric invariance indicated equivalence of factor loadings, and scalar invariance showed that item intercepts were largely invariant. Changes in fit indices ($\Delta CFI \leq 0.01$, $\Delta RMSEA \leq 0.015$) were within recommended thresholds, supporting invariance. Partial scalar invariance was established for the age and education groups, which is considered sufficient for meaningful latent mean comparisons.

Structural Model

The structural model revealed that all hypothesised direct effects of advertising spending and regulatory approval on the dimensions of brand equity were positive and statistically significant (Table 7). Advertising spending demonstrated significant positive effects on brand equity ($\beta = 0.32$, $p < .001$), perceived quality ($\beta = 0.28$, $p < .001$), brand loyalty ($\beta = 0.30$, $p < .001$), and brand equity ($\beta = 0.32$, $p < .001$).

.001), brand awareness ($\beta = 0.34, p < .001$), and brand associations ($\beta = 0.26, p < .001$). Among these, the strongest effect of advertising was observed on brand awareness ($\beta = 0.34$), while the weakest effect was on brand associations ($\beta = 0.26$). This pattern suggests that advertising spending primarily enhances visibility and recognition, with comparatively minor but still meaningful effects on deeper cognitive associations. Regulatory approval also consistently showed significant positive effects across all brand equity dimensions. It exerted strong positive effects on brand equity ($\beta = 0.38, p < .001$), perceived quality ($\beta = 0.29, p < .001$), brand loyalty ($\beta = 0.27, p < .001$), brand awareness ($\beta = 0.33, p < .001$), and brand associations ($\beta = 0.31, p < .001$). The most substantial effect of regulatory approval was on brand equity ($\beta = 0.38$), indicating that legitimacy signals play a central role in shaping overall brand value. The weakest effect was on brand loyalty ($\beta = 0.27$), suggesting that loyalty formation still depends on additional experiential or relational factors.

Moderation analysis confirmed that regulatory approval positively moderated the relationship between advertising and Brand Equity (H9: $\beta = 0.12, p < .05$). The effect of advertising on Brand Equity was stronger when regulatory approval was present, underscoring the synergistic impact of advertising and regulatory legitimacy in contested herbal markets. The overall structural model demonstrated good fit ($\chi^2/df = 2.23$, CFI = 0.95, TLI = 0.94, RMSEA = 0.053, SRMR = 0.046), consistent with the measurement model results. To further interpret the interaction, simple slope analyses were conducted at low (-1 SD), medium (mean), and high ($+1$ SD) levels of regulatory approval. The conditional effects showed that advertising spending had a modest positive effect on brand equity when regulatory approval was low ($\beta_{\text{low}} = 0.24$), a more substantial effect at medium levels ($\beta_{\text{medium}} = 0.40$), and the most significant effect at high levels of regulatory approval ($\beta_{\text{high}} = 0.57$). Advertising spending becomes increasingly effective as regulatory approval increases.

Table 6. Structural Model Results by Hypotheses

Hypothesis	Path	Standardized β	SE	t value	p value	Decision
H1	Advertising Spending → Brand Equity	0.32	0.07	4.57	< .001	Supported
H1a	Advertising Spending → Brand Awareness	0.34	0.07	4.86	< .001	Supported
H1b	Advertising Spending → Brand Associations	0.26	0.06	4.33	< .001	Supported
H1c	Advertising Spending → Perceived Quality	0.28	0.06	4.67	< .001	Supported

Hypothesis	Path	Standardized β	SE	t value	p value	Decision
H1d	Advertising Spending → Brand Loyalty	0.30	0.06	5.00	< .001	Supported
H2	Regulatory Approval → Brand Equity	0.38	0.06	6.33	< .001	Supported
H2a	Regulatory Approval → Brand Awareness	0.33	0.07	4.71	< .001	Supported
H2b	Regulatory Approval → Brand Associations (	0.31	0.07	4.43	< .001	Supported
H2c	Regulatory Approval → Perceived Quality	0.29	0.06	4.83	< .001	Supported
H2d	Regulatory Approval → Brand Loyalty Advertising ×	0.27	0.07	3.86	< .001	Supported
H3	Regulatory Approval → Brand Equity	0.12	0.05	2.40	< .05	Supported

Note. All hypothesised paths were significant and positive, consistent with theoretical expectations.

Model fit indices: $\chi^2/df = 2.23$, CFI = 0.95, TLI = 0.94, RMSEA = 0.053, SRMR = 0.046.

Mediation, Robustness Checks and Multigroup Analysis

To assess whether the dimensions of brand equity mediate the effects of advertising spending and regulatory approval on overall brand equity, a series of indirect effects was examined using bootstrapped confidence intervals (5,000 resamples). All indirect pathways were positive and statistically significant, indicating that both advertising spending and regulatory approval influence brand equity through multiple consumer-level mechanisms. For advertising spending, significant indirect effects were observed through brand awareness ($\beta = 0.11$, 95% CI [0.05, 0.19], $p < .01$), perceived quality ($\beta = 0.09$, 95% CI [0.04, 0.16], $p < .01$), brand loyalty ($\beta = 0.10$, 95% CI [0.05, 0.18], $p < .01$), and brand associations ($\beta = 0.08$, 95% CI [0.02, 0.15], $p < .05$). The strongest mediating pathway was through brand awareness, consistent with advertising's primary role as a visibility signal. The weakest pathway was through brand associations, suggesting that deeper cognitive meaning structures require more than exposure alone. Regulatory approval also demonstrated significant indirect effects through brand awareness ($\beta = 0.12$, 95% CI [0.06, 0.21], $p < .01$), perceived quality ($\beta = 0.10$, 95% CI [0.04, 0.18], $p < .01$), brand loyalty ($\beta = 0.09$, 95% CI [0.03, 0.17], $p < .01$), and brand associations ($\beta = 0.07$, 95% CI [0.01, 0.14], $p < .05$). The strongest mediating effect again occurred through brand awareness, indicating that regulatory approval not only signals

credibility but also enhances visibility by drawing consumer attention to approved products. The weakest pathway was through brand associations, reflecting that legitimacy contributes to meaning-making but does not fully determine it.

Robustness checks using the Akaike Information Criterion (AIC) and the Bayesian Information Criterion (BIC) showed that the hypothesized model achieved the lowest AIC (12,480) and BIC (12,710) values among competing specifications, indicating that the proposed model provides the best balance between explanatory power and parsimony. Multigroup analyses were conducted for gender (male vs. female), age (younger than 35 vs. 35 and above), and education (lower vs. higher education). Structural paths remained positive and statistically significant across all groups, demonstrating that the hypothesized relationships are stable and not driven by any single demographic segment (Table 7). Advertising spending effects were consistently significant across groups, with slightly stronger effects among females and younger respondents, particularly for brand awareness and brand loyalty. Regulatory approval effects were also robust, with somewhat stronger influences among older and more highly educated respondents, especially for brand equity and brand associations. The moderating effect of regulatory approval on the relationship between advertising spending and brand equity remained significant across all demographic categories ($\beta = 0.10^*$ to 0.15^{**}), confirming that the synergistic interaction between advertising visibility and regulatory legitimacy is stable across demographic groups.

Table 7. Multi-Group Structural Path Comparisons (Gender, Age, Education)

Path	Male	Female	Age < 35	Age ≥ 35	Lower Education	Higher Education
Advertising Spending → Brand Equity	0.28***	0.33***	0.30***	0.31***	0.31***	0.32***
Advertising Spending → Brand Awareness	0.29***	0.36***	0.38***	0.29***	0.33***	0.34***
Advertising Spending → Brand Associations	0.24*	0.29*	0.27*	0.25*	0.26*	0.28*
Advertising Spending → Perceived Quality	0.29***	0.34***	0.28***	0.27***	0.28***	0.29***
Advertising Spending → Brand Loyalty	0.30***	0.35***	0.34***	0.26***	0.29***	0.31***
Regulatory Approval → Brand Equity	0.37***	0.39***	0.35***	0.41***	0.36***	0.39***
Regulatory Approval → Brand Awareness	0.31*	0.35*	0.33*	0.34*	0.30*	0.36*

Path	Male	Female	Age < 35	Age ≥ 35	Lower Education	Higher Education
Regulatory Approval → Brand Association	0.30***	0.32***	0.29***	0.32***	0.27***	0.34***
Regulatory Approval → Perceived Quality	0.27***	0.30***	0.28***	0.30***	0.25***	0.32***
Regulatory Approval → Brand Loyalty	0.26***	0.28***	0.27***	0.28***	0.26***	0.29***
Advertising Spending × Regulatory Approval → Brand Equity	0.11*	0.13*	0.10*	0.15**	0.11*	0.14**

Notes: ***p < .001; **p < .01; *p < .05. All coefficients are standardised.

DISCUSSION

Qualitative interviews revealed that consumers often interpret advertising spending as a proxy for firm strength (“if they can afford to advertise, the product must be reliable”). At the same time, regulatory approval was described as a safeguard against risk. Notably, participants emphasized that advertising without regulatory approval was perceived as “noise,” whereas regulatory approval without advertising was seen as “invisible.” This helps explain why the moderation effects were significant in the SEM analysis. Consumers expect both visibility and credibility for herbal brands to achieve strong brand equity. The quantitative results reveal a clear hierarchy of effects. For advertising spending, the strongest influence was on brand awareness, reinforcing its role as a visibility signal in crowded herbal markets. The weakest effect was on brand associations, suggesting that advertising alone is less effective in shaping deeper meaning structures without complementary cues. For regulatory approval, the most substantial effect was on overall brand equity, underscoring its role as a macro-level legitimacy signal that elevates the brand’s perceived value. It also had strong effects on brand awareness, and the weakest effect was on brand loyalty, indicating that legitimacy alone does not guarantee repeat patronage unless supported by positive experiences.

The findings suggest that advertising and regulatory approval operate through different but complementary pathways. Advertising enhances visibility, while regulatory approval enhances credibility. Their interaction shows that visibility is most persuasive when credibility is assured, aligning with competitive bioeconomy theory’s emphasis on strategic resonance and on integrating governance signals with firm-level strategy. The mediation results further show that both advertising spending and regulatory approval shape brand equity indirectly by strengthening the foundational dimensions of awareness, perceived quality, loyalty, and associations. The presence of multiple significant mediators suggests that brand equity in the

herbal bioeconomy does not arise from a single mechanism but emerges from interconnected consumer perceptions.

Advertising investment is known to strengthen awareness, brand associations, and perceived quality in consumer goods and other markets (Villarejo-Ramos & Sánchez-Franco, 2005; Yoo et al., 2000), while regulatory oversight enhances credibility in herbal markets (Rahman et al., 2025). The path coefficients in this study replicate these patterns, reinforcing the multidimensional mediation mechanism of brand equity (Yoo et al., 2000). The study also nuances earlier work in meaningful ways. Few prior studies have modelled the moderation between advertising and regulation, yet the analysis here shows that advertising's effect on brand equity is amplified under strong regulatory oversight. This finding extends the traditional view of advertising as a standalone driver by demonstrating that its effectiveness depends on the regulatory context.

The results highlight brand awareness as the strongest anchor of brand equity, reflecting both industry context and evolving consumer priorities in markets where regulatory signals are salient. Advertising has been shown to drive awareness but often struggles to sustain loyalty without institutional endorsement (Dzeparoski & Trajkovic-Jolevska, 2018). The findings complement but also diverge from regulatory policy perspectives, which emphasize that advertising outcomes depend on how herbal products are legally classified, underscoring the managerial and institutional constraints on promotional practice. This study shows that at the perceptual level, consumers interpret advertising as “noise” unless accompanied by regulatory legitimacy, and regulatory approval as “invisible” unless paired with advertising. These insights reinforce the broader conclusion that advertising cannot be treated as a standalone driver of herbal brand equity because regulation shapes its meaning both structurally, through classification, and perceptually, through credibility.

The findings also show that firms operating in the competitive herbal bioeconomy rely heavily on credible market signals to overcome information asymmetries and build consumer-based brand equity. Where product quality, safety, and authenticity are not directly observable, consumers depend on visible, costly, and externally validated cues to infer underlying firm capabilities. Advertising investment, regulatory legitimacy, and brand-building activities therefore function as strategic signals that communicate reliability, competence, and long-term commitment (Aaker, 2020; Akorede, 2023). Advertising spending acts as a costly signal, meaning only firms confident in their product quality and future market performance can sustain consistent promotional spending. Similarly, regulatory legitimacy, through compliance with recognized standards serves as a credibility-enhancing signal, indicating that the firm meets externally verified thresholds of safety and quality (Suchman, 1995; Verhoest et al.,

2024). These cues reduce uncertainty, strengthen perceived credibility, and differentiate firms in a crowded and contested bioeconomy landscape. Firms that combine visible advertising signals with strong regulatory credibility cues are better positioned to shape consumer perceptions, build consumer-based brand equity and compete effectively in the herbal bioeconomy.

IMPLICATIONS

Theoretical Implications

The study advances understanding of the multilevel Competitive Bioeconomy Theory. At the macro level, regulatory systems create the legitimacy environment that shapes how firms communicate and compete. At the meso level, industry norms and competitive pressures influence how consumers interpret visibility and credibility signals. At the micro level, firms embed these signals into their strategic positioning and brand-building activities. By illustrating how these levels interact, the study positions signalling as a core strategic mechanism linking regulatory structures, market competition, and firm-level branding strategies. The study demonstrates that strong consumer-based brand equity reinforced through credible regulatory signals functions as a strategic resource that enhances competitiveness within the herbal bioeconomy.

The results extend signalling theory by demonstrating that regulatory approval of advertising serves as a credibility signal that shapes consumer perceptions of safety, quality, and authenticity. This shows that in sustainability-oriented markets, formal regulatory signals complement traditional market signals (e.g., advertising intensity, brand reputation) and exert a stronger influence on consumer decision-making when product attributes are difficult to verify. It also advances legitimacy theory by demonstrating that regulatory endorsement enhances pragmatic and moral legitimacy at the consumer level, thereby strengthening brand equity. It highlights that legitimacy is not only an organisational-level construct but also a consumer-level perception that directly influences brand evaluations and sustainable consumption behaviour in the herbal sector.

The findings enrich CBBE theory by showing that brand equity formation in sustainability-oriented markets is shaped not only by marketing actions but also by institutional signals. Regulatory approval strengthens the core dimensions of CBBE: awareness, associations, perceived quality, and loyalty, indicating that institutional credibility is a foundational antecedent of brand knowledge structures in credence-based product categories.

This has implications for sustainable marketing theory and practice. Strengthening consumer-based brand equity through credible associations, heightened awareness, perceived quality, and loyalty is a central mechanism for advancing sustainable market behaviour in the

herbal sector. When brands are perceived as credibly aligned with regulatory standards, consumers exhibit greater loyalty toward sustainably produced herbal products, indicating that sustainable marketing depends as much on robust brand knowledge structures as on ecological or ethical claims. Regulatory approval and credible signalling reduce information asymmetries in credence-based markets, reinforcing legitimacy and encouraging responsible market participation. Brand equity is not merely a commercial asset, but it is also a mechanism that enables consumers to support firms engaged in sustainable innovation, thereby advancing broader sustainability outcomes within the herbal bioeconomy.

Managerial Implications

The study underscores the pivotal role of regulatory bodies in shaping sustainable market behaviour. When advertising receives regulatory approval, it signals credibility and strengthens consumer-based brand equity. For policymakers, this means that robust, transparent, and consistently enforced regulatory frameworks are not merely compliance mechanisms but market-shaping tools that enhance consumer trust and support sustainable consumption. Strengthening oversight of herbal product claims, improving visibility of certification, and ensuring that approved advertising communicates verifiable quality standards can help reduce information asymmetries and encourage responsible market participation. In this way, policy becomes a catalyst for sustainable development within the herbal bioeconomy. For producers, sustainable marketing is inseparable from credibility and brand-building. Regulatory approval of advertising enhances brand equity, and so producers must align their practices with the standards being signalled. Producers who integrate these elements into their brand narratives can leverage regulatory legitimacy to differentiate themselves in a crowded market. Strong brand equity, built on awareness, positive associations, perceived quality, and loyalty, becomes a strategic asset that supports long-term customer relationships. For marketers, the results reinforce the importance of credible, compliant, and strategically crafted communication. Advertising that is aligned with regulatory approval not only reduces consumer uncertainty but also amplifies the impact of sustainability messages. By building strong brand knowledge structures, marketers can enhance brand equity and encourage consumers to adopt sustainable herbal products. This positions marketing not as a promotional function but as a driver of sustainable consumption and long-term brand value.

Managers should treat advertising spending and regulatory approval as strategic investments rather than routine promotional activities. Sustained advertising enhances visibility and signals confidence, while approved advertising content strengthens credibility by demonstrating compliance with recognised standards. Managers who integrate these signals

into their broader consumer-based brand-building strategies are better positioned to reduce uncertainty and compete effectively in contested herbal bioeconomy markets. Managers should adopt a dual-strategy approach: invest in compelling advertising to build awareness and loyalty, while simultaneously leveraging regulatory approval to reinforce credibility and perceived quality. Managers should prioritise sustained, strategically targeted advertising campaigns that reflect brand perceptions of gender, age and education.

CONCLUSION

This study examined how perceived advertising spending and regulatory approval of advertising jointly shape brand equity in contested herbal markets. Using SEM supported by qualitative narratives, the analysis showed that advertising spending and regulatory approval of advertising operate as independent antecedents of brand equity, with regulatory approval of advertising moderating the relationship between advertising spending and brand equity. Both advertising spending and regulatory approval strongly enhanced brand awareness. Advertising's effectiveness depends on the regulatory context, as promotional signals are significantly amplified when consumers perceive strong institutional endorsement. In the competitive herbal bioeconomy, advertising spending and regulatory approval serve as powerful signals of visibility and credibility, reducing consumer uncertainty in markets where quality and safety are difficult to verify. Firms that invest in advertising and secure regulatory approval communicate both market presence and compliance with recognized standards, improving brand evaluations.

LIMITATIONS AND FUTURE DIRECTIONS

The study's limitations stem primarily from its scope, design, and measurement choices. The cross-sectional design limits causal inference, capturing consumer perceptions at only one point in time rather than tracking how the effects of advertising and regulatory approval evolve. In addition, the quantitative phase relied on self-reported perceptions, which may be influenced by recall bias or social desirability, even though diagnostic tests indicated minimal common method bias. The regulatory approval of advertising construct, while grounded in qualitative insights, was measured using a concise three-item scale that captures perceived regulatory approval rather than objective regulatory status. Future research can build on these findings by expanding the geographic and institutional scope to include multiple markets, regulatory environments, and cultural contexts, enabling comparative insights into how consumers interpret visibility and legitimacy signals across diverse bioeconomy settings. Longitudinal designs would help clarify how signalling effects unfold over time, particularly as firms adjust

their advertising strategies or as regulatory regimes evolve. Further work could also incorporate additional signalling mechanisms such as sustainability certifications, traceability technologies, digital visibility, or third-party endorsements to develop a more comprehensive understanding of how consumers evaluate herbal products in complex, information-asymmetric markets. Finally, integrating objective regulatory data, experimental designs, or multi-stakeholder qualitative approaches would deepen understanding of how advertising, legitimacy, and consumer trust interact to shape sustainable marketing and competitiveness in the herbal bioeconomy.

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REFERENCES

- Aaker, D., 2020. Winning against a dominant brand. *Journal of Brand Strategy*. 9(2), 103–112.
- Aaker, D.A., 1991. *Managing brand equity: Capitalizing on the value of a brand name*. New York: Free Press.
- Aaker, D.A., Jacobson, R., 2001. The value relevance of brand equity. *Journal of Marketing Research*. 38(4), 468–479.
- Adner, R., Zemsky, P., 2006. A demand-based perspective on sustainable competitive advantage. *Strategic Management Journal*. 27(3), 215–239.
- Ahenkora, K., 2025. A framework of the bioeconomy as a competitive strategy for sustainable development. *Sustainable Environment*. 11(1).
- Akorede, H., 2023. Advertising and financial performance: Insight from a competitive market in Africa. *Measuring Business Excellence*. 27(4), 634–650.
- Archibald, R.B., Haulman, C.A., Moody, C.E., 1983. Quality, price, advertising, and published quality ratings. *Journal of Consumer Research*. 9(4), 347–356.
- Arnould, E.J., Thompson, C.J., 2005. Consumer culture theory (CCT): Twenty years of research. *Journal of Consumer Research*. 31(4), 868–882.
- Bowman, C., Ambrosini, V., 2000. Value creation versus value capture: Towards a coherent definition of value in strategy. *British Journal of Management*. 11(1), 1–15.
- Braun, V., Clarke, V., 2006. Using thematic analysis in psychology. *Qualitative Research in Psychology*. 3(2), 77–101.
- Bugge, M.M., Hansen, T., Klitkou, A., 2016. What is the bioeconomy? A review of the literature. *Sustainability*. 8(7), 691.
- Burlea-Şchiopoiu, A., Popa, I., 2013. Legitimacy theory. In Idowu, S.O., Capaldi, N., Zu, L., Das Gupta, A. (Eds.), *Encyclopedia of corporate social responsibility*. Springer.
- Connelly, B.L., Certo, S.T., Reutzel, C.R., DesJardine, M.R., Zhou, Y.S., 2024. Signaling theory: State of the theory and its future. *Journal of Management*. 51(1), 24–61.
- Dzeparoski, M., Trajkovic-Jolevska, S., 2018. Impact of regulation on advertising and promotion of traditional herbal medicines and food supplements. *Medicinski Glasnik*. 15(2), 1–10.
- Erdem, T., Swait, J., 1998. Brand equity as a signaling phenomenon. *Journal of Consumer Psychology*. 7(2), 131–157.
- Farquhar, P.H., 1989. Managing brand equity. *Marketing Research*. 1(3), 24–33.

- Food and Agriculture Organization, 2018. The global bioeconomy: Agricultural and food perspectives. Rome: FAO.
- Global Bioeconomy Council, 2018. Global Bioeconomy Summit proceedings. Berlin: Global Bioeconomy Council.
- GlobeNewswire, 2025. Herbal medicine market size to achieve USD 580.81 billion by 2034. Towards FnB / Precedence Research.
- Grahovac, J., Miller, D.J., 2009. Competitive advantage and performance: The impact of value creation and costliness of imitation. *Strategic Management Journal*. 30(11), 1192–1212.
- Gutiérrez Gutiérrez, M.M., Perona Páez, J.J., Gutiérrez Bonilla, F. de P., 2024. Models of brand equity: A systematic and critical review. *Cogent Business & Management*. 11(1), 2433168.
- Hauser, J.R., Wernerfelt, B., 1990. An evaluation cost model of consideration sets. *Journal of Consumer Research*. 16, 393–408.
- Jose, L.M., 2024. Assessing the role of advertising and sales promotion on brand equity. *British Journal of Marketing Studies*. 12(2), 16–26.
- Keller, K.L., 1993. Conceptualizing, measuring, and managing customer-based brand equity. *Journal of Marketing*. 57, 1–22.
- Keller, K.L., 2013. *Strategic brand management: Building, measuring, and managing brand equity* (4th ed.). Harlow: Pearson Education.
- Kirmani, A., Wright, P., 1989. Money talks: Perceived advertising expense and expected product quality. *Journal of Consumer Research*. 16(3), 344–353.
- Lepak, D.P., Smith, K.G., Taylor, M.S., 2007. Value creation and value capture: A multilevel perspective. *Academy of Management Review*. 32(1), 180–194.
- Leuthesser, L., 1988. *Defining, measuring and managing brand equity: A conference summary*. Cambridge, MA: Marketing Science Institute.
- Milgrom, P., Roberts, J., 1986. Price and advertising signals of product quality. *Journal of Political Economy*. 94(4), 796–821.
- Rahman, S.U., Singh, R., Chen, Y., 2025. Regulatory considerations for herbal products in Europe, America, and Asia. *Journal of Herbal Pharmacology*. 12(1), 55–70.
- Research and Markets, 2025. *Herbal nutraceuticals market report: Industry size, competition, trends and growth opportunities by region – Forecast by types and applications (2024–2032)*. Dublin: Research and Markets.
- Riessman, C.K., 2008. *Narrative methods for the human sciences*. Thousand Oaks, CA: Sage Publications.
- Rojas-Lamorena, Á.J., Del Barrio-García, S., Alcántara-Pilar, J.M., 2022. Brand equity research: A systematic review and future directions. *Journal of Business Research*. 144, 1–15.
- Schivinski, B., Dąbrowski, D., 2014. The consumer-based brand equity inventory: Scale construct and validation. GUT FME Working Paper Series.
- Suchman, M.C., 1995. Managing legitimacy: Strategic and institutional approaches. *Academy of Management Review*. 20(3), 571–610.
- van Andel, T., Myren, B., van Onselen, S., 2012. Ghana's herbal market survey: Crude medicine trade and livelihoods. *Journal of Ethnopharmacology*. 140(2), 368–378.
- Verhoest, K., Guaschino, M.M.E., Wynen, J., 2025. How trust matters for the performance and legitimacy of regulatory regimes. *Regulation & Governance*. 19, 3–20.
- Villarejo-Ramos, Á.F., Sánchez-Franco, M.J., 2005. The impact of marketing communication and price promotion on brand equity. *Brand Management*. 12(6), 431–444.
- World Health Organization, 2025. *World Health Organisation report on global use of traditional medicine*. Geneva: World Health Organization.
- Yoo, B., Donthu, N., Lee, S., 2000. An examination of selected marketing mix elements and brand equity. *Journal of the Academy of Marketing Science*. 28(2), 195–211.
- Yoo, B., Donthu, N., 2001. Developing and validating a multidimensional consumer-based brand equity scale. *Journal of Business Research*. 52(1), 1–14.
- Zhang, Y., Li, H., Chen, X., 2025. Media coverage and brand equity: Evidence from China with institutional moderators. *Journal of Brand Management*.

APPENDIX

Final Measurement Scales

Advertising Spending
In general, I like X's advertisement.
My opinion of X's advertising is very high.
X's advertising campaigns seem very expensive compared to other products.
I see or hear advertisements for X more often.
The more advertising campaigns X runs, the more it makes sense to buy X instead of less-advertised products.
Loyalty
X is my first choice for this product.
I do recommend X to my friends.
I am attached to X
I think I am loyal to X.
Regulatory approval of advertising
I hear the statement: This advertisement has been vetted and approved by the FDA.
FDA approval of X's advertisement is good
My opinion of X is high because the FDA has approved its advertising.
Brand awareness
I know X
I can easily recognise X among other products.
When I think about this product, X is the first thing that comes to mind.
Brand association
X has a good impression on me.
I feel good buying X
Quality
X is a good quality product.
I can rely on X