



The subtle power of nudging: consumer choice in ethical and sustainable retailing

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Abstract

This study investigates how nudging mechanisms in brand cues and social interactions influence ethical and sustainable consumer behavior in religious markets. Drawing on Nudge Theory, the study proposes a dual-pathway model to explain how formal signals (logo certification) and informal cues (peer communication) shape green consumption through identity-driven and spiritually grounded processes. Using Bayesian Structural Equation Modeling on data from 270 Malaysian consumers, the study finds two distinct yet converging nudging effects. Logo certification enhances green behavior directly and indirectly by strengthening brand distinctiveness and prestige. Peer communication promotes Islamic practices and emotional connectedness with Allah, which in turn drives halal green behavior. The model also shows that both logo certification and peer communication have significant direct effects on green consumption intention. This research extends Nudge Theory beyond simple heuristics by incorporating emotional and identity-based mechanisms situated within religious contexts by integrating institutional, psychological, and religious-affective pathways. The findings provide theoretical and practical insights into how subtle, value-aligned interventions can promote sustainable behavior without restricting consumer autonomy.

Keywords Green consumption · Peer influence · Sustainable consumption · Environmental stewardship · Nudge theory · Islamic practices

Introduction

Sustainable consumption has emerged as a critical global priority, with the sustainable products market projected to grow from USD 355.3 billion in 2024 to USD 692 billion by 2033, reflecting increasing consumer environmental

consciousness worldwide (Business Research Insights 2024). This global trend toward sustainable consumption is particularly pronounced in religious markets, where ethical values amplify environmental concerns (White et al. 2019). Malaysia is positioning itself as a global center for halal commerce. The halal sector already contributes about 6–7%

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of national gross domestic product and is valued at roughly RM 54 billion (Halal Development Corporation Berhad 2024), while halal product exports reached RM 61.5 billion in 2024, a rise of about 15% over the previous year [Ministry of Investment, Trade and Industry (MITI) 2025]. At the same time, the domestic halal-food market is estimated at about USD 50.7 billion and is projected to keep expanding through 2030 (BlueWeave Consulting 2025). Together, these figures show a fast-growing opportunity for products that meet both Shariah requirements and environmental standards. Beyond food, halal certification now covers fast-moving consumer goods, personal-care items, pharmaceuticals, and hospitality services worldwide. The global halal-cosmetics segment alone was estimated at about USD 57.76 billion in 2024, with sustained growth in Indonesia, Turkey, and the Gulf states (Anubha 2023; Fiandari and Andharini 2024; Fortune Business Insights 2024). Experimental and survey evidence shows that halal logos on skincare and toiletries work as credibility signals that raise purchase intention among millennial women across Thailand and Indonesia (Anubha 2023; Fiandari and Andharini 2024). In tourism, a recent study reports that non-Muslim travelers in Lombok adjust dining and activity choices when exposed to halal-compliant services, suggesting that certification influences behavior beyond food categories (Yasin et al. 2025). Together with a 2023 to 2025 review that maps a wider halal-brand image literature (Rahman et al. 2024), these findings indicate that logo certification and peer cues operate across multiple sectors, motivating the present dual-pathway model. Halal Green Consumerism refers to consumer choices that (a) comply with Islamic dietary and ethical rules and (b) minimize ecological impacts across the product life cycle, uniting the Qur'anic principle of *ṭayyib* (wholesome and pure) with contemporary green consumption norms (Muhammad and Hanapi 2018; Deuraseh et al. 2023). We distinguish two focal constructs. Green Consumption Intention (GCI) is a consumer's stated willingness or plan to choose, purchase, or use products that lower environmental impact within halal-eligible categories. Halal Green Consumer Behavior (HGCB) refers to self-reported past or likely future actions that both satisfy Shariah permissibility and reduce environmental impact across acquisition, usage, and post-consumption practices. We include both constructs to examine the eco-halal intention-behavior gap and the conditions under which nudges narrow it. Building on this distinction, the investigation—how religion-embedded choice cues—logo certification and peer communication—may help close Malaysia's eco-halal intention-behavior gap. To explain these effects, we draw on Nudge Theory, which highlights how subtle choice-architecture cues steer behavior.

Halal and eco-certification labels are commonly used to signal product attributes, serving as informational cues

that transform credence characteristics into quasi-search attributes for consumers (Atkinson and Rosenthal 2014; Grunert et al. 2014; Yener 2022). Previous studies on halal or eco-labels show that certification logos help Muslim shoppers recognize product legitimacy and quality, yet most analyses stay at the information level and do not track how such cues activate personal identity or spiritual feeling (Nijssen et al. 2023). Research on social influence shows that peer norms guide pro-environmental behavior (Cialdini and Goldstein 2004; White et al. 2019); however, it seldom examines peer communication as a nudging force that can strengthen or weaken the influence of formal brand signals (Olya et al. 2023). Classical research in religious communities demonstrates that peer communication significantly shapes consumption values and brand preferences, particularly when discussions involve moral and spiritual dimensions (Wilson and Liu 2010; Mukhtar and Butt 2012). Recent studies continue to validate this influence, with research showing how religious narratives and peer discussions shape pro-environmental behavior within faith communities, demonstrating that social norms remain powerful determinants of sustainable consumption across diverse cultural contexts. In addition, the few models that link nudges with green outcomes rarely test whether these mechanisms vary across life stages, even though evidence from social psychology suggests that value priorities shift with age (Sunstein 2014a, b; Halpern 2015). These gaps leave open three questions: How do religion-anchored logos and peer communication translate eco-halal intent into action? Do they work through distinct psychological routes? Does their impact differ for younger and older Muslims?

On these questions, the present study develops a dual-path framework. The first path proposes that logo certification signals brand legitimacy, raises perceived distinctiveness, and builds prestige, which together foster green consumption intention and behavior which together foster green consumption intention and, indirectly, Halal Green Consumer Behavior. The second path proposes that peer communication affirms Islamic practice and deepens a felt connectedness with Allah, thereby guiding the same behavioral outcome. We test this model using Bayesian structural equation modelling (BSEM) and compare path strengths across two age cohorts. The Bayesian approach suits moderate sample size and allows us to estimate credible intervals for indirect effects while modeling non-normal data.

The study makes three advances. Conceptually, it integrates formal and social nudges within a single model and shows that identity-based and emotion-based processes can coexist and converge. Empirically, it demonstrates that the relative weight of these processes shifts with age, which refines the boundary conditions of Nudge Theory



in religious markets. Methodologically, the Bayesian multigroup design aligns with the probabilistic nature of our framework: it updates prior uncertainty with cohort-specific evidence, yielding full posterior distributions for each path and thereby exposing age-based differences in the nudging process that conventional maximum-likelihood estimation would likely overlook.

This study tests when formal and social nudges convert eco-halal intentions into behavior, offering new evidence on religion-anchored choice architecture.

Literature review

Nudge Theory, first introduced by Thaler and Sunstein (2008), offers a behavioral framework for explaining how subtle adjustments in the choice environment shape decision-making. Unlike rational-choice models, it highlights the influence of heuristics, affective reactions, and contextual cues (Sunstein 2023). A nudge refers to any feature of choice architecture that changes behavior in a predictable way without removing options or adding material incentives. The concept began in public policy but now guides marketing and consumer-behavior research, where shoppers often confront cognitive overload or competing motives. The application of Nudge Theory in marketing contexts has grown substantially, with systematic reviews documenting its increasing adoption across various consumer domains (Caraban et al. 2019; Hummel and Maedche 2019), particularly in sustainable consumption where nudges have proven effective in guiding environmentally responsible choices (Sunstein 2014a, b; Polman et al. 2023; De Backer et al. 2024; González-Ramírez 2024; Ardesch et al. 2025). Work on sustainable marketing shows that well-designed nudges can steer greener choices while preserving perceived freedom (Arno and Thomas 2016; Lehner et al. 2016). Consumer studies point to two nudge types that matter for eco-friendly purchasing. Information nudges such as eco-labels lower cognitive effort and can affirm self-identity (Grunert et al. 2014). Social-information nudges use peer cues and are strongest when reputation is on the line (Bicchieri and Dimant 2019a, b). These paths can converge in Muslim markets: devotional talk about halal and the environment spreads descriptive norms (what fellow Muslims do) and injunctive norms (what one ought to do). Emotional transmission within that devotional talk has been linked to later pro-environmental action, because shared feelings of gratitude, awe, and moral elevation strengthen environmental concern and behavioral intention (White and Billet 2024; Billet et al. 2025a, b).

Green consumption requires consumers to process abstract, long-term benefits while often facing trade-offs such as higher prices or lower convenience. Such abstract

and temporally distant benefits increase cognitive processing demands and complicate decision-making processes (Stern 2000a, b; Frederick et al. 2002; Kahneman 2011). Traditional models that emphasize cognitive evaluation—such as the Theory of Planned Behavior or the Value-Belief-Norm theory—have offered limited explanatory power for actual green behaviors, particularly when consumers are not fully engaged or motivated to deliberate. In contrast, Nudge Theory proposes that small, well-placed environmental cues can influence behavior without requiring active engagement or rational trade-offs. This makes the framework particularly suitable for understanding how consumers make environmentally responsible decisions in real-world contexts.

One of the most common types of nudges in green marketing is the use of certification labels, such as organic, fair trade, or halal eco-labels. These logos serve as simplified cues that convey product legitimacy and ethical alignment. Existing studies suggest that such logos increase product appeal by building trust and signaling conformity with social or religious norms (Atkinson and Rosenthal 2014; Grunert et al. 2014). Certification logos reduce cognitive effort and act as heuristic shortcuts, particularly when consumers are not inclined to engage in complex evaluations. This aligns with dual-processing theory, where such visual cues activate automatic processing mechanisms that bypass the cognitive limitations identified in traditional green consumption models (Slooman 1996; Kahneman 2011). Recent neuroscientific research continues to validate these dual-system mechanisms, with meta-analyses confirming the neural foundations of automatic versus deliberative processing in decision-making contexts (Gavazzi et al. 2024), while contemporary studies demonstrate how cognitive load specifically affects consumer information processing (Zucchelli et al. 2025). In religious markets, where ethical consistency is paramount, certification can also reinforce identity-relevant values. However, prior research has often treated these logos as static information cues, without sufficiently exploring how they influence internal states such as brand identity or emotional resonance, which may mediate behavioral outcomes.

Brand identity, defined as the extent to which a consumer identifies with a brand's values, personality, and image, can also function as a form of internalized nudge. Unlike traditional nudges that operate through external cues, identity-based nudges work by aligning brand signals with the consumer's self-concept. When a brand is perceived as representing values that the consumer holds deeply—such as religious beliefs, environmental consciousness, or social integrity—it becomes more than just a functional choice; it becomes part of the individual's extended self. Research suggests that identity-congruent branding increases emotional attachment and long-term commitment (Bhattacharya and Sen 2003; Reed et al. 2012). However, the role of brand identity as a mediator between nudges (such as logo



certification) and emotional or behavioral outcomes in green marketing remains underdeveloped.

Another dimension often overlooked in the application of Nudge Theory is emotion. Emotional resonance refers to the affective impact a brand has on a consumer, often shaped by past experiences, social narratives, or symbolic meaning. While traditional nudging techniques are primarily cognitive or visual, emotional responses are increasingly recognized as central to decision-making. Loewenstein and Lerner (2003) argue that emotions not only guide attention but also shape preferences and intentions. In the green marketing context, emotional resonance can act as a behavioral trigger when consumers feel connected to the brand's message or mission. Yet, little empirical research has integrated faith emotion as a mediating mechanism through which nudges translate into consumption intention.

In addition to formal nudging cues, social nudges—particularly those arising from peer communication—play a critical role in shaping green behavior. Peer communication involves informal conversations, recommendations, and shared narratives that reinforce or challenge brand perceptions. According to Cialdini and Goldstein (2004), social norms significantly influence consumer choices, particularly when individuals face uncertainty or value alignment issues. In religious communities, peer communication can reinforce interpretations of what is considered ethically acceptable or spiritually appropriate. This study extends Nudge Theory by positioning peer communication not only as a direct influencer of emotional resonance, but also as a moderator that enhances or weakens the effect of other nudges. This is consistent with emerging findings in social marketing, where peer norms often shape the emotional tone and perceived relevance of environmental messages (White et al. 2019).

Recent extensions of Nudge Theory also point to the need to integrate value-based and culturally embedded factors into the design of nudging strategies. Scholars have called for more research in religious and collectivist contexts where decision-making is not solely individualistic but shaped by community values and normative beliefs (Sunstein 2014a, b; Halpern 2015). In such contexts, nudges that align with internalized religious values, such as the feeling of connectedness with Allah or the enactment of Islamic practices, may have a stronger impact on emotional resonance and behavior. However, empirical work that connects religious constructs with nudging outcomes in the context of green consumption remains limited.

Hypotheses and research model

Formal nudging path: logo certification, brand distinctiveness, and brand prestige

The relationship between logo certification and brand distinctiveness is grounded in classical signaling theory (Spence 1973) and brand identity theory (Aaker 1996). Certification logos not only convey product quality information but also establish unique brand identity positioning in consumers' minds. When brands obtain dual halal and environmental certification, they create differentiated value propositions that directly manifest as enhanced brand distinctiveness (Keller 2013). Recent research continues to validate this connection, demonstrating how green certification enhances brand differentiation in sustainable consumption contexts (Zhang et al. 2024). Sustainable brand marketing requires strong brand identity to compete effectively, particularly in markets where consumers increasingly demand transparency and authenticity in environmental claims (Seberíni et al. 2024). The signaling effect of environmental certifications has become even more pronounced as consumers develop greater sophistication in evaluating brand sustainability claims (Shahid et al. 2024). Logo certification operates as a formalized institutional nudge. Certifications such as halal, eco-labels, or organic symbols not only reduce consumers' cognitive effort but also enhance trust, ethical assurance, and value alignment (Grunert et al. 2014). In particular, certification logos may signal that a brand is uniquely committed to values that align with the consumer's identity. This symbolic function enhances perceived brand distinctiveness, which reflects the perceived uniqueness and value-based differentiation of the brand. As such, the following hypothesis is put forward:

H1 *Logo certification has a positive effect on brand distinctiveness.*

It is crucial to distinguish between brand distinctiveness and brand prestige as they represent different dimensions of brand perception. Brand distinctiveness reflects the degree of brand differentiation in competitive environments, emphasizing uniqueness and value-based positioning. In contrast, brand prestige embodies the brand's social status and symbolic value, representing elevated status in consumers' perceptions (Steenkamp et al. 2003; Baek et al. 2010). According to social identity theory, when distinctive brands align with socially recognized values such as religious compliance and environmental responsibility, they acquire prestige attributes through identity-signaling mechanisms (Escalas and Bettman 2005). Distinctive brands are often perceived as more socially and spiritually



prestigious, especially in high-commitment categories like religious or sustainable consumption. When a brand is seen as ethically superior or spiritually aligned, it may acquire brand prestige, which refers to its elevated symbolic status in the consumer's perception (Baek et al. 2010). Based on this, the following hypothesis is advanced:

H2 *Brand distinctiveness has a positive effect on brand prestige.*

The relationship between brand prestige and behavioral intention is particularly relevant in value-driven consumption contexts. Unlike purely functional attributes, prestige operates through identity-signaling mechanisms where consumers use prestigious brands to construct and express their self-concept (Reed et al. 2012). In religious and environmental consumption domains, prestige serves as a psychological bridge between value alignment and action, as consumers are motivated to support brands that reflect their moral and spiritual commitments (Escalas and Bettman 2005). How luxury consumers' perceived social and economic value primarily affects brand social identity, while emotional and functional values drive personal identity formation (Yang et al. 2024). Contemporary studies further demonstrate that consumers are willing to pay premium prices for brands that signal both prestige and sustainability, with 85% of consumers experiencing climate change effects prioritizing consumption that integrates sustainability-focused practices (PwC 2024). The integration of sustainability within prestige consumption has emerged as a key trend, with sustainable practices enhancing brand appeal especially among younger consumers who prioritize ethical considerations alongside prestige (Chwialkowska et al. 2024). Consumers who perceive a brand as prestigious are more likely to form favorable green consumption intention, particularly when prestige aligns with deeply held values. Brand prestige fosters admiration, trust, and intention to support the brand through consumption (He et al. 2012). Thus, the following hypothesis is presented:

H3 *Brand prestige has a positive effect on green consumption intention.*

In addition to these indirect effects, logo certification may also directly influence green consumption intention. According to Nudge Theory, visual and institutional cues can trigger behavior through automatic, fast-processing channels. When consumers view a logo as a heuristic cue that reflects religious authority or ecological legitimacy, it can lead to immediate behavioral intentions, bypassing complex cognitive or emotional pathways (Sunstein 2023). This direct effect reflects a core principle of libertarian paternalism: nudges can guide decisions while preserving choice autonomy. Therefore, we propose the following hypothesis:

H4 *Logo certification has a positive effect on green consumption intention.*

Social and spiritual nudging path: peer communication, religious engagement, and green intention

In addition to institutional cues like certification logos, peer communication represents a powerful social nudge that shapes how consumers interpret and respond to brand-related information. Peer communication refers to informal interpersonal exchanges among family, friends, or religious community members about consumption practices and brand values. In religious markets, such conversations often act as credibility enhancers by reinforcing social and spiritual norms (White et al. 2019; Olya et al. 2023).

When trusted peers endorse a product or brand as religiously appropriate or environmentally responsible, consumers may experience a form of social validation. This peer reinforcement increases the likelihood of engaging in behavior that is consistent with both ethical and religious expectations. Specifically, peer communication is likely to promote Islamic practice, which includes religiously motivated consumption behaviors such as selecting halal-certified, modest, or environmentally responsible goods. Based on this, the following hypothesis is advanced:

H5 *Peer communication has a positive effect on Islamic practice.*

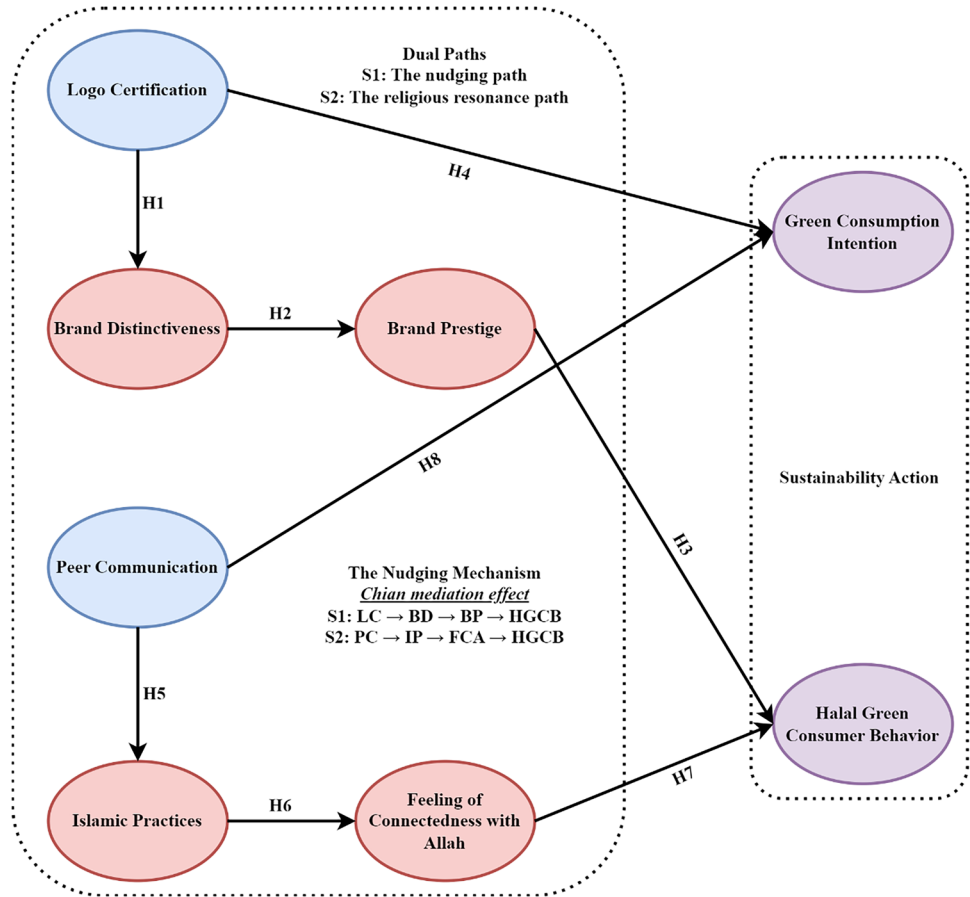
Engagement in Islamic practice may evoke spiritual mindfulness, moral responsibility, and a sense of divine accountability. These feelings are expected to strengthen the feeling of connectedness with Allah—a core spiritual experience linked to ethical consumption consistency in Muslim settings (Mukhtar and Butt 2012). Regular prayer, Qur'an recitation, and mosque participation heighten self-transcendent emotions that generalize to consumption domains (Yener 2022; Aldbyani 2024; White and Billet 2024). Islamic environmental values rooted in daily worship practices directly raise pro-environmental intention (Hermawan et al 2025). In adolescent samples, higher positive religious affect ("love for Allah") is also linked to prosocial dispositions, suggesting that devotional emotions generalize beyond strictly religious domains (Erken et al 2023). Based on this, the following hypothesis is advanced:

H6 *Islamic practice has a positive effect on the feeling of connectedness with Allah.*

The feeling of connectedness with Allah represents an affective and existential state that aligns consumer actions with internalized religious values. Religious spiritual



Fig. 1 Research Model



experiences serve as intrinsic motivators for pro-environmental behavior, with Rice (2006) finding that strong religious emotional experiences can stimulate environmental stewardship responsibility among Muslim consumers. Recent advances in the psychology of religion and environment confirm this connection, with Omoyajowo et al. (2024) demonstrating significant associations between spirituality and environmental responsibility across multicultural contexts. In the Islamic context, spiritual connectedness reflects the Qur’anic concept of ‘khalifa’ (stewardship responsibility), which directly translates into environmentally conscious consumption behaviors (Foltz 2006; Abdul-Matin 2010). Spiritual norms serve as effective mediators between environmental citizenship and pro-environmental behavior among Muslim students (Yusuf and Fajri 2023), while spiritual leadership significantly impacts environmental conservation efforts (Das 2025). Based on this, the following hypothesis is advanced:

H7 *Feeling of connectedness with Allah has a positive effect on halal green consumer behavior.*

Besides influencing internal religious engagement, peer communication may also exert a direct effect on green

consumption intention. In this case, peer communication operates as a behavioral shortcut by conveying social proof and trust in the brand’s ethical stance. This reflects a fast-processing heuristic mechanism, consistent with Nudge Theory, where individuals rely on others’ opinions to reduce uncertainty in complex or ambiguous decisions (Sunstein 2023). Based on this, the following hypothesis is advanced:

H8 *Peer communication has a positive effect on green consumption intention.*

According to the research hypotheses, we constructed the following conceptual model. The resulting conceptual model is presented in Fig. 1.

Research method

Measures, sample, and data collection

This study employed established multi-item constructs to measure all latent variables in the proposed model. The measurement items were adapted from prior validated scales, including those focusing on halal consumption behavior and



Islamic religiosity (Wilson and Liu 2010; Mukhtar and Butt 2012; Wilson 2012, Azam 2016), with minor wording modifications to reflect the halal and green consumption context. All items were measured using a 7-point Likert scale ranging from “strongly disagree” (1) to “strongly agree” (7), which is widely used in social science research and shown to improve psychometric performance by offering clear response gradations (Asún et al. 2016). The complete measurement instrument and all scale items are detailed in Appendix A.

The sampling frame consisted of Malaysian Muslim consumers aged 18 and above who had purchased halal-certified products within the previous 12 months. This population represents approximately 61.3% of Malaysia’s 32.6 million residents, constituting a significant consumer segment with growing interest in products that align with both religious values and environmental sustainability. While Malaysia’s population includes over 15% of Indian ethnic origin, these communities predominantly practice Hinduism and Sikhism, with Hindu traditions deeply embedded in their cultural identity. Following the India–Pakistan partition, most Muslims of South Asian origin migrated to Pakistan, leaving relatively few Muslims in the Indian community. Furthermore, the Malaysian Muslim population itself encompasses diverse sects and interpretations of Islam, all unified by their identification with the broader Islamic faith. These Muslim communities have developed distinctive characteristics through integration with local ethnic traditions (including indigenous practices), creating a rich tapestry of Islamic expression that combines religious principles with local cultural elements. This unique intersection of religious values and cultural adaptation makes Malaysia an ideal context for examining how religious principles influence sustainable consumption practices across various Muslim communities.

The criterion-based purposive sampling, a non-probability sampling technique selected for its appropriateness in studying specific consumer segments with particular experiences and characteristics. This methodological approach is well suited for theory testing in specialized contexts like religious consumption, where random sampling might yield insufficient numbers of qualified participants. The selection criteria required participants to (1) self-identify as Muslim, (2) have purchased halal-certified products within the past 12 months, and (3) demonstrate familiarity with eco-friendly product options. Participants were primarily recruited through MARA University of Technology (UiTM) networks and established Islamic community organizations across Malaysia. UiTM represents a particularly valuable sampling channel for this research as it primarily serves Malay and indigenous Malaysian populations who are predominantly Muslim. It is Malaysia’s largest university, with over 180,000 students across multiple campuses, providing access to a diverse

Muslim population with varying degrees of religious practice and environmental consciousness.

Data were collected through a structured online questionnaire administered via Qualtrics between March and April 2025. The survey instrument was developed following a comprehensive literature review and refined through two stages of expert review ($n=2$ academics with expertise in Islamic marketing) and cognitive interviews ($n=7$ Muslim consumers) to ensure content validity, cultural appropriateness, and semantic clarity.

To enhance response quality and methodological rigor, we implemented several procedural safeguards: (1) three attention-check questions strategically distributed throughout the survey, (2) minimum time thresholds for completion (excluding surveys completed in less than 4 min), (3) IP address verification to prevent duplicate submissions, and (4) assurances of anonymity to reduce social desirability bias. Participants received compensation of 2 euros upon successful completion, an amount determined through pilot testing to be appropriate without being coercive.

The questionnaire was pre-tested with 100 omnichannel users recruited from professional and social networks to ensure reliability and cultural sensitivity. Following pre-testing and minor adjustments to question wording, the final data collection yielded 276 responses. After excluding incomplete responses and those failing quality checks ($n=6$), a final sample of 270 valid cases was retained, resulting in an effective response rate of 97.83%, exceeding the recommended minimum of 25% for online surveys (Armstrong and Overton 1977; Ramshaw 2023). The dataset was complete with no missing values due to Qualtrics’ forced-response design.

This recruitment strategy provides access to a diverse Muslim population with varying degrees of religious practice and environmental consciousness. Although a significant portion of this demographic consists of UiTM students, they are active consumers with independent purchasing power derived from part-time work, making them a highly relevant segment for this research. This demographic is particularly pertinent to the research context, as young Malaysian Muslims represent an important emerging market segment for sustainable halal products with increasing purchasing influence.

The final sample size ($n=270$) satisfies the minimum requirement for structural equation modeling in complex models, particularly under Bayesian estimation. While traditional PLS-SEM suggests using 10–15 times the number of indicators in the most complex construct (Chin 1998), the use of Bayesian Structural Equation Modeling (BSEM) in this study allows for greater robustness, even in small or skewed datasets, as detailed in the following section.



Justification for Bayesian SEM (BSEM)

Given the theoretical and empirical goals of this study, Bayesian Structural Equation Modeling (BSEM) was employed using Mplus 8.3. The decision to adopt a Bayesian approach was motivated by both the data characteristics and the theoretical nature of the model. From a data standpoint, the sample exhibited non-normality and small size (e.g., Halal Green Behavior skewness = -3.125), which violates assumptions of conventional maximum-likelihood estimation. BSEM is well suited to small samples and non-normal distributions, and it naturally incorporates uncertainty in estimates through posterior distributions (Zyphur and Oswald 2013). Unlike PLS-SEM, which emphasizes predictive modeling and does not provide formal hypothesis testing, BSEM allows for the estimation of full posterior distributions, credible intervals, and significance assessments through Bayesian credible levels.

Furthermore, BSEM supports complex mediation structures and hierarchical modeling, which are essential for testing the multiple indirect pathways proposed in the dual-nudge framework. The approach also enables researchers to derive posterior probabilities and marginal distributions, which enhance interpretability, especially when modeling behavioral uncertainty in line with Nudge Theory.

In terms of theoretical alignment, Bayesian estimation offers a suitable probabilistic lens to interpret nudge effects. Since nudging is inherently probabilistic—based on behavioral tendencies rather than deterministic outcomes—Bayesian modeling enables a more nuanced analysis of how small cues influence behavior under uncertainty. The posterior distributions generated by BSEM can be interpreted as degrees of belief about the magnitude and credibility of indirect effects, which aligns conceptually with the behavioral framing of Nudge Theory.

Lastly, model comparison in BSEM was conducted using standard Bayesian fit indices such as Deviance Information Criterion (DIC) and Posterior Predictive p-values (PPP), providing robust tools to assess model adequacy and path plausibility across competing model specifications.

Ethics statement

This study adhered to the ethical principles set forth in the Declaration of Helsinki. Prior to responding to the questionnaire, participants were provided with written informed consent materials detailing the study's objectives and procedures. Consent was obtained via the online survey platform used for data collection. Participants were clearly informed that their involvement was completely voluntary and that they could withdraw at any point without facing any negative consequences. Furthermore, robust confidentiality protocols were implemented to safeguard their responses. According

to the regulations of MARA University of Technology, Malaysia and local institutions, the study received ethics approval from MARA University of Technology (UiTM) and relevant local bodies.

Data analysis and results

Descriptive statistics

To ensure relevance to the research context, respondents were selected based on their familiarity with halal and green product categories. All participants confirmed at least one online purchase involving certified or value-based products within the previous 12 months. The final sample consisted of 270 valid responses. Of these, 45.9% identified as male ($n = 124$) and 54.1% as female ($n = 146$). The age distribution was relatively diverse, with the largest group aged 18–24 years (41.1%, $n = 111$), followed by those aged 35–44 years (30.0%, $n = 81$). Participants aged 45–54 accounted for 13.0% ($n = 35$), while smaller proportions represented age brackets 25–34 (11.9%, $n = 32$) and 55–64 years (4.1%, $n = 11$).

Educational attainment was high: 35.9% ($n = 97$) held a bachelor's degree, 23.0% ($n = 62$) held a master's degree, and 27.0% ($n = 73$) had completed a doctoral degree or higher. Only a small fraction reported education at high school or vocational level and below (4.1%, $n = 11$). Monthly household income varied, with the largest group (45.2%, $n = 122$) earning below 3000 MYR. A notable proportion (25.2%, $n = 68$) earned between 8001 and 12,000 MYR, and 15.9% ($n = 43$) fell into the 5001–8000 MYR range. Less than 8% reported incomes above 12,000 MYR.

In terms of marital status, most respondents were single (60.0%, $n = 162$), followed by married individuals (35.9%, $n = 97$). A small proportion were divorced/separated (1.1%, $n = 3$), widowed (1.1%, $n = 3$), or preferred not to disclose this information (1.9%, $n = 5$). The sample included a balanced representation of employment statuses: 55.9% ($n = 151$) were employed full time, while students accounted for 38.9% ($n = 105$). Other categories, such as part-time workers (3.0%, $n = 8$), self-employed individuals (1.1%, $n = 3$), and retirees (1.1%, $n = 3$), were less represented.

Respondents were also geographically diverse: 40.0% ($n = 108$) resided in urban centers, 38.1% ($n = 103$) in suburban areas, and 18.1% ($n = 49$) in small towns, with a minority (3.7%, $n = 10$) living in rural areas. Household size varied, with most participants living in households of four to five people (41.9%, $n = 113$) or six or more people (28.1%, $n = 76$). Finally, 40.0% ($n = 108$) reported making household purchase decisions jointly with others, while 17.0% ($n = 46$) served as the sole decision-maker. Only 8.9%



($n = 24$) reported having no role in purchasing decisions (see Table 1).

In addition, this study investigates a sample of educated Malaysian Muslim consumers, primarily characterized by high tertiary educational attainment. While this demographic represents a significant segment of the urban population, we acknowledge that it may not fully capture the

diversity of less-educated or rural communities, a point we address in the limitations.

To rigorously test the generalizability of the model, particularly in light of the sample's age distribution (younger cohort, 18–34; older cohort, 35+), we conducted a multigroup Bayesian SEM. Crucially, this analysis revealed that the model is not fully invariant across age. We found

Table 1 Respondents' profile ($n = 270$)

Category	Response	%	<i>n</i>
Gender	Male	45.9	124
	Female	54.1	146
Age	18–24 years	41.1	111
	25–34 years	11.9	32
	35–44 years	30.0	81
	45–54 years	13.0	35
	55–64 years	4.1	11
Education level	Secondary school or below	1.1	3
	High school/Vocational school	3	8
	Diploma	10	27
	Bachelor's degree	35.9	97
	Master's degree	23	62
Monthly income	Doctoral degree or above	27	73
	Below 3000	45.2	122
	3001–5000	5.9	16
	5001–8000	15.9	43
	8001–12,000	25.2	68
	12,001–20,000	5.2	14
Marital status	Above 20,000	2.6	7
	Single	60.0	162
	Married	35.9	97
	Divorced/Separated	1.1	3
	Widowed	1.1	3
Employment status	Prefer not to say	1.9	5
	Full-time employed	55.9	151
	Part-time employed (No student)	3	8
	Self-employed/Entrepreneur	1.1	3
	Student (including part-time employed)	38.9	105
	Retired	1.1	3
Residential area	Unemployed	0.0	0
	Urban center	40	108
	Suburban area	38.1	103
	Small town	18.1	49
Household size	Rural area	3.7	10
	1 person	8.1	22
	2–3 people	21.9	59
	4–5 people	41.9	113
Household purchase decision-maker	6 or more people	28.1	76
	Yes, I am the sole decision-maker	17	46
	Yes, but I make decisions jointly with others	40	108
	No, but I participate in decision-making	34.1	92
	No, I do not participate in decision-making	8.9	24



significant path differences between the cohorts, indicating that age acts as a key moderator. For instance, the influence of BP on HGCB was strong and significant only in the younger group ($\beta=0.692$), whereas its effect was non-significant in the older group. The results are shown in Appendix C.

This analysis revealed significant path differences between the cohorts, indicating that age is a key moderator.

Confirmatory factor analysis

A Bayesian confirmatory factor analysis (CFA) was conducted using Mplus 8.3 to assess the reliability and validity of the latent constructs. The model included eight first-order constructs: Logo Certification, Brand Distinctiveness, Brand Prestige, Peer Communication, Islamic Practices, Feeling of Connectedness with Allah, Green Consumption Intention, and Halal Green Behavior. All items were specified as continuous indicators, and parameter estimation was conducted using Bayesian Markov Chain Monte Carlo (MCMC) methods with default priors.

All factor loadings exceeded the recommended threshold of 0.70, confirming indicator reliability across constructs. Specifically, loadings ranged from 0.745 to 0.969. Table 2 reports the factor loadings in detail. The posterior predictive p value (PPP) for the CFA model was acceptable (PPP=0.36), indicating good model fit in Bayesian terms.

Internal consistency was confirmed using Cronbach's alpha (α), with values ranging from 0.873 to 0.973. Composite reliability (CR) scores for all constructs exceeded the standard cutoff of 0.70, ranging from 0.912 to 0.980. Furthermore, Average Variance Extracted (AVE) values were all above the minimum acceptable value of 0.50, with the lowest AVE being 0.674 (for Logo Certification) and the highest reaching 0.925 (for Green Consumption Intention), indicating satisfactory convergent validity (Fornell and Larcker, 1981).

Discriminant validity was evaluated by comparing the square root of each construct's AVE with its correlations to other constructs. The square roots of AVEs were consistently greater than the corresponding inter-construct correlations, supporting discriminant validity. Table 2 presents detailed reliability and validity metrics.

If the posterior predictive p value (PPP) for the Bayesian CFA model was exactly 1.000, which may initially suggest potential overfit or model-data mismatch, recent literature emphasizes that PPP should not be interpreted in isolation or treated as a strict accept/reject decision rule. As noted by Gelman (2003) and Gelman et al. (2013), the core function of posterior predictive checking is not to produce a p value for formal hypothesis testing, but rather to diagnose where the model fails to capture key patterns in the data. Gelman argues against the rigid use of p values in Bayesian settings,

Table 2 Bayesian confirmatory factor analysis result

		α	CR	AVE	
Brand distinctiveness	BD_1	0.938	0.93	0.96	0.88
	BD_2	0.956			
	BD_3	0.922			
Brand prestige	BP_1	0.949	0.94	0.96	0.90
	BP_2	0.969			
	BP_3	0.928			
Feeling of connectedness with Allah	FCA_1	0.745	0.96	0.97	0.71
	FCA_10	0.913			
	FCA_11	0.909			
	FCA_12	0.753			
	FCA_2	0.807			
	FCA_3	0.770			
	FCA_4	0.857			
	FCA_5	0.851			
	FCA_6	0.890			
	FCA_7	0.869			
Green consumption intention	GCI_1	0.960	0.97	0.98	0.93
	GCI_2	0.967			
	GCI_3	0.969			
	GCI_4	0.951			
Halal green consumer behavior	HGCB_1	0.893	0.87	0.92	0.80
	HGCB_2	0.890			
	HGCB_3	0.896			
Islamic practices	IP_2	0.934	0.90	0.94	0.84
	IP_3	0.938			
	IP_4	0.868			
Logo certification	LC_1	0.859	0.88	0.91	0.67
	LC_2	0.817			
	LC_3	0.772			
	LC_4	0.826			
	LC_5	0.827			
Peer communication	PC_1	0.763	0.93	0.94	0.69
	PC_2	0.856			
	PC_3	0.860			
	PC_4	0.883			
	PC_5	0.851			
	PC_6	0.768			
	PC_7	0.839			

encouraging instead more interpretive, diagnostic use of graphical and statistical comparisons between observed and replicated data.

Supporting this view, Muthén and Asparouhov (2012) also emphasize the limited diagnostic value of PPP when used alone. Within the BSEM framework, they advocate



examining the 95% credible intervals of model parameters—especially cross-loadings and residual covariances—as a more reliable basis for model revision. When parameters have narrow credible intervals that exclude zero, and their posterior distributions align with theoretical expectations, the model can still be considered substantively valid, regardless of PPP extremity. Furthermore, recent work by Asparouhov and Muthén (2021) introduces Bayesian analogs of traditional fit indices, such as RMSEA and CFI, which offer more stable alternatives to PPP under varying sample conditions.

Van de Schoot et al. (2014) likewise caution that PPP may be overly sensitive to minor discrepancies, particularly in large or highly constrained models, and may underestimate the practical adequacy of a model. They recommend a pragmatic approach: researchers should combine PPP interpretation with a close examination of key model parameters and their credible intervals. In this study, all factor loadings are high and statistically credible, and each construct displays strong internal consistency and convergent validity. Hence, despite the boundary PPP value, the measurement model is considered acceptable and theoretically meaningful.

These perspectives suggest that while PPP offers a useful overview of global model fit, it should be integrated with substantive theory and parameter-level diagnostics. In this study, the measurement model's adequacy is supported by both statistical indicators and theoretical coherence, justifying its use in subsequent structural modeling.

Correlation analysis

To examine the bivariate associations between the study variables, a Bayesian correlation matrix was constructed using posterior means of latent variable relationships. Table 3 presents the posterior correlations (γ), two-tailed Bayesian p values, and 95% credible intervals. Most of the estimated correlations were statistically credible, with posterior p values below 0.001 and credible intervals excluding zero, supporting the strength and consistency of the observed associations.

Halal Green Consumer Behavior (HGCB) was positively and significantly associated with all other constructs. Notably, it was strongly correlated with Feeling of Connectedness with Allah ($\gamma=0.648$, $p<0.001$), Logo Certification ($\gamma=0.573$, $p<0.001$), and Brand Prestige ($\gamma=0.567$, $p<0.001$). Similarly, Green Consumption Intention (GCI) was significantly related to Peer Communication ($\gamma=0.560$, $p<0.001$), Logo Certification ($\gamma=0.607$, $p<0.001$), and Islamic Practice ($\gamma=0.574$, $p<0.001$), supporting the proposed dual-path influence model.

The strongest observed correlation was between Feeling of Connectedness with Allah and Islamic Practice ($\gamma=0.783$, $p<0.001$), indicating internal consistency in the

Table 3 Correlations results

Pair	Correlation (γ)	p	Lower	Upper
HGCB—LC	0.573	0	0.456	0.67
HGCB—BP	0.567	0	0.449	0.666
HGCB—BD	0.477	0	0.345	0.59
HGCB—FCA	0.648	0	0.546	0.731
HGCB—IP	0.434	0	0.296	0.554
HGCB—PC	0.22	0.006	0.064	0.366
HGCB—GCI	0.346	0	0.199	0.478
LC—BP	0.688	0	0.594	0.763
LC—BD	0.621	0	0.513	0.709
LC—FCA	0.474	0	0.342	0.588
LC—IP	0.383	0	0.239	0.51
LC—PC	0.293	0	0.141	0.431
LC—GCI	0.607	0	0.497	0.698
BP—BD	0.808	0	0.746	0.857
BP—FCA	0.452	0	0.316	0.569
BP—IP	0.395	0	0.252	0.521
BP—PC	0.349	0	0.202	0.481
BP—GCI	0.503	0	0.374	0.612
BD—FCA	0.405	0	0.264	0.53
BD—IP	0.34	0	0.192	0.472
BD—PC	0.308	0	0.157	0.444
BD—GCI	0.448	0	0.312	0.566
FCA—IP	0.783	0	0.714	0.838
FCA—PC	0.408	0	0.267	0.532
FCA—GCI	0.568	0	0.45	0.666
IP—PC	0.488	0	0.358	0.6
IP—GCI	0.574	0	0.457	0.671
PC—GCI	0.56	0	0.441	0.66

religious-affective dimension of the model. Furthermore, Brand Distinctiveness and Brand Prestige also showed a very strong correlation ($\gamma=0.808$, $p<0.001$), as expected given their shared brand identity domain.

Although all correlations were statistically significant, none approached multicollinearity thresholds, suggesting discriminant validity across constructs. The descriptive statistics for each variable—including means, standard deviations, and correlation coefficients—are reported in Tables 3 and 4. These results provide preliminary support for the hypothesized relationships and justify the progression to full structural modeling.

Structural model and hypothesis testing

The proposed research model was tested using Bayesian structural equation modeling (BSEM) in Mplus 8.3. All paths were estimated using Markov Chain Monte Carlo (MCMC) simulation, with four independent chains and 30,000 iterations per chain. The estimation followed a



Table 4 Correlation matrix

Variable	Mean	SD	HGCB	BP	BD	FCA	IP	GCI	LC	PC
HGCB	6.301	1.055462	1							
BP	5.976	1.189958	0.567**	1						
BD	5.732	1.302306	0.477**	0.808**	1					
FCA	6.593	0.719722	0.648**	0.452**	0.405**	1				
IP	6.509	0.850294	0.434**	0.395**	0.340**	0.783**	1			
GCI	6.094	1.017841	0.346**	0.503**	0.448**	0.568**	0.574**	1		
LC	6.026	1.015874	0.573**	0.688**	0.621**	0.474**	0.383**	0.607**	1	
PC	5.427	1.10227	0.220**	0.349**	0.308**	0.408**	0.488**	0.560**	0.293**	1

* $p < 0.05$; ** $p < 0.01$, two-tailed test

non-informative prior setup for regression paths, assuming $\beta_j \sim \mathcal{N}(0, \sigma^2)$, with $\sigma^2 \rightarrow \infty$, and inverse-gamma priors for residual variances. Gibbs sampling with parameter expansion (PX1) was used, with all chains initialized without perturbation. Critically, the estimation process itself proved highly stable, with the Potential Scale Reduction (PSR) factor holding steady from 1.003 at the 30,000th iteration to 1.004 at the 60,000th iteration, demonstrating excellent convergence.

All inferential statistics reported below are Bayesian. The posterior mean is the average value of a parameter across its posterior probability distribution after combining prior information (here, weakly informative) with the observed data. A 95% credible interval (CI) is the interval that contains 95% of the posterior probability mass; under the model, there is a 0.95 probability that the true parameter value lies within this range. This differs from a frequentist 95% confidence interval, which refers to long-run coverage across repeated samples. Readers new to Bayesian SEM may find this distinction helpful when interpreting the paths reported below.

Using Bayesian SEM with small-variance priors on every cross-loading and latent residual covariance ($n=0$, $\sigma^2=0.01$), the model converged at max-PSR = 1.004 after 30,000 iterations. Fit was adequate: PPP = 0.36, and the 95% posterior χ^2 discrepancy ranged from -21.73 to 32.75 . A robustness run doubling the chain length to 60,000 iterations reproduced PPP = 0.368 and virtually identical information criteria (DIC = 2896.9; WAIC = 3090.4), confirming stability.

In terms of explanatory power, the model accounted for a substantial proportion of variance in key constructs: R^2 was 0.403 for halal green consumer behavior (HGCB), 0.452 for green consumption intention (GCI), 0.631 for brand prestige (BP), 0.353 for brand distinctiveness (BD), 0.452 for feeling of connectedness with Allah (FCA), and 0.195 for Islamic practices (IP). These values suggest that the model provides a meaningful account of both behavioral and psychological outcomes. Significant paths of the BSEM results are shown in Fig. 2 and Table 5.

All hypothesized direct effects were supported. Logo certification (LC) significantly predicted brand distinctiveness ($\gamma = 0.615$) and green consumption intention ($\gamma = 0.503$, 95% CI [0.405, 0.594]). Brand distinctiveness, in turn, strongly influenced brand prestige ($\gamma = 0.807$), which subsequently predicted HGCB ($\gamma = 0.389$, 95% CI [0.255, 0.519]). In the religious pathway, peer communication (PC) influenced Islamic practices ($\gamma = 0.483$) and green consumption intention ($\gamma = 0.388$, 95% CI [0.279, 0.487]). Islamic practices had a strong effect on FCA ($\gamma = 0.722$), which then predicted HGCB ($\gamma = 0.494$, 95% CI [0.367, 0.614]).

Multiple indirect effects were statistically significant. In the identity-based path, LC indirectly influenced brand prestige through brand distinctiveness ($\gamma = 0.496$, 95% CI [0.391, 0.599]), and brand distinctiveness indirectly influenced HGCB through brand prestige ($\gamma = 0.314$, 95% CI [0.191, 0.446]). A serial mediation effect from LC to HGCB via BD and BP was also observed ($\gamma = 0.194$, 95% CI [0.117, 0.278]). In the religious-affective path, PC influenced FCA via IP ($\gamma = 0.349$), and IP predicted HGCB through FCA ($\gamma = 0.357$). The full mediation chain—PC \rightarrow IP \rightarrow FCA \rightarrow HGCB—was supported ($\gamma = 0.158$, 95% CI [0.094, 0.232]). The convergence plots of the mediation effects of the two sequences are shown in Figs. 3 and 4.

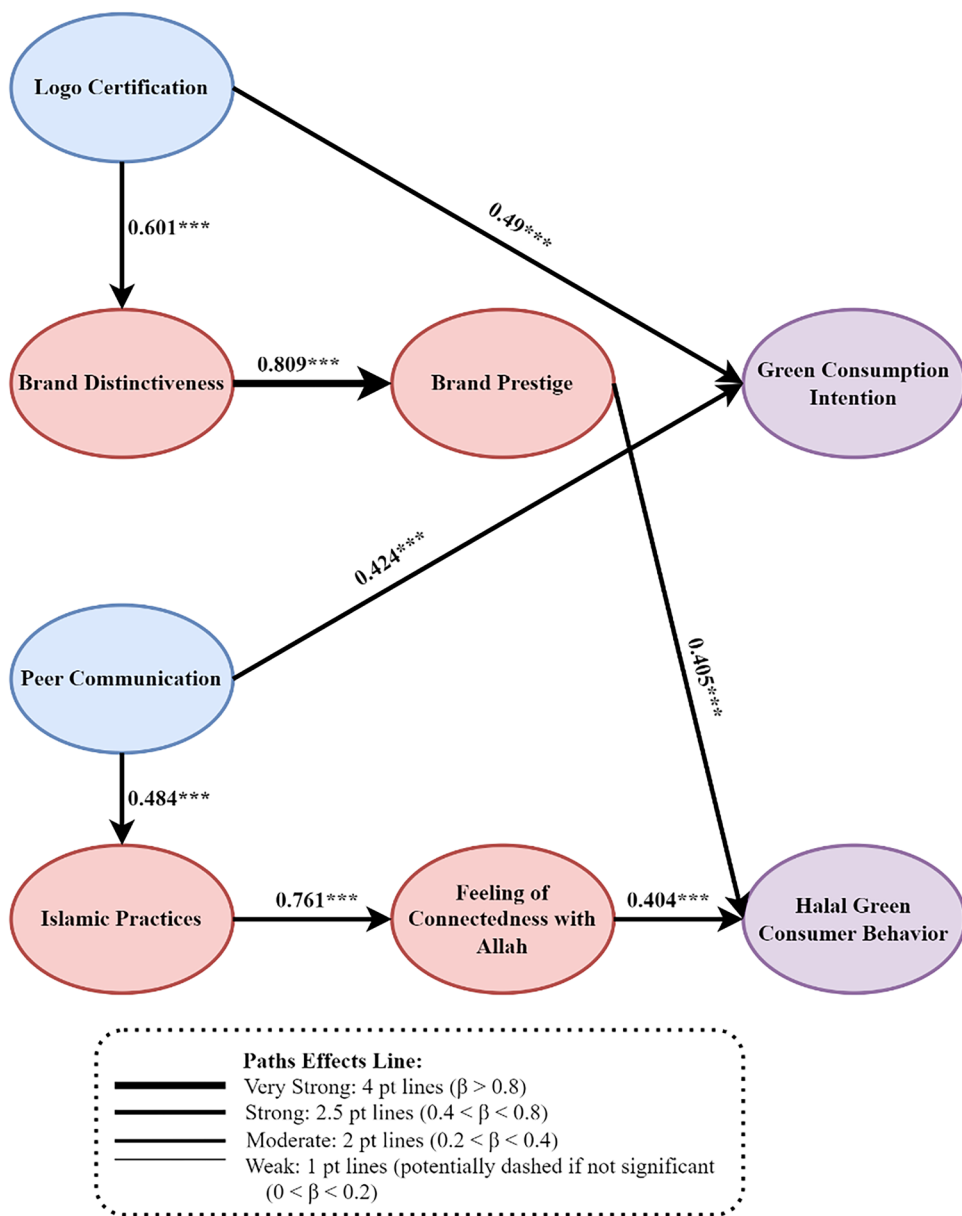
In line with recommendations for model transparency, Table 6 summarizes the estimation parameters, priors, sampling algorithm, and computational specifications used. These details enhance reproducibility and provide a clear view of how the BSEM model was implemented. The credible intervals for all main effects were narrow and excluded zero, indicating stability and interpretability of estimates.

For mathematical clarity and reproducibility, the following expressions define the structure of the model and its estimation framework. The core structural equations can be expressed as follows:

$$BD_i = \gamma_1 \cdot LC_i + \zeta_1$$



Fig. 2 Path Effects



$$BP_i = \gamma_2 \cdot BD_i + \zeta_2$$

$$BP_i = \gamma_2 \cdot BD_i + \zeta_2$$

$$FCA_i = \gamma_4 \cdot IP_i + \zeta_4$$

$$HGCB_i = \gamma_5 \cdot BP_i + \gamma_6 \cdot FCA_i + \zeta_5$$

$$GCI_i = \gamma_7 \cdot LC_i + \gamma_8 \cdot PC_i + \zeta_6,$$

where BD: Brand Distinctiveness, BP: Brand Prestige, HGCB: Halal Green Consumer Behavior, FCA: Feeling of Connectedness with Allah, IP: Islamic Practices, GCI: Green Consumption Intention, LC: Logo Certification, PC:

Peer Communication, γ_i : Standardized path coefficients for respective relationships, ζ_i : Disturbance terms (residuals), assumed to be normally distributed with zero mean.

The Bayesian estimation process follows Bayes' rule:

$$P(\theta|D) = \frac{P(D|\theta) \cdot P(\theta)}{P(D)},$$

where θ represents the vector of model parameters, $P(D|\theta)$ is the likelihood function, and $P(\theta)$ is the prior distribution. The model assumes flat (non-informative) priors for regression coefficients and inverse-gamma priors for residual variances, as is standard in Mplus.



Table 5 Path of structural model

	Effect	95% CI	
		Lower	Upper
Indirect paths			
LC → BD → BP	0.486	0.305	0.668
BD → BP → HGCB	0.328	0.085	0.57
PC → IP → FCA	0.368	0.127	0.609
IP → FCA → HGCB	0.307	0.014	0.601
Serial mediations			
LC → BD → BP → HGCB	0.197	0.04	0.354
PC → IP → FCA → HGCB	0.149	- 0.012	0.309
Direct paths			
LC → GCI	0.49	0.245	0.735
PC → GCI	0.424	0.203	0.645
LC → BD	0.601	0.419	0.783
BD → BP	0.809	0.633	0.985
BP → HGCB	0.405	0.119	0.691
FCA → HGCB	0.404	0.057	0.751
PC → IP	0.484	0.241	0.727
IP → FCA	0.761	0.442	1.08
R square	HGCB: 0.403 FCA: 0.452	BP: 0.631 IP: 0.195	BD: 0.363 GCI: 0.462
Final PSR value: 1.004	Posterior Predictive p-value (PPP): 0.36		

Robustness checks

Bayesian variance-inflation factors were all below 3.5 and HTMT ratios below 0.85, indicating that multicollinearity among latent predictors is not a concern. A Harman single-factor test captured only 30% of total variance, and adding a latent method factor changed substantive loadings by ≤ 0.04 , suggesting that the high means on FCA and IP reflect genuine religiosity rather than uniform acquiescence. For

completeness, we repeated the ten-fold Bayesian cross-validation for all six endogenous constructs; the average drop in R^2 was never larger than 0.02 (see Table 7), which confirms that the small-variance priors do not inflate predictive power. Statistically, the model meets Muthén and Asparouhov’s (2012) and Asparouhov and Muthén’s (2021) Bayesian convergence and fit criteria (PPP ≈ 0.36 ; max-PSR = 1.004) and remains stable in a 60 k-iteration robustness run. Multicollinearity, response-style bias, and over-fitting were ruled out

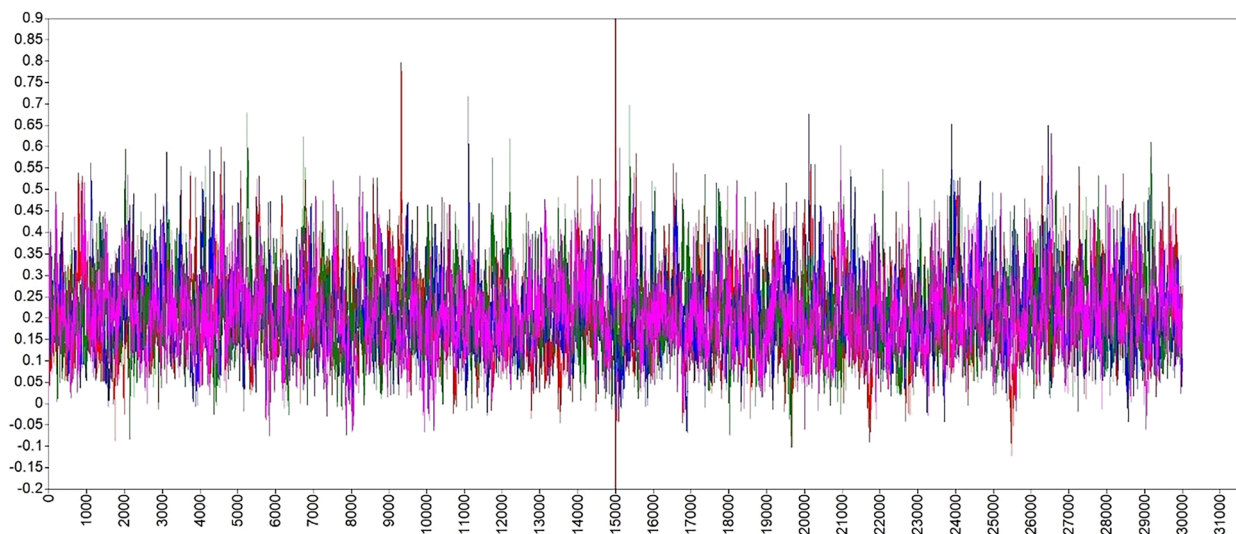


Fig. 3 The First Sequence Convergence. Note: LC → BD → BP → HGCB



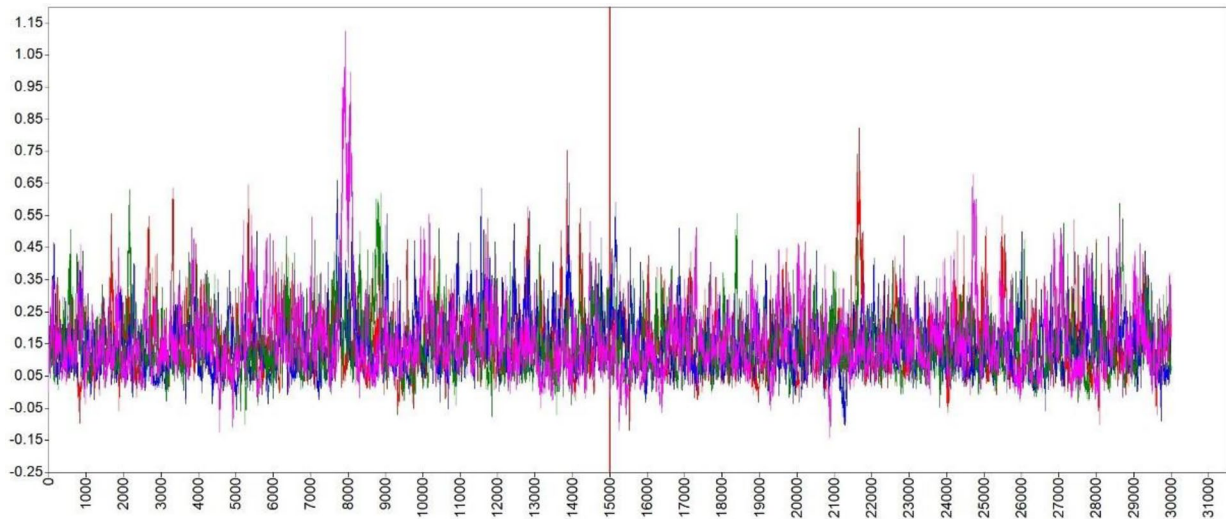


Fig. 4 The Second Sequence Convergence. Note: PC → IP → FCA → HGC

Table 6 Model transparency and fit indicators

Category	Item	Content/value	Explanation
Model transparency	Software and version	Mplus 8.3	Software used for Bayesian SEM
	Prior distribution of regression paths	$\beta \sim N(0, \infty)$	Non-informative prior
	Prior distribution of residual variances	Inverse-gamma (default)	Default prior in Mplus
	Sampling method	Gibbs sampling with parameter expansion (GIBBS PX1)	Bayesian estimation method
	Number of MCMC chains	4 chains	For convergence and robustness
	Iterations per chain	30,000 iterations	Total number of draws per chain
	Thinning	None ($k=1$)	No thinning applied
	initialization	Unperturbed	Initial values not perturbed
	Random seeds	Chain 1:0; Chains 2–4: 285,380, 253,358, 93,468	Used for reproducibility
Model fit indicators	Posterior predictive p value (PPP)	0.36	Adequate fit (PPP \approx 0.36 indicates plausible replication)
	95% CI of χ^2 difference	[− 21.73, 32.75]	Confidence interval for discrepancy between observed and model-implied data
	Deviance information criterion (DIC)	2896.9	For model comparison; lower values indicate better fit
	Widely applicable information criterion (WAIC)	3090.4	Stricter, fully Bayesian criterion for model comparison
	Estimated parameters (pD)	\approx 28–30	Number of effective parameters
	Potential scale reduction (PSR)	1.004	Good convergence (recommended \leq 1.05)
	Sample size (N)	270	directly below Number of MCMC Chains
	Bayesian VIF (range)	1.12–3.45	Predictive diagnostics block
HTMT (max)	0.84	Same block	

The robustness run (60 k iterations) and note that PPP, DIC, WAIC, and PSR were unchanged, confirming stability

through VIF/HTMT, method-factor analysis, and ten-fold cross-validation, respectively. The calculation formulas for these Bayesian indicators are shown in Appendix B.

Discussion



Table 7 Ten-fold cross-validation results

Variable	Mean in-sample R^2	Mean out-of-sample R^2	Difference
HGCB (Green Halal Choice Behavior)	0.40	0.38	0.02
BP (Brand Prestige)	0.63	0.61	0.02
BD (Brand Distinctiveness)	0.36	0.34	0.02
FCA (Feeling of Connectedness with Allah)	0.45	0.43	0.02
IP (Islamic Practice)	0.19	0.17	0.02
GCI (Green Consumption Intention)	0.45	0.43	0.02

All gaps are small (≤ 0.02), which supports the claim that the priors have not led to over-fitting anywhere in the model

The Bayesian SEM results provide empirical support for the theoretical underpinnings of Nudge Theory in explaining halal green consumer behavior within value-laden retail environments. Nudge Theory proposes that individuals are not strictly rational actors but instead rely on heuristics and context-based cues embedded within the choice architecture (Thaler and Sunstein 2008; Sunstein 2014a, b; Chuang et al 2025). The findings show that logo certification and peer communication function as structured nudges, influencing consumer behavior through two distinct yet complementary pathways: a brand identity path and a religious-affective path.

The significant direct and indirect effects observed in the identity-based nudging path support the idea that formal visual cues, such as halal or eco-labels, can serve not merely as indicators of quality or compliance but also as catalysts for deeper psychological engagement. Specifically, LC significantly predicted brand distinctiveness (BD), which subsequently enhanced brand prestige (BP), ultimately contributing to halal green consumer behavior (HGCB). This chain mediation effect confirms that certification-based nudges do not operate solely through shallow heuristics but can activate value-congruent brand perceptions and emotionally aligned judgments. These results align with the broader implications of Nudge Theory, which suggest that well-designed nudges can enhance not just behavior but also meaning construction within consumers' decision-making processes (Lehner et al. 2016).

The second pathway, rooted in religious-affective dynamics, offers equally compelling support for socially and spiritually grounded nudging mechanisms. Peer communication was found to influence Islamic practices (IP), which then strengthened the feeling of connectedness with Allah (FCA)—a deeply personal emotional state with strong behavioral consequences. This sequence reflects how socially embedded cues—such as interpersonal conversations—can serve as informal reinforcements of value-congruent behaviors. FCA emerged as a critical mediating variable, linking internalized religious emotion with pro-environmental behavior. This pathway not only supports

the emotional foundations of Nudge Theory (Marteau et al. 2011) but also extends its application into moral and faith-based consumption domains where emotional salience is derived from spiritual congruence.

The mediation results further elucidate how nudging strategies function through sequential psychological stages. The LC \rightarrow BD \rightarrow BP \rightarrow HGCB serial path indicates that brand cues are cognitively processed, internalized through brand identity, and emotionally evaluated before resulting in sustainable behavior. Meanwhile, the PC \rightarrow IP \rightarrow FCA \rightarrow HGCB chain confirms that religiously meaningful social interactions evolve into routine practices and affective alignment, ultimately guiding action. The credibility of both chains is supported by Bayesian posterior distributions, with narrow credible intervals that exclude zero, strengthening the claim that nudging mechanisms operate through layered mediating structures rather than isolated stimuli.

The dual-path findings offer a nuanced refinement of Nudge Theory by showing that effective nudges can vary in their psychological depth and mode of influence. On one hand, LC demonstrates the utility of institutional nudges that shape decisions by providing clear, credible cues aligned with cultural or ethical norms. On the other hand, PC operates as a social nudge, indirectly modifying behavior through peer influence, moral reinforcement, and the cultivation of emotion-laden experiences. Together, these two nudging routes show that behavioral change in sustainability contexts arises from the convergence of informational cues and emotional resonance—both of which are facilitated by the consumer's cultural and spiritual ecosystem.

In this context, the model also contributes to recent work that emphasizes the importance of “value-congruent nudging,” where the success of interventions depends not just on presentation but on alignment with the individual's core beliefs (Sunstein, 2021). The finding that FCA is a stronger predictor of HGCB than brand prestige suggests that in markets with strong religious frameworks, emotionally and spiritually aligned nudges may outperform conventional market-based strategies. Moreover, the robust direct effects of both LC and PC on green consumption intention (GCI) imply



that such nudges not only activate identity or affect but can independently stimulate goal-directed behavior.

The investigation into the moderating role of age, conducted via a multigroup Bayesian path analysis, yielded a critical finding. The model, as detailed in Appendix C, fits the younger cohort's data well ($PPP=0.106$) but was strongly rejected by the older cohort's data ($PPP=0.000$), pointing to fundamental structural differences between the groups. Strikingly, the strength of several key paths differed significantly. The first mediation chain ($LC \rightarrow \dots \rightarrow HGCB$), for example, was fully operational in the younger group, but broke down in the older group where the $BP \rightarrow HGCB$ link became non-significant. In contrast, the final step of the second chain ($FCA \rightarrow HGCB$) showed a more pronounced trend in the older cohort. These findings demonstrate that the theory is not universal; rather, its mechanisms are deeply contingent on age.

Rather than being limited to choice simplification, nudges can act as vehicles for emotional and identity activation, particularly when placed in culturally or religiously sensitive settings. These findings broaden the explanatory scope of Nudge Theory by illustrating how nudges designed around internal belief systems and community validation—rather than purely instrumental logic—can influence consumer behavior in complex, high-involvement domains like ethical and religious consumption.

Theoretical implications

This study advances Nudge Theory by showing how nudges operate within a culturally anchored consumer segment whose choices are shaped by halal compliance—a segment-defining constraint that can be explicitly encoded in data-driven targeting and causal machine-learning models (von Zahn et al. 2024). Previous work has applied nudge principles mainly in secular domains such as tax compliance, organ donation, and energy conservation (List et al. 2023; Ehtuish 2024; Yang et al. 2024). In contrast, we demonstrate that nudges can also promote ethical choice through deeper psychological and social channels in religious retail environments. A Bayesian survey-based test provides an operational template that other scholars can replicate when seeking clean causal verification of nudge mechanisms in belief-driven segments. Prior frameworks—including the Theory of Planned Behavior, the Value-Belief-Norm model, and the Stimulus-Organism-Response tradition—stress cognitive and attitudinal determinants of pro-environmental behavior (Mehrabian and Russell 1974; Ajzen 1991; Stern 2000a, 2000b; Trautwein et al. 2021; Solekah and Handriana 2023). The dual-pathway model separates a cognitive-identity mechanism from a spiritual-affective mechanism, explaining how symbolic cues and peer communication

jointly encourage halal green behavior. These distinctions establish a clear gap that the present work fills.

Religion supplies a deeply rooted cognitive frame that heightens the salience of certain market cues. The empirical setting involves halal-certified brands spanning snacks, beverages, and personal-care categories, so the findings do not hinge on a single food product. For Muslim consumers, the halal logo signals that a product aligns with their faith-based rules; it therefore functions as a nudge precisely because the individual identifies with Islam. By positioning religion as an identity-linked target within the nudge architecture, the study extends Nudge Theory beyond generic heuristics—or prompts that work mainly through default options and visual prominence—to cues that activate personal identity and moral duty. The finding that logo certification directly increases green behavioral intention shows that nudging power is amplified when ethical consumption resonates with religious self-concept. This extension broadens the scope of Nudge Theory, integrating it with identity-based decision processes that are central to sustainable consumption in faith-governed markets.

A nudge is an indirect prompt that steers choice by directing attention and recognition without restricting options (Thaler and Sunstein 2008). Religious identity acts as an attentional filter, making halal signals especially salient and reducing cognitive effort when consumers evaluate ethically complex products. This interpretation situates our model within the bounded-rationality tradition, where individuals rely on shortcuts to conserve mental resources. We link nudge effectiveness to long-term memory structures and social learning rather than to momentary primes by framing halal compliance as a category-level shortcut.

The pathway from brand prestige to green behavior weakens for older Muslims, underscoring how trait-environment interplay refines the nudge mechanism. The model distinguishes two context-dependent avenues: logo certification operates as an institutional cue that signals rule compliance, while peer communication functions as a social-context cue that normalizes sustainable behavior through interpersonal validation. The two cues converge in their influence on consumption, yet they activate different aspects of identity. The logo pathway highlights formal adherence to religious law, whereas the peer pathway activates communal belonging and observational learning. By interpreting emotional resonance—pride in following Islamic law, gratitude toward approving peers—as features of the religious setting rather than as stand-alone theories, we maintain a unified explanatory logic. This approach clarifies that symbolic and social channels belong inside the nudge framework and do not require separate theoretical labels. Also, peer communication fosters Islamic practices, which in turn enhance the feeling of connectedness with Allah, a spiritually grounded emotional state that significantly predicts halal green



consumer behavior. This contributes to the emerging literature on moral nudges (Bicchieri and Dimant 2019a, b) and identity-based interventions (Yoeli et al. 2013), emphasizing that nudging can be culturally and morally contextualized rather than universally applied.

Because this logic springs from a trait–environment interaction, it should generalize to any context where consumption is governed by stable moral norms, giving the contribution a reach that extends beyond halal markets.

The study illustrates how a Bayesian **survey-based test** can generate probability statements about the strength of nudges in an identity-rich population. In other words, the use of Bayesian SEM allows for the modeling of uncertainty in behavioral mechanisms, which aligns with Nudge Theory’s premise that behavioral change is probabilistic and context-sensitive. Rather than focusing on linear and deterministic pathways, the current model embraces the probabilistic structure of behavior by estimating full credible intervals for each effect. Bayesian estimation yields full posterior distributions for path coefficients, enabling direct assessment of how strongly each cue promotes sustainable behavior under uncertainty. **This approach** is well suited to segments where sampling frames are small yet information-rich, such as niche religious markets. Researchers can build predictive tools that respect consumer autonomy while encouraging socially desirable outcomes by combining machine-learning-driven targeting variables with psychologically grounded nudges. The probabilistic evidence also supports external validity, as posterior predictions can be transported to similar faith-governed contexts—an advantage over traditional null-hypothesis testing. Future investigations may apply the same survey-based Bayesian design to other certification regimes—for example, kosher or Jain labels—to test whether identity-linked cues encourage comparable shifts toward ethical consumption.

Practical implications

This study offers several actionable implications for marketers, retailers, and policy designers operating in culturally sensitive markets, particularly where ethical and religious considerations shape consumption behavior. The methodological contribution translates directly into practical tools. Halal-certified brands often target consumers whose purchasing decisions are governed by moral or religious rules. The posterior probabilities generated by the Bayesian structural model can be exported as household-level propensity scores for halal-brand promotions, analogous to standard churn-risk scores. Because these scores guide differential treatment, managers should audit them for fairness before deployment, following the framework of Lo et al. (2024). The substantive findings reveal certification as a dual-function mechanism. Certification-based nudging—through the

use of credible logos such as halal or eco-labels—is not merely a functional tool for signaling compliance, but also a powerful symbolic asset. Retailers should prioritize the visibility and credibility of certification logos across digital and physical touchpoints, especially in markets where values and moral signaling strongly influence consumer judgment. Moreover, such certifications should be communicated not only as compliance symbols but as part of a broader brand narrative that aligns with consumers’ identities and aspirations. This can deepen emotional resonance and reinforce loyalty beyond price or product features.

Identity-driven marketing emerges as the strategic priority. Brand strategists should consider investing in identity-driven marketing that highlights both brand distinctiveness and prestige, especially in product categories where moral and environmental values are salient. The pathway from logo certification to halal green consumer behavior—mediated by brand identification constructs—demonstrates that nudges anchored in brand design can activate self-relevant motivations. This means that nudging is not limited to choice architecture at the point of purchase but can begin upstream in brand development, packaging design, and narrative construction. For example, campaigns that integrate ethical certification with imagery and language that reflect cultural norms and personal dignity can strengthen the perceived congruence between consumer identity and brand values. Managers can replicate our three-cell factorial field design—logo cue, peer message, and their interaction—in staged roll-outs. Such multi-arm, multi-stage adaptive experiments improve power and speed, as demonstrated by Legare et al. (2023). Practitioners can discontinue ineffective cells and reallocate budget without compromising statistical validity by analyzing interim data.

Although the present test uses halal certification, the same trait-aware scoring plus factorial design applies to other value-laden labels. Sustainable-product cues systematically shift demand elasticities across consumer segments (Amaldoss and Prusty 2025), and a quasi-natural experiment on mandatory GMO disclosure shows measurable changes in category shares when moral labels are introduced (Adalja et al. 2022). These studies affirm that label effectiveness rises when moral norms and peer cues align with the choice architecture. The findings suggest that peer communication functions as a naturally occurring social nudge that enhances both religious practice and emotional engagement with sustainable brands. Retailers should leverage this by designing community-centric marketing initiatives—such as online discussion forums, local ambassador programs, or user-generated content campaigns—that encourage consumers to share their ethical or religious consumption experiences. These peer-driven endorsements can reinforce behavioral consistency, build trust, and stimulate emotional validation,



especially in markets where religious affiliation shapes moral legitimacy.

Additionally, the role of religious engagement as an emotional mediator suggests that policy makers and sustainability advocates must move beyond purely rational appeals when promoting ethical consumption. Educational campaigns and behavioral interventions will likely be more effective when they incorporate emotionally resonant messages tied to spirituality, family values, or community well-being. In Muslim-majority contexts, for instance, linking green consumption with concepts such as *amanah* (trustworthiness) or *halalan tayyiban* (lawful and pure) can create affective bridges between daily consumption and moral responsibility.

Finally, the use of Bayesian estimation methods in this study also carries practical value. Because our model is Bayesian, firms can refresh the propensity scores whenever new data arrive, a flexibility highlighted by Blozis (2022) for longitudinal consumer analytics. For practitioners and researchers operating in small or segmented markets—such as religious minority communities or emerging sustainable categories—Bayesian models offer a robust approach to testing mechanisms even when sample sizes are modest or prior information is uncertain. This reinforces the practical feasibility of applying theory-informed models in real-world, resource-constrained environments, without compromising on the accuracy or depth of insight.

These practical implications suggest that effective nudging in sustainable and ethical consumption domains requires more than minimal interventions. It calls for culturally embedded, psychologically meaningful, and emotionally salient strategies that align institutional signals, brand values, and community discourse. When designed with care and contextual sensitivity, nudging can become a bridge between organizational intent and individual action, capable of fostering not only behavioral change but enduring value alignment. A practical workflow therefore emerges: derive trait-aware propensity scores, audit them for fairness, run the factorial experiment, and recalibrate as new data accumulate. This loop translates psychological nudges into verifiable, data-driven gains while honoring faith-based preferences.

Limitations, recommendations, and future research

Limitations

While this study offers novel insights into the role of nudging in ethical and sustainable consumption, it is not without limitations. First, the research employed a

cross-sectional design, which limits the ability to draw conclusions about the temporal dynamics or causal relationships among variables. Although the Bayesian estimation allowed for robust mediation analysis under uncertainty, longitudinal or experimental designs are needed to verify how nudging effects evolve over time or under repeated exposure. Second, the data were collected exclusively from Malaysian consumers, a context where both halal certification and religious identity play a prominent role. This specific cultural and religious context may limit the generalizability of the findings to non-Muslim populations or secular markets. Third, although the study focused on emotional and religious mechanisms as key mediators, it did not account for other potential moderators such as message framing, product category, or regulatory environment, which could influence the strength of nudging effects.

Recommendation

For practitioners, the study recommends that nudging interventions should be context-sensitive and culturally embedded. In markets where religious identity influences consumer behavior, integrating spiritual values into marketing communications—rather than relying solely on rational appeals—can significantly improve message effectiveness. Policymakers promoting sustainable consumption should also consider working closely with community leaders or religious authorities to co-develop certification systems that are perceived as both credible and spiritually aligned. Furthermore, brand managers should adopt a holistic approach to nudging by combining institutional signals (such as logos) with emotionally resonant storytelling and peer-driven reinforcement. This strategy not only aligns with consumers' moral beliefs but also increases behavioral consistency and long-term engagement. Methodologically, researchers are encouraged to consider Bayesian SEM in small-sample contexts, particularly when investigating models with multiple indirect paths and context-dependent variables.

Future research

Building on the current study, future research could pursue several directions. First, longitudinal studies could explore how repeated exposure to nudging elements—such as certification logos or religious framing—affects the durability of halal green consumer behavior over time. This would help clarify whether nudging effects are transient or can produce sustained behavioral shifts. Second, cross-cultural comparisons between Islamic, secular, and other faith-based contexts (e.g., Hindu, Christian, or Buddhist) could illuminate how cultural variability shapes the emotional and



cognitive mechanisms underlying nudging. Third, experimental manipulations of different nudging elements—such as the tone of peer messages, or inclusion of spiritual references—could provide causal evidence for which types of nudges are most effective under various conditions. Fourth, this study should use natural experiment methods to track the natural behavior of religious groups. If possible, it is best to use medical instruments and neuroscience-related detection instruments to detect their subtle neural changes in the nudge environment. Lastly, future studies might integrate physiological or neurocognitive measures to assess how nudges operate at the subconscious level, offering deeper insights into the emotional and moral processing that accompanies ethical consumption. Future work should replicate these diagnostics in broader demographic strata to confirm external validity.

Conclusion

This study examined how nudging strategies anchored within brand architecture and social communication can influence ethical and sustainable consumer behavior in value-oriented markets. Drawing upon Nudge Theory, we proposed and tested a dual-pathway model incorporating both brand identity and religious-affective mechanisms. Using Bayesian structural equation modeling (BSEM) with data from Malaysian consumers, the results confirmed that logo certification functions not only as a heuristic cue but also as a signal of identity alignment that fosters brand distinctiveness and prestige. These identity-related perceptions, in turn, shape green consumption outcomes. At the same time, peer communication was shown to influence Islamic practices and emotional connection with Allah, providing a second pathway through which nudging operates via spiritual resonance rather than rational evaluation. Furthermore, the multigroup Bayesian path analysis revealed a significant moderating effect of age. While the theoretical model fits the younger cohort well, key pathways—such as the link between brand prestige and green behavior—lost significance in the older group. This suggests the model's mechanisms are not universal but are instead age-dependent, advancing a more nuanced understanding of how nudges operate across different consumer segments.

The study highlights both symbolic and affective dimensions of nudging. Parallel results in halal cosmetics, toiletries, and hospitality (Anubha 2023; Fiandari and Andharini 2024; Yasin et al. 2025) suggest that the present findings can inform certified-brand strategy outside the food segment. This research advances current understandings of how subtle

changes in choice architecture can activate personal and communal values without limiting freedom of choice. The findings extend the theoretical boundaries of Nudge Theory by demonstrating that nudges are not universally shallow or context-neutral but can be deeply anchored in religious, emotional, and identity-laden structures. In practice, the results suggest that effective nudging requires alignment with cultural and moral expectations, rather than relying solely on behavioral economics principles developed in secular or general consumer contexts.

Appendix A

Scale items in the study

Scale items used in the model

Brand Distinctiveness	BD_1	The brand (Halal and Green Product Verification) is different from other brands in the sector
	BD_2	The brand (Halal and Green Product Verification) is different from the rest of its competitors
	BD_3	The brand (Halal and Green Product Verification) stands out from its competitors
Brand Prestige	BP_1	The brand (Halal and Green Product Verification) is very prestigious
	BP_2	The brand (Halal and Green Product Verification) has high status
	BP_3	The brand (Halal and Green Product Verification) is very upscale



Scale items used in the model			Scale items used in the model		
Feeling of Connectedness with Allah	FCA_1	When I pray, I feel that Allah is listening to my prayer	Islamic Practices	IP_2	I recite the Quran
	FCA_10	The feeling of Allah's love has brought favorable change in my daily life		IP_3	I do Zikr
	FCA_11	To me, it is essential to strive to learn about Islam		IP_4	I fast
	FCA_12	I feel that the search for truth is possible	Logo Certification	LC_1	You believe that truly halal products should also respect environmental principles as part of Islamic stewardship
	FCA_2	I am proud to be a Muslim		LC_2	Products that have both halal certification and eco-friendly features better align with your Islamic values
	FCA_3	When I am in any difficulty, I find help and assistance from Allah		LC_3	You consider green/eco-friendly manufacturing processes to be compatible with halal principles
	FCA_4	I am hopeful that despite all my wrongdoing, Allah will forgive me		LC_4	When choosing between two halal products, you select the one with better environmental credentials
	FCA_5	I feel that Allah is conversing with me through Qur'anic Ayat (Verses)		LC_5	You believe the Islamic concept of "tayyib" (pure/good) extends to environmentally sustainable products
	FCA_6	I can feel the love of Allah	Peer Communication	PC_1	I talked with fellow Muslims about this halal and green product on social media
	FCA_7	I can feel that Allah is observing all my acts		PC_2	I discussed with members of my religious community about purchasing this product online
	FCA_8	I can feel the fear of Allah in my heart		PC_3	I sought advice about this product from others who share my Islamic values
	FCA_9	When I have to face any difficulty, I think of it as a source from Allah for the strengthening of my faith		PC_4	I obtained information about this product's compliance with Islamic principles from my Muslim peers
Green Consumption Intention	GCI_1	I intend to buy environmentally friendly halal daily necessities and products in the future		PC_5	Other Muslims in my social network encouraged me to choose this environmentally responsible product
	GCI_2	I will choose environmentally friendly halal daily necessities and products to consume		PC_6	I value recommendations about this product from those who practice Islam faithfully
	GCI_3	I tend to select environmentally friendly halal daily necessities and products in the future		PC_7	Discussions with my Muslim community influenced my perception of this brand's identity
	GCI_4	I will fulfill my needs by buying environmentally friendly halal daily necessities and products			
Halal Green Consumer Behavior	HGB_1	Halal certification and logos are essential to ensure that products are both halal and produced using environmentally responsible methods			
	HGB_2	These products you buy must have a halal logo and preferably be environmentally friendly			
	HGB_3	When buying a product, you prioritize halal certification first and environmental sustainability second			

Note(s): "I fast" = Not eating for a period of time, usually for spiritual, religious, or health reasons; "I do Zikr" = Remembrance of Allah



Appendix B

Statistical robustness checks—formulas and definitions

1. Bayesian Variance Inflation Factor (VIF)

$$VIF_j = \frac{1}{1 - R_j^2},$$

where (R_j^2) is the R-squared value obtained by regressing the predictor x_j on all other predictors. Bayesian VIF values are derived from Markov Chain Monte Carlo (MCMC) posterior samples. Values below 3.5 indicate acceptable levels of multicollinearity.

2. Heterotrait-Monotrait Ratio (HTMT)

$$HTMT_{ab} = \frac{\text{mean}(|r_{ab}|)}{\text{mean}(|r_{aa}, r_{bb}|)}$$

HTMT evaluates discriminant validity by comparing average heterotrait correlations to average monotrait correlations. HTMT values under 0.85 suggest good discriminant validity.

3. Ten-Fold Bayesian Cross-Validation (for R2)

$$R_{\text{fold}_k}^2 = 1 - \frac{\sum_{i \in k} (y_i - \hat{y}_i)^2}{\sum_{i \in k} (y_i - \bar{y})^2}$$

Cross-validation tests predictive generalizability. The model is trained on 9 folds and tested on the 10th. Mean R2 difference between in-sample and out-of-sample should remain < 0.02 for robustness.

Appendix C

Multigroup Bayesian path analysis by age cohort

Parameter	Younger cohort (18–34) estimate (95% CI)	Older cohort (35+) estimate (95% CI)
Model fit		
Posterior predictive <i>p</i> value (PPP)	0.106	0.000
Deviance information criterion (DIC)	1681.747	1192.189
Structural paths (standardized β)		
Direct paths to GCI		
LC→GCI	0.449* [– 0.690, 0.202]	0.533* [0.269, 0.789]

Parameter	Younger cohort (18–34) estimate (95% CI)	Older cohort (35+) estimate (95% CI)
PC→GCI	0.435* [0.196, 0.673]	0.410* [0.155, 0.656]
Mediation Chain 1 (LC→HGCB)		
LC→BD	0.660* [0.476, 0.832]	0.369* [0.052, 0.653]
BD→BP	0.814* [0.642, 0.976]	0.770* [0.546, 0.985]
BP→HGCB	0.692* [0.402, 0.981]	0.291 [– 0.042, 0.633]
Mediation Chain 2 (PC→HGCB)		
PC→IP	0.594* [0.347, 0.822]	0.320 [– 0.008, 0.633]
IP→FCA	0.812* [0.514, 1.108]	0.602* [0.164, 0.992]
FCA→HGCB	0.100 [– 0.255, 0.446]	0.322 [– 0.104, 0.711]
Indirect effects (unstandardized)		
LC→BD→BP→HGCB	0.400* (Est: 0.364)	0.080 (Est: 0.085)
PC→IP→FCA→HGCB	0.049 (Est: 0.046)	0.081* (Est: 0.081)
R square (R^2)		
HGCB	0.423	0.249
BP	0.654	0.466
BD	0.424	0.124
FCA	0.507	0.206
IP	0.298	0.062
GCI	0.423	0.494

Estimate refers to the posterior median of the standardized (STDYX) path coefficient. 95% CI is the 95% Credibility Interval. Path coefficients are from the standardized model results. Indirect effects and their significance are derived from the unstandardized New/Additional Parameters section of the Mplus output. *Indicates the 95% Credibility Interval does not contain zero, $p < 0.05$



Halal and sustainable certification logos (Partial)



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Data availability The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Code availability The Mplus 8.3 code used to test this model has been uploaded and can be directly called to calculate the required model. The file needs to be opened with Mplus 8.3 software.

Declarations

Conflict of interest The authors declare no conflict of interest.

Informed consent Informed consent was obtained from all subjects involved in the study. Written consent was obtained from all individuals involved in this study.

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