“Sustainability management for building Green Brand Equity in higher education: The mediating role of perceived authenticity”

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SUSTAINABILITY MANAGEMENT FOR BUILDING GREEN BRAND EQUITY IN HIGHER EDUCATION: THE MEDIATING ROLE OF PERCEIVED AUTHENTICITY

Abstract

The development of Green Brand Equity in higher education institutions has emerged as a strategic approach to enhance legitimacy and differentiation in competitive environments. However, empirical evidence supporting its structure and implementation remains limited. This study analyzes the impact of sustainability management on the configuration of university Green Brand Equity. Sequential mixed-methods design was employed, with measurement instruments derived from a comprehensive literature review. Data were collected from 1,231 students across 13 accredited higher education institutions in Colombia (8 public and 5 private) between February and June 2025, using online and face-to-face surveys. Five key dimensions were validated: perceived quality of sustainability actions, green brand image, green brand trust, green campus experience, and loyalty. Instrument validation using Exploratory Factor Analysis (EFA) and robust PLS-SEM showed strong results (KMO = 0.937–0.960; explained variance = 75.5%–77.4%). The structural model confirmed significant effects of strategic management ($\beta = 0.454$, $p < 0.001$), eco-efficient infrastructure ($\beta = 0.199$, $p = 0.001$), and student participation ($\beta = 0.118$, $p = 0.049$), while eco-innovation in educational services was not significant ($\beta = 0.114$, $p = 0.079$). The model explained 73.7% of the variance in Green Brand Equity and revealed a significant mediation effect ($p \leq 0.020$). The findings highlight the critical role of infrastructure and strategic consistency, as well as the importance of perceived authenticity in transforming sustainability practices into reputational value and student loyalty.

Keywords green branding, sustainability management, loyalty, eco-innovation, higher education, PLS-SEM

JEL Classification M31, Q56, O31, I23

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INTRODUCTION

Higher education institutions (HEIs) have transformed the way they position themselves in highly competitive markets by redefining their brand promise and adopting sustainability values and principles (Juhaidi et al., 2025). Thus, the growing social sensitivity towards sustainability, especially with regard to caring for the environment and social welfare, has driven universities to redefine their positioning and value proposition to achieve stakeholder validation (Castro-Gómez et al., 2024). Consequently, academic quality and organizational reputation are not enough for an effective university brand strategy, they also have to show coherence and integrity between principles, statements of agreement signed with their real capacity to respond to the needs of society and the environment have become essential requirements (Giraldo-Giraldo et al., 2025; Jia & Park, 2023).

Despite the boom in university brand literature, branding models implemented by HEIs (Amani, 2025; Castro-Gómez et al., 2024;

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Eschenbacher et al., 2025; Gao et al., 2024; Huyen et al., 2024), still operate under traditional marketing models that do not consider environmental sustainability values as constitutive elements of the promise of value. Besides, there is a theoretical and empirical gap about how sustainability principles transform the experience, emotions and perceptions of the stakeholders about the reception and development of the educational service (Amani, 2024). Likewise, few studies on the organizational principles support the creation of Green Brand Equity in HEIs. There is also a theoretical gap in how the formation and performance of substantive functions, campus activities, and principles of governance oriented towards innovation and implementation in ecological practices consolidate the formation of university brand value and its positioning.

This study addresses a significant gap in the literature by offering theoretical and empirical contributions to the construction of university green brand equity. This brand equity is developed not only as part of the institution's corporate reputation but also as an organizational model whose strategic perspective promotes eligibility, recommendation, and loyalty of higher education institutions in a highly competitive context. The problem that the research addresses is relevant given the limited existence of explanatory models that understand the relationships between sustainable management, brand authenticity, and university Green Brand Equity.

1. LITERATURE REVIEW

The integration of sustainability practices into university management necessitates a shift in conventional marketing strategies. This initiative is designed to enhance the user experience of educational services and fortify the standing of universities in highly competitive markets. Furthermore, these changes in university management allow for the alignment of stakeholders' perceptions and behaviors regarding the institution's brand (Ahmed et al., 2026). In the context of higher education, sustainability practices have been shown to impact brand value beyond the perceived quality of educational processes (Na et al., 2025). In this sense, this section seeks to address the theoretical background of the components that support the relationship between sustainability in universities and green brand identity as part of university brand management. This relationship will serve as the foundation for the study's theoretical model and hypotheses.

1.1. University brand

University branding has become a strategic field where HEIs must demonstrate differential values in saturated markets and socio-cultural contexts with decreased interests in higher education (Díez-Martín et al., 2025; Sun et al., 2025). Therefore, university brand is constituted as a platform for interaction with stakeholders to attract, position, and create symbolic alliances that allow effectively communicating its differential value as an educational institution (Kethüda, 2021). The offer of educational services is a complex decision process that involves reputation, coherence, image and institutional trust in congruence with the expectations of the target audience and linked to their personal and professional performance (Brzaković et al., 2019; Çati et al., 2016).

Recent studies have shown that the main educational marketing actions in HEIs are linked to brand strategies that aim at satisfying loyalty and identity (Giraldo-Giraldo et al., 2025; Irshad, 2025). However, branding approaches focused on employability possibilities persist in higher education institutions, mainly in the global south. They include functional attributes of brand management, such as teaching quality on campus and access to innovative technologies (Díez-Martín et al., 2025). However, the bureaucratic and hierarchical management of universities is perceived as a form of control that affects the quality of the university brand. Historically, the strategies adopted by HEIs have focused on strengthening the external brand to attract new students, rather than strengthening the internal brand (Ahmed et al., 2026). Consequently, these educational branding processes are insufficient to respond to the current trends that target audiences demand from HEIs, in addition to the aforementioned functional aspects, an evident commitment to ethics, the environment, and the needs of society (Guilbault, 2018).

The integration of management practices, such as Corporate Social Responsibility, enhances stakeholder confidence in the university brand by incorporating actions that empower stakeholders to carry out activities aimed at enhancing societal well-being and mitigating adverse environmental impacts (Amani, 2024). Studies also have shown that satisfaction and loyalty levels are related to a brand consciously focused on sustainability values (Juhaidi et al., 2025). Therefore, literature published in the last years develops the concept of university brand as a relational system that articulates the creation, expectations, participation, and experience of stakeholders, especially students, in the construction of a symbolic system that transmits the evident commitment of the institution with the needs of the communities (Castro-Gómez et al., 2024; Eschenbacher et al., 2025).

1.2. University's sustainability view

Universities play a transformative role in society through their sustainability practices, including research, innovation, and technology activities developed jointly with industry to develop green solutions to real-world problems (Subrahmanyam & Anand, 2024). The motivation of university stakeholders to adopt sustainability practices determines the probability of individual choice to adopt and maintain environmentally responsible behaviors, such as water conservation, energy savings, recycling, and sustainable consumption (Hou et al., 2026). Therefore, to establish a policy aimed at integrating sustainability in universities, managers must create opportunities for training, curriculum updates, and partnerships with local communities and businesses (Dalelo, 2026).

Sustainability values have been extended to the field of university branding, not limited to regulatory compliance and organizational internal management (Chen, 2022). Demonstrating that a HEI operates holistically under the sustainability principles has become a means of legitimizing reputation and space to convene stakeholders around value creation (Sharipudin et al., 2024). Therefore, sustainability becomes a dynamic capacity and a valuable resource to demonstrate the ability to respond to social and environmental pressures by showing an innovative, dynamic approach to the development of substantive functions and structural adaptation capacity to the requirements of the community (Buckner & Zhang, 2025).

Some studies have shown that students perceive university sustainability as differential value and a sign of institutional authenticity. Consequently, students' pro-environmental behavior is influenced by environmental responsibility, sustainability strategies, and training initiatives aimed at achieving the Sustainable Development Goals (SDGs) (Aggarwal et al., 2026). In essence, the development of sustainable university campuses entails the integration of renewable and cost-effective alternatives to conventional resources (Bekkouche et al., 2026). On the other hand, a campus with smart infrastructure, implementation of policies and declarations of sustainability in governance, integration of sustainability issues in the curriculum, and participation in extension and research projects are some components of brand positioning in the academic community (Ishaq & Di Maria, 2020a; Srivastava et al., 2019).

1.3. Green Brand Equity in university

Furthermore, literature raises relevant theoretical and strategic gaps. The components for the consolidation of a university green brand are not clear, in addition to the lack of empirical evidence on how sustainable practices strengthen brand value in HEIs (Zhong et al., 2025). In addition to these gaps, some studies raise the need to address the impact of sustainability on the positioning and reputation of the university brand (Sun et al., 2025).

In this context, Green Brand Equity is addressed as a corporate tool that strengthens the perception of satisfaction and trust as drivers of loyalty (Ng et al., 2014). It is an element of branding that integrates the emotional and symbolic functional dimensions for the construction of the authenticity and legitimacy of the brand (Aaker, 1991; Pinar et al., 2020). In general, Brand Equity has been conceptualized by the consumer as the reason for a brand's preference and choice with respect to its competition (Gutiérrez et al., 2024). It has been defined as the set of financial assets of the organization; in addition, from an internal perspective, as the attachment and commitment of employ-

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ees to the mission of the organization (Mirzaei et al., 2016; Ng et al., 2014). Regarding Green Brand Equity, it has been defined as an emerging concept that understands the differential value of the brand when it is perceived to be committed to environmental and social causes (Aghaz et al., 2024). Therefore, it integrates trust, green image and ecological credibility and influences loyalty. Green Brand Equity has become a tool to generate positive associations among authenticity, social responsibility and how to evidence the implementation of sustainability (Iglesias et al., 2023). Recent studies have shown that students acquire a greater sense of belonging and commitment to the institution when they perceive sustainable practices in the institution (Buckner & Zhang, 2025; Díez-Martín et al., 2025). They are associated with quality and institutional coherence, thus strengthening the image and identity of the university brand and influencing the recommendation and choice of the institution (Castro-Gómez et al., 2024). However, its application in higher education institutions is only in its initial phase, which implies that there is no conclusive foundation on the specific dimensions of university Green Brand Equity. Some authors have highlighted ecological innovation, smart campus, student participation and governance actions as the main references for its construction (Chen, 2010; Ishaq & Di Maria, 2020; Mourad et al., 2020).

One of the key factors to address the relationships between Green Brand Equity and higher education is the institutional capacity to align the organization to promote brand experiences on green projects (Castro-Gómez, 2025; Giraldo-Giraldo et al., 2025). In the context of HEIs, today campus activities and the development of missional functions are the starting point for the construction of Green Brand Equity (Buckner & Zhang, 2025; Sonetti et al., 2021). Besides, an experience consistent with institutional policies is associated with innovative practices not only because they relate to the use of infrastructure technologies and clean and sustainable initiatives but also because they promote the relevance and differentiation of the university brand (Amoako et al., 2023). Thus, the present study considers that the experience of sustainability by students structures the subsequent development of Green Brand Equity (Gutiérrez et al., 2024).

1.4. Theoretical model

Therefore, the literature review suggests that sustainability is a strategic organizational and marketing factor for positioning and development of competitive advantages in HEIs. However, theoretical and managerial gaps for higher education persist such as the lack of integrated models to establish Green Brand Equity in addition to empirical evidence to support its dimensions (Amani, 2024). Despite the growing number of studies on university brand and sustainability, there is still limited literature that directly addresses university Green Brand Equity (Ishaq & Di Maria, 2020). Consequently, the contribution of sustainable innovation to the construction of the university brand is not clear. Besides, it is necessary to have a broader understanding of how campus experiences can strengthen the effects of sustainable practices on the construction of university Green Brand Equity (Giraldo-Giraldo et al., 2025). Hence, this study proposes a model that analyzes sustainable management constituted by Sustainable Strategic Management, Ecological Innovation in Educational Services, Smart and Eco-efficient Infrastructure, understood as the set of physical, technological, and operational conditions on campus designed to reduce environmental impact through efficient use of resources, clean technologies, sustainable design, and smart management systems, and Student participation in sustainable projects.

This study aims at analyzing the influence of sustainability management on the composition of university Green Brand Equity.

Based on the literature review that looked for the relationship between sustainable management and university Green Brand Equity, the following hypothetical relationships are proposed (see Figure 1):

H1: Sustainable Strategic Management has a positive effect on university Green Brand Equity.

H2: Ecological Innovation in educational services has a positive effect on university Green Brand Equity.

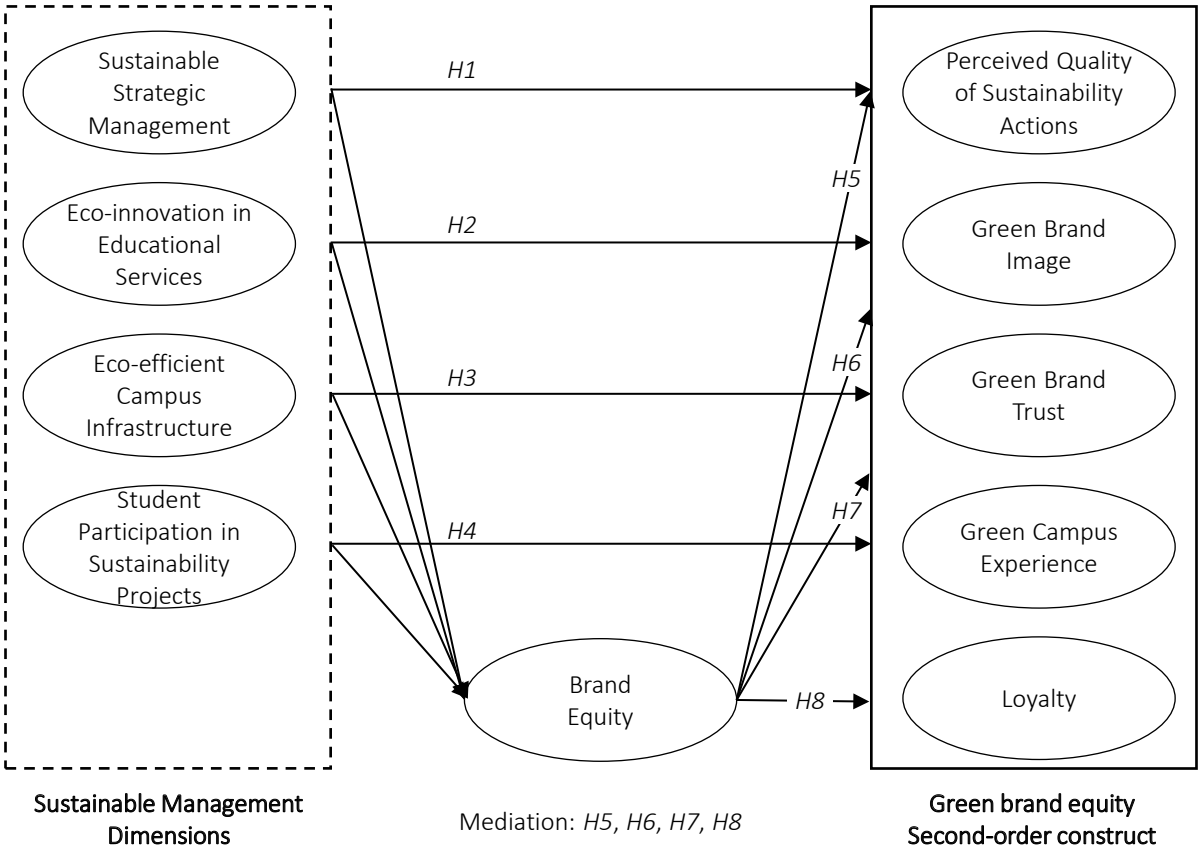

Figure 1. Theoretical model

H3: Campus Eco-innovation Infrastructure has a positive effect on university Green Brand Equity.

H4: Student Participation in Sustainability Projects has a positive effect on university Green Brand Equity.

Mediation hypotheses are as follows:

H5: Brand Authenticity mediates the relationship between Sustainable Strategic Management and university Green Brand Equity.

H6: Brand Authenticity mediates the relationship between Ecological Innovation in educational services and university Green Brand Equity.

H7: Brand Authenticity mediates the relationship between the Eco-efficient Infrastructure of the campus and university Green Brand Equity.

H8: Brand Authenticity mediates the relationship between student participation in sustainability projects and university Green Brand Equity.

The hypothesized relationships are presented in Figure 1.

2. METHODOLOGY

A sequential mixed methodology was used. First, using a qualitative approach, a literature review was conducted to establish the measurement tools. Each dimension was assessed using a seven-point Likert scale, ranging from 1 (strongly disagree) to 7 (strongly agree). After a review by 5 experts, who evaluated conceptual clarity, sufficiency, relevance and the absence of induction to responses. Then, a pilot test was carried out with 10 students to make additional adjustments and improve the clarity of the items. Second, results of the fieldwork were analyzed under a quantitative approach

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with Exploratory Factor Analysis (EFA) using the SPSS software and causal relationships using structural equations with Partial Least Squares Structural Equation Modeling (PLS-SEM) with the SmartPLS 4.1.1.6 software.

2.1. Construction of measuring instruments

For the Perceived Authenticity of Institutional Sustainability construct, the contributions of Beverland and Farrelly (2010), Morhart et al. (2015), Hu et al. (2020) not mentioned in the references, Napoli et al. (2014) not mentioned in the references and Iglesias et al. (2019) not mentioned in the references, which emphasize coherence, transparency and credibility as central elements to evaluate whether the sustainable actions of an institution reflect a real and not merely communicational commitment were adapted. These works enabled us to establish items aimed at measuring the consistency between institutional discourses and the effective implementation of sustainable practices. For the Sustainable Strategic Management construct, the contributions of Amani (2024), Chen (2022), Juhaidi et al. (2025), Buckner and Zhang (2025), Ishaq and Di Maria (2020) and Guilbault (2018) who highlight the incorporation of sustainability in planning, governance, and institutional decision-making processes were considered. The Ecological Innovation in Educational Services dimension was built from Mourad et al. (2020), Sun et al. (2025), Aghaz et al. (2024), Castro-Gómez et al. (2024), Sonetti et al. (2021) and Iglesias et al. (2023), whose studies address the integration of innovative practices, contents and processes linked to sustainability within the educational service and university substantive functions.

For the Intelligent and Eco-efficient Infrastructure dimension, the contributions of Srivastava et al. (2019), Chen (2010), Buckner and Zhang (2025), Sonetti et al. (2021) and Ishaq and Di Maria (2020), focused on campus environmental management, clean technologies, energy efficiency, and physical-environmental spaces were considered. The Student Participation in Sustainability Projects dimension was built based on Guilbault (2018), Sharipudin et al. (2024), Buckner and Zhang (2025) and Juhaidi et al. (2025) who highlight the role of the student as an active party in the co-creation of sustainable practices, environmental awareness and strengthening of the institutional ecological culture. For the Green Brand Equity model, the scales proposed by Chen (2010), Iglesias et al. (2023), Gutiérrez et al. (2024), Aghaz et al. (2024), Sun et al. (2025), Mourad et al. (2020), Buckner and Zhang (2025), Ishaq and Di Maria (2020), Juhaidi et al. (2025), Ng et al. (2014), Mirzaei et al. (2016), Sonetti et al. (2021), Srivastava et al. (2019), Guilbault (2018), Castro-Gómez et al. (2024) and Pinar et al. (2020) were taken as reference. They enabled structuring the dimensions of Perceived Quality of sustainable actions, Green Image, Trust in the Green Brand, Green Experience in the Campus, and Student Loyalty.

2.2. Sample

The study surveyed 1,231 students from thirteen Colombian higher education institutions with high-quality accreditation. These institutions were purposely selected because high-quality accreditation, granted by Colombia's Ministry of National Education, indicates that the institution has established robust academic, organizational, and stakeholder-related processes, including commitments related to quality assurance, social responsibility, and sustainable management. Therefore, accredited higher education institutions provide a suitable empirical framework for analyzing how sustainability management contributes to the formation of the university's ecological brand value.

Non-probabilistic convenience sampling was used due to access conditions and institutional collaboration. However, the study sought analytical heterogeneity by including students from 8 public and 5 private institutions, across different academic fields and both on-campus and distance learning modalities. The number of participants per institution was distributed according to enrollment size to obtain a balanced institutional representation and avoid excessive concentration on a single university profile. The survey was disseminated through virtual platforms such as Google Forms and through in person visits to each of the selected universities. Data on both constructs were collected in the same field work and before the formal quantitative analysis, atypical data were collected and filtered.

Table 1. Demographic profile of the sample

Variable	Category	Frequency	Percentage
Type of university	Public	952	77.3%
	Private	536	43.5%
Age range	15-25 years old	823	66.9%
	26-35 years old	334	27.1%
	Over 36 years old	74	6.0%
Faculty	Economic and Administrative Sciences	453	36.8%
	Engineering	452	36.7%
	Health Sciences	125	10.2%
	Law and Social Studies	201	16.3%
Mode of study	On-site	1,040	84.5%
	Remote	191	15.5%
Total sample		1,231	100.0%

The focus on students is justified from a theoretical standpoint, as they are the primary stakeholders who experience the university's sustainability practices in everyday campus life, academic services, and institutional communication. From a brand value perspective, students are the stakeholders directly linked to trust, perceived quality, image formation, recommendation, and loyalty. Therefore, their perceptions are relevant for evaluating the model. The sample size is adequate for the PLS-SEM estimation, given the model's complexity, the number of latent variables, and the study's predictive orientation.

The research guaranteed respondents anonymity and confidentiality, and participation was voluntary. Prior to completing the questionnaire, participants were informed about the general objectives of the study, the academic nature of the research, and the exclusively scientific use of the information collected. No data were collected that would allow for the individual identification of participants. The research protocol was reviewed and approved by the Ethics Committee of the Technological University of Antioquia, Minutes "Number 05 of the 2024-02 semester" of the regular meeting of "July 25, 2024."

3. RESULTS

As a result of the expert validation and pilot test, modifications were made to the measuring instruments. Three items were eliminated from Sustainable Management, namely Sustainable Strategic Management, GSE5; Eco-innovation in Educational Services, understood as the incorporation of sustainability-oriented innovations into teaching, research, outreach, and other processes within educational services, IE4; and Student Participation in Sustainability, PE5. Four items were deleted from Green Brand Equity: Loyalty, LOY3, LOY4; and Green Campus Experience, GCE4. After debugging, the final management instrument for sustainability was composed of a total of 17 items, the mediating variable with 4 items, and Green Brand Equity with 21 items.

3.1. Results of Exploratory Factor Analysis (EFA)

Instruments were validated by Exploratory Factor Analysis using the SPSS software by main axis analysis and oblique rotation. The total variance explained was calculated to guarantee the practical significance of the factors, which, in the case of Sustainability Management, yielded a percentage of 75.5% and, in the case of Green Brand Equity, of 77.4%, exceeding the minimum threshold of 60%. To verify the adequacy of the variables and the relevance of the data collected, the Kaiser-Meyer-Olkin (KMO) measure was used. In the case of Sustainability Management, it yielded a value of 0.937 and, in the case of Green Brand Equity, 0.960, thus indicating an excellent sample size. The Bartlett and chi-square sphericity test, with a significance of 0.000, ratifies the statistical relevance of the instruments. Factorial loads of the items for Sustainability management were between 0.839 and 0.942 with a total of 17 items and four dimensions, and for Green Brand Equity between 0.779 and 0.939 with 21 items and five dimensions. Cronbach's Alpha of the AFE ranged between 0.84 and 0.97 in both constructs.

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3.2. Confirmatory Factor Analysis

Factorial loads obtained for the items exceeded the value of 0.773. It is a solid indicator of congruence and supports the permanence of items within their respective constructs. Internal reliability reached optimal levels, with Cronbach's Alpha coefficients greater than 0.932 and composite reliability values greater than 0.932, far exceeding the threshold of 0.70 recommended by Hair et al. (2019) not mentioned in the references to ensure internal consistency and stability of measurements. Convergent validity was estimated by calculating the Average Variance Extracted (AVE). Its results confirmed the strength of the model. All values exceeded the minimum criterion of 0.50 established by Hair et al. (2019) not mentioned in the references, with values higher than 0.715, thus showing that indicators share a high proportion of common variance within each latent dimension (see Table 2). These results confirm the reliability and convergent validity of the instrument and ensure statistical robustness and the theoretical coherence of the scales used in the structural model.

The discriminant validity of the model was verified by the Heterotrait-Monotrait (HTMT) criterion, widely recommended to evaluate the empirical differentiation between correlated constructs. Results showed that all the correlations between pairs of latent variables were less than 0.90, according to the latest observations by Schuberth et al. (2023). In turn, confidence intervals remained below 1.0, meeting the criteria proposed by Gold et al. (2001) not mentioned in the references and Hair et al. (2019) not mentioned in the references. These results show that constructs maintain a clear theoretical and empirical differentiation, reflecting that each dimension provides unique information without significant redundancies (see Table 3).

Table 2. Reliability and convergent validity of the model

	Construct reliability and validity			
	Cronbach's Alpha	**Composite reliability (rho_a)**	**Composite reliability (rho_c)**	**Average Extracted Variance (AVE)**
GBT	0.972	0.972	0.972	0.873
GCE	0.929	0.932	0.930	0.816
GSE	0.961	0.961	0.961	0.859
GUI	0.962	0.963	0.962	0.837
GBE	0.981	0.982	0.981	0.715
IE	0.951	0.951	0.951	0.829
INF	0.945	0.945	0.945	0.774
LOY	0.964	0.964	0.964	0.898
PAI	0.964	0.964	0.964	0.870
PE	0.963	0.963	0.963	0.868
PQSP	0.932	0.935	0.932	0.734

Notes: GBT: Green Brand Trust. GCE: Green Campus Experience. GSE: Sustainable Strategic Management. GUI: Green University Image. GBE: Green Brand Equity (Second-order Construct). IE: Eco-innovation in Educational Services. INF: Eco-efficient Campus Infrastructure. LOY: Student Loyalty. PAI: Perceived Authenticity of Institutional Sustainability. PE: Student Participation in Sustainability Projects. PQSP: Perceived Quality of Sustainability Practices.

Table 3. Heterotrait-Monotrait Ratio Matrix (HTMT)

	GBT	**GCE**	**GSE**	**GUI**	**GBE**	**IE**	**INF**	**LOY**	**PAI**	**PE**
GBT										
GCE	0.852									
GSE	0.814	0.739								
GUI	0.811	0.801	0.759							
GBE	0.801	0.843	0.839	0.774						
IE	0.771	0.729	0.810	0.730	0.805					
INF	0.784	0.712	0.829	0.730	0.807	0.820				
LOY	0.814	0.743	0.797	0.791	0.820	0.756	0.759			
PAI	0.721	0.633	0.812	0.672	0.745	0.835	0.808	0.701		
PE	0.739	0.701	0.829	0.707	0.777	0.815	0.852	0.725	0.845	
PQSP	0.837	0.789	0.781	0.840	0.779	0.750	0.754	0.751	0.714	0.731

Table 4. Fornell-Larcker criterion

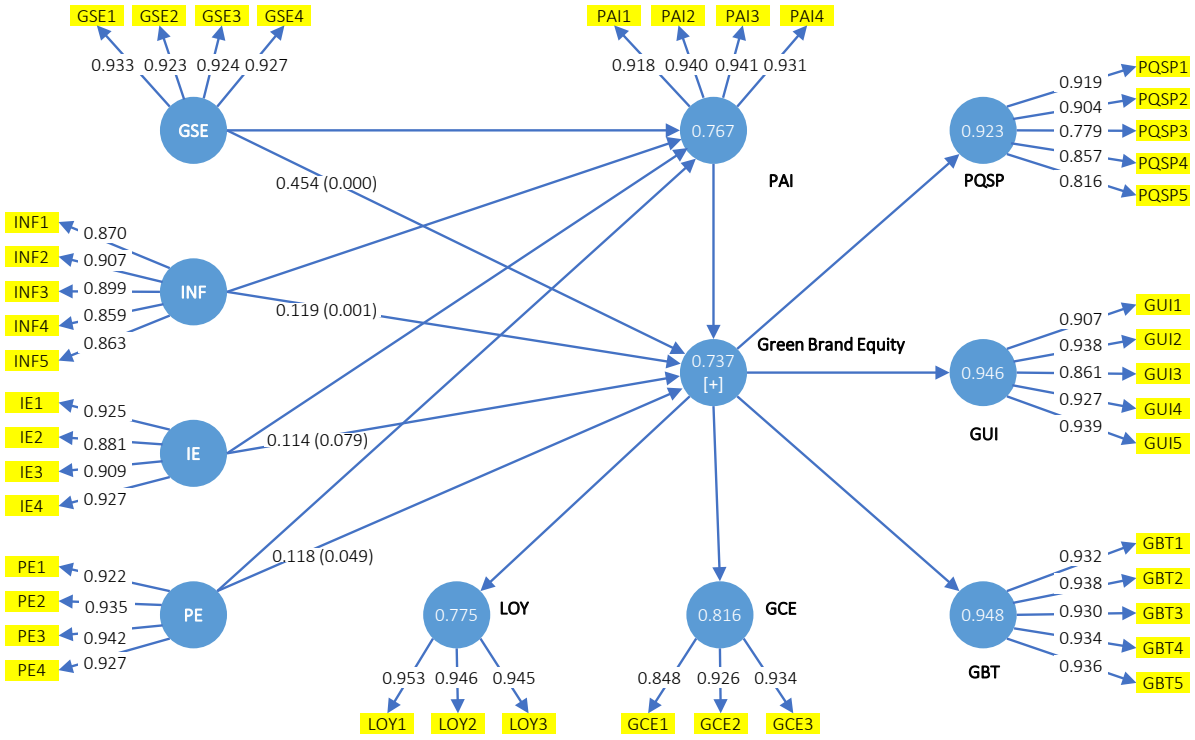
	GBT	GCE	GSE	GUI	GBE	IE	INF	LOY	PAI	PE	PQSP
GBT	0.934										
GCE	0.852	0.904									
GSE	0.814	0.737	0.927								
GUI	0.804	0.801	0.758	0.915							
GBE	0.801	0.843	0.839	0.774	0.845						
IE	0.771	0.729	0.810	0.730	0.805	0.910					
INF	0.784	0.712	0.829	0.730	0.807	0.870	0.880				
LOY	0.814	0.743	0.797	0.791	0.820	0.756	0.759	0.948			
PAI	0.721	0.633	0.812	0.672	0.745	0.835	0.808	0.701	0.933		
PE	0.739	0.701	0.829	0.707	0.777	0.875	0.852	0.725	0.845	0.932	
PQSP	0.837	0.789	0.781	0.840	0.779	0.750	0.754	0.751	0.714	0.731	0.857

Likewise, the Fornell-Larcker criterion confirmed the discriminant validity of the model (see Table 4), since in all cases the square root of the AVE of each construct was superior to its correlations with the other latent variables. These results complement HTMT and ensure that each construct better explains its own variance than the one shared with others, thus evidencing an adequate differentiation between dimensions.

3.3. Structural model

Results of the structural model estimated by robust PLS-SEM and bootstrapping show significant and theoretically consistent effects among the proposed variables. The relationships between Sustainability management and Green Brand Equity as a second order model were verified. Mediation of perceived brand authenticity was also observed, as illustrated in Figure 2.

The model confirmed three out of the four direct effects: Sustainable Strategic Management (β= 0.454: p ≤ 0.000), Eco-efficient Campus Infrastructure (β = 0.119: p ≤ 0.001), and Student Participation in Sustainability Projects (β = 0.118: p ≤ 0.049). The relationship between Eco-innovation in Educational Services and the de-



Note: Significant at 5%. Bootstrap samples = 5,000 and confidence level = 95%.

Figure 2. Inner model, Smart PLS 4.1.1.6

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pendent variable (β = 0.114: p ≤ 0.079) is not confirmed. The Perceived Authenticity of Institutional Sustainability mediation presented adequate route levels (> 0.30) and significance (p < 0.005), as seen in Table 5.

Overall, the findings provide support for most of the proposed hypotheses, as the majority of the hypothesized relationships were found to be statistically significant (see Table 6).

3.4. Indicators of the structural model

R^2 values show a substantial explanatory capacity of the model. In all cases, endogenous variables presented results equal to or greater than 0.816. This confirmed that their predictors significantly explain the constructs (see Table 7). Likewise, the second order construct Green Brand Equity presents an R^2 = 0.737, which indicates an appropriate explanation according to the green dimensions evaluated. Bootstrap analyses showed that all the coefficients have highly significant t values (t > 28; p < 0.001). This confirms the stability and robustness of the estimated model. The adjusted R^2 show an outstanding explanatory power of the model with results greater than 0.775 (see Table 7). The stability and statistical significance of the estimates and the consistency of the structural model were confirmed.

As for the f2 coefficients, the contribution of each predictor on Green Brand Equity was evidenced. Thus, Sustainable Strategic Management (f2 = 0.136; p = 0.002) and Student Participation (f2 = 0.136; p = 0.005) show small but significant effects,

Table 5. Path coefficients

Source: Own elaboration, Smart PLS 4.1.1.6.

Construct	Original sample (O)	Sample average (A)	Standard deviation (STDEV)	t-statistics (|O/STDEV|)	p-values
GSE → Green Brand Equity	0.454	0.451	0.061	7.481	0.000
IE → Green Brand Equity	0.114	0.116	0.065	1.755	0.079
INF → Green Brand Equity	0.199	0.199	0.057	3.473	0.001
PE → Green Brand Equity	0.118	0.104	0.053	1.948	0.049
IE → PAI → Green Brand Equity	0.032	0.031	0.013	2.461	0.014
PE → PAI → Green Brand Equity	0.041	0.040	0.017	2.412	0.016
GSE → PAI → Green Brand Equity	0.028	0.027	0.012	2.333	0.020
INF → PAI → Green Brand Equity	0.022	0.022	0.010	2.200	0.028

Table 6. Hypotheses testing results

Hypothesis	Relationship	β	t-value	p-value	Decision
H1	GSE → Green Brand Equity	0.454	7.481	0.001	Supported
H2	IE → Green Brand Equity	0.114	1.755	0.079	Not supported
H3	INF → Green Brand Equity	0.199	3.473	0.001	Supported
H4	PE → Green Brand Equity	0.118	1.948	0.049	Supported
H5	IE → PAI → Green Brand Equity	0.032	2.461	0.014	Supported
H6	PE → PAI → Green Brand Equity	0.041	2.412	0.016	Supported
H7	GSE → PAI → Green Brand Equity	0.028	2.333	0.020	Supported
H8	INF → PAI → Green Brand Equity	0.022	2.200	0.028	Supported

Table 7. R_2 and adjusted R_2

Source: Own elaboration, Smart PLS 4.1.1.6.

	R-square		Adjusted R-square	
Construct	Original sample (O)	p-values	Original sample (O)	p-values
GBT	0.948	0.000	0.948	0.000
GCE	0.816	0.000	0.816	0.000
GUI	0.946	0.000	0.946	0.000
Green Brand Equity	0.737	0.000	0.735	0.000
LOY	0.775	0.000	0.775	0.000
PAI	0.767	0.000	0.766	0.000
PQSP	0.923	0.000	0.923	0.000

indicating differentiated and consistent contributions to Green Brand Equity. Eco-innovation in Educational Services ($f2 = 4.443$; $p < 0.001$) and Perceived Authenticity showed moderate effects ($f2 = 3.449$; $p < 0.001$). Finally, Eco-efficient Campus Infrastructure exhibited a large effect ($f2 = 17.570$; $p < 0.001$). Therefore, it is the main determinant of Green Brand Equity in the model. Results confirm that all dimensions have a significant impact, although with differentiated magnitudes, on the construction of the university green brand value.

Likewise, PLSpredic$_t$ results presented a high predictive capacity of the model, with Q^2 predict values greater than 0.50 in all constructs, highlighting PAI (0.725), Green Brand Equity (0.709) and GBT (0.654). RMSE and MAE values remain low and stable, which confirms good predictive performance out of the sample and general robustness of the model (see Table 8).

Table 8. Summary of prediction of endogenous variables. PLSpredict

Source. Own elaboration, Smart PLS 4.1.1.6.

Construct	Q^2predict	RMSE	MAE
PAI	0.725	0.525	0.345
Green Brand Equity	0.709	0.541	0.361
GBT	0.654	0.589	0.394
GCE	0.529	0.688	0.478
GUI	0.567	0.659	0.431
LOY	0.616	0.621	0.442
PQSP	0.587	0.644	0.445

Finally, the overall fit of the model showed SRMR values = 0.041 well below the threshold of 0.08 suggested by Hair et al. (2019) not mentioned in the references, indicating a good fit. The NFI = 0.92 supported adequate global fit.

4. DISCUSSIONS

By contrasting empirical findings with the literature review, it was confirmed that HEIs have addressed sustainability management not only as a requirement for validation and verification before external entities, but also as a strategic resource to generate university brand community, positioning, and loyalty of their stakeholders (Aghaz et al., 2024; Buckner & Zhang, 2025). Empirical results coincided with current trends in studies that address sustainability as a component of university branding and as an element of competitive advantage that transforms the performance of its substantive functions (Buckner & Zhang, 2025; Gallardo-Vázquez et al., 2025). Thus, sustainability is constituted as a symbolic and functional element of university Green Brand Equity; therefore, it is a factor that conditions the eligibility of the institution (Castro-Gómez et al., 2024).

Consequently, the study confirmed that *H1* – Sustainable Strategic Management – has a positive effect on green brand equity. This finding demonstrated that student perception includes sustainability as a criterion to evaluate institutional coherence and congruence among governance actions, brand communication, and verifiable and measurable actions of the institution (Ishaq & Di Maria, 2020). As some studies point out (Arias-Valle & Marimon, 2024; Brzaković et al., 2022), the articulation of policies, guidelines and institutional strategic decisions that aim at socioeconomic well-being and environmental care generate interceptions between brand integrity and credibility. These attributes are essential for the consolidation of Green Brand Equity (Sharipudin et al., 2024). The structural model evidenced a significant relationship both direct and mediated, where the perception of authenticity reflects that student expectations are focused on a verifiable and consistent institutional management of sustainable actions (Gao et al., 2024).

In contrast to these results, *H2* – Ecological Innovation in Educational Services – did not show significant effects on their direct relationship. This result has been presented as a novelty: students do not instantly perceive innovation processes as a determining factor in sustainable brand positioning. In contrast to the arguments presented in the literature review that have shown that environmental innovation is a strong component of differentiation (Aghaz et al., 2024; Giraldo-Giraldo et al., 2025; Sonetti et al., 2021), empirical findings do not present this relationship in an evident way. One cause of this event is the association that students make between innovation processes and curric-

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ular development (Alcaide-Pulido et al., 2024). Training for innovation differs by professional career and therefore its focus is not transversal in the development of the pensum. Hence, this dimension does not generate the same type of associations in students of various professional programs (Casanoves-Boix et al., 2025). Moreover, the model showed significant levels in the mediated effect, which demonstrated that innovations reinforce transparency and institutional coherence, strengthening brand value (Spry & Pich, 2021). The authenticity generated by innovation actions generates loyalty behaviors and a sense of belonging as some studies have shown (Aghaz et al., 2024).

Likewise, it was confirmed that *H3* – Intelligent and Efficient Infrastructure – has significant and solid effects on the dependent variable as demonstrated by the size of the effect ($f^2 = 17.570$). This finding confirms studies that have shown that the campus, both in terms of branding and sustainability, is one of the main factors of eligibility and differentiation (Al-Dmour, 2023; Dawodu et al., 2022; Lauder et al., 2015). Infrastructure management for sustainability is also one of the easiest indicators to verify and observe (Pereira Ribeiro et al., 2021). Besides, the findings today demonstrated the positions raised in terms of educational marketing on how the university campus is an essential factor of brand value because it makes its values tangible and bridges discourse, generation of experiences, and participation (Manzoor et al., 2021). Likewise, mediation confirms that an eco-efficient management of the campus promotes student credibility, identification, and trust in the brand (Rahman et al., 2024).

It was confirmed that *H4* – Student Participation in Sustainability Projects – affects university Green Brand Equity. Although the route coefficient is of a lower magnitude, the result obtained supports previous research that underlines student participation as a starting point for an effective implementation of university sustainability as an organizational component and element of the brand (Barnett-Itzhaki et al., 2025; Hernández-Diaz et al., 2021). Since the student is the center of the development of the university's missionary functions, their participation as a co-creator of sustainable value is the most effective way to guarantee the materialization of sustainability principles as brand values (Albornoz-Toyohama et al., 2025; Costa et al., 2021; Seow & Hussain, 2024). Then, empirical findings agree with studies indicating that student participation strengthens the sense of belonging and symbolic associations that become eligibility, recommendation, and positioning (Ali et al., 2024; Castro-Gómez, et al., 2024). Besides, it agrees with studies that indicate that student participation actions in sustainability projects generate additional commitment and behavioral roles in the student's life (Çataldaş & Yalçınkaya, 2025; Kountouridou & Domic, 2022). In other words, students evidence the experience of university sustainability in their speech and their private actions. Thus, results of mediation showed that these practices, when genuine, consolidate the perception of authenticity, reputation, and loyalty (Buckner & Zhang, 2025).

Regarding the mediating role of authenticity (*H6-H9*), the proposed model showed significant and robust relationships between the dimensions of sustainability management and university Green Brand Equity. Studies on educational marketing have shown that the perception of authenticity is an intangible asset in brand building (Beverland & Farrelly, 2010; Morhart et al., 2015). In the context of HEIs, results show that students not only forge criteria on institutional actions or messages, but that the perception of coherence and sincerity in strategic management validate their feelings of support and acceptance (Castro-Gómez, 2025; Dabija et al., 2023). For example, ecological innovation whose relationship was not statistically validated became significant in the mediation processes. This implies that authenticity is a key element for understanding the impact of sustainability on brand value (Srivastava et al., 2019). Thus, sustainable management only presents significant contributions to Green Brand Equity when there is a perception of authenticity on the part of students (Miotto et al., 2020). Finally, the validation of the proposed model, by presenting much higher R^2 and adjusted R^2 values, demonstrates that the sustainability management significantly explains the formation of today's Green Brand Equity, supporting the theoretical contributions that highlight sustainability as a constitutive element of the university brand.

CONCLUSIONS

The results show that strategic sustainable management, eco-efficient campus infrastructure, and student participation in sustainability projects have positive effects on the university's eco-brand value, while eco-innovation in educational services does not have a direct effect. Furthermore, perceived authenticity significantly mediates the relationship between all dimensions of sustainability management and eco-brand value. The model explains a substantial proportion of the variance in eco-brand value (adjusted $R^2 = 0.735$), confirming the predictive relevance of sustainability-related perceptions in the context of the university brand.

These findings suggest that sustainability should not be understood solely as an operational or regulatory requirement in higher education, but rather as a strategic intangible asset that reinforces institutional brand value. Students attribute greater eco-brand value when sustainability translates into visible infrastructure, consistent strategic decisions, and real opportunities for participation. Sustainable actions only generate reputational and loyalty effects when students perceive them as credible and consistent with the university's actual behavior. From a management perspective, universities should invest in coherent governance, tangible campus transformation, and participatory sustainability initiatives. From a theoretical perspective, the study contributes empirical evidence to the emerging literature on the ecological brand value of universities by validating a multidimensional explanatory model in the context of higher education.

One of the main limitations of the study is that it only considers student perception. Future research could incorporate comparative studies of HEIs from various socio-cultural contexts as well as the role of the business sector. Likewise, future studies could incorporate variables such as the perception of coherence, co-creation, and institutional pride.

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CONFLICT OF INTERESTS

All authors approved the final version of the manuscript and declared no conflicts of interest.

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APPENDIX A

MEASURING INSTRUMENTS

Measuring instrument with a Likert scale from 1 (strongly disagree) to 7 (strongly agree).

Table A1. Perceived Authenticity of Institutional Sustainability

Item	Source
PAI1: I think my university's sustainability actions really reflect its institutional values.	Beverland and Farrelly (2010), Morhart et al. (2015)
PAI2: I think that the university's environmental initiatives are consistent with what it communicates publicly.	Schallehn et al. (2014), Hu et al. (2020)
PAI3: I perceive that the institution does not use sustainability only as marketing, but it is a real organizational commitment.	Napoli et al. (2014), Iglesias et al. (2020)
PAI4: I believe that the university demonstrates transparency and coherence when implementing its sustainability policies.	Jahn et al. (2017), El-Kassar et al. (2023)

Table A2. Sustainable Strategic Management

Item	Source
GSE1: I think that my institution integrates sustainability goals into its strategic planning.	Amani (2024), Chen (2022)
GSE2: I perceive that senior management promotes policies aligned with sustainable development.	Juhaidi et al. (2025)
GSE3: I think institutional decisions consider environmental and social impacts.	Buckner and Zhang (2025)
GSE4: I observe that governance processes include sustainability criteria.	Ishaq and Di Maria (2020)
GSE5: I perceive that the institution transparently communicates its commitments to sustainability.	Guilbault (2018)

Table A3. Eco-innovation in Educational Services

Item	Source
IE1: I think that my institution provides educational services with innovative ecological practices.	Mourad et al. (2020)
IE2: I believe that academic programs integrate content on sustainability and green innovation.	Sun et al. (2025)
IE3: I perceive that institutional research drives innovative environmental solutions.	Aghaz et al. (2024)
IE4: I observe that extension projects incorporate sustainable innovation approaches.	Castro-Gómez et al. (2024)
IE5: I perceive that initiatives are implemented to reduce the environmental impact of the educational service.	Sonetti et al. (2021)
IE6: I think that sustainable innovation is a central part of the institutional value proposition.	Iglesias et al. (2023)

Table A4. Eco-efficient Campus Infrastructure

Item	Source
INF1: I perceive that the campus has eco-efficient infrastructure.	Srivastava et al. (2019)
INF2: I believe that the institution uses smart technologies to optimize the consumption of resources.	Chen (2010)
INF3: I think that physical spaces facilitate sustainable practices in the university community.	Buckner and Zhang (2025)
INF4: I perceive that waste and energy management complies with recognized environmental standards.	Sonetti et al. (2021)
INF5: I believe that the institutional infrastructure reinforces the sustainable image of the university.	Ishaq and Di Maria (2020)

Table A5. Student Participation in Sustainability Projects

Item	Sourcing
PE1: I participate or have real opportunities to get involved in institutional sustainability projects.	Guilbault (2018)
PE2: I perceive that the institution promotes student activities for environmental care.	Sharipudin et al. (2024)
PE3: I feel that there are spaces to propose student initiatives oriented to sustainability.	Buckner and Zhang (2025)
PE4: I think that my participation contributes to strengthening the sustainable culture of the institution.	Juhaidi et al. (2025)

Table A6. Perceived Quality of Sustainability Practices

Item	Source
PQSP1: I perceive that the institution takes sustainable actions in a coherent and effective manner.	Chen (2010), Iglesias et al. (2023)
PQSP2: I think that the university's sustainable practices are of high quality.	Fernández-Gubieda and Gutiérrez-García (2025)
PQSP3: I think environmental actions are well implemented in institutional processes.	Aghaz et al. (2024)
PQSP4: I perceive that the university complies with recognized standards of sustainability.	Sun et al. (2025)
PQSP5: I think that the institution maintains reliable and transparent sustainable management.	Sharipudin et al. (2024)

Table A7. Green University Image

Item	Source
GUI1: I believe that the university projects an environmentally responsible image.	Mourad et al. (2020)
GUI2: I perceive that the institution has a solid reputation for sustainability.	Buckner and Zhang (2025)
GUI3: I think that the university brand reflects a commitment to the environment.	Ishaq and Di Maria (2020)
GUI4: I believe that the university is recognized for its sustainable good practices.	Juhaidi et al. (2025)
GUI5: The institutional image conveys clear environmental values.	Amani (2024)

Table A8. Green Brand Trust

Item	Source
GBT1: I am confident that the institution acts in a sustainable way.	Ng et al. (2014)
GBT2: I believe that the university fulfills what it promises in environmental terms.	Aghaz et al. (2024)
GBT3: I am confident in the capacity of the institution to manage ecological practices.	Iglesias et al. (2023)
GBT4: I think that the university offers reliable information about its sustainable actions.	Mirzaei et al. (2016)
GBT5: I believe that the institution is honest regarding its environmental commitment.	Fernández-Gubieda and Gutiérrez-García (2025)

Table A9. Student Loyalty

Item	Source
LOY1: I would recommend this institution for its sustainable commitment.	Pinar et al. (2020)
LOY2: I am motivated to maintain a link with the university for its environmental practices.	Ng et al. (2014)
LOY3: I would choose this institution again due to its sustainable values.	Castro-Gomez (2025)

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