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From Environmental Sustainability Discourse to Exploratory Institutional Dimensions: A Documentary Analysis of Higher Education Quality Assurance Through GreenComp

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Abstract

The integration of sustainability into higher education increasingly requires attention not only to curricular content but also to the institutional conditions through which sustainability is represented, documented, and translated into quality-assurance processes. This study examines environmental sustainability discourse and its institutional translation at the Universidad de la Amazonia, Colombia, using a documentary corpus of 61 documents: nine Colombian National Development Plans, 50 undergraduate programme registration documents, and two institutional self-evaluation reports. For longitudinal analysis, the corpus was organized into nine presidential-period observations and eight predefined lexical indicators. The quantitative sequence comprised a Friedman analysis, an exploratory Principal Component Analysis (PCA) with Promax rotation and Kaiser normalization, and an initial covariance-based Structural Equation Model (CB-SEM) estimated by maximum likelihood in AMOS. The PCA suggested three exploratory dimensions—Institutional Sustainability Orientation, Institutional Sustainability Capacity, and Transformation Readiness—accounting for 72.795% of the extracted variance. The initial SEM yielded favourable numerical fit indices but an inadmissible solution, including a non-positive-definite covariance matrix and negative variance estimates; it was therefore retained only as a diagnostic specification and not as confirmatory evidence. Critical Discourse Analysis (CDA) identified four recurring patterns: normative institutionalization of sustainability, agent representation, managerial relexicalization, and institutional improvement needs. The three exploratory dimensions were subsequently interpreted in relation to three GreenComp competence areas as a conceptual mapping rather than a measurement of individual competences. The resulting preliminary quality-assurance framework distinguishes institutional orientation, organizational capacity, and readiness for transformation while explicitly separating documentary evidence from demonstrated implementation or competence development.

Keywords: environmental sustainability discourse; GreenComp; higher education quality assurance; documentary analysis; institutional sustainability; critical discourse analysis; covariance-based structural equation modelling

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1. Introduction

This study examines how environmental sustainability is represented and institutionally translated within higher education quality assurance documents at the Universidad de la Amazonia, and identifies exploratory documentary dimensions associated with sustainability-oriented institutional conditions, using GreenComp as an interpretive framework.

The conceptual architecture of the study distinguishes between four analytical levels. First, environmental sustainability is examined as a discursive and normative object represented in national policy and higher education quality-assurance documents. Second, the study examines its institutional translation, understood as the way sustainability-related orientations are incorporated into programme documentation and institutional self-evaluation processes. Third, exploratory quantitative analyses are used to identify documentary dimensions associated with sustainability-oriented institutional conditions. Fourth, these dimensions are interpreted in relation to the GreenComp competence framework, which serves as a conceptual bridge rather than as a measurement instrument.

This distinction is important because documentary representations of sustainability, institutional conditions, and individual sustainability competences are analytically related but empirically different phenomena. The study therefore does not infer competence acquisition directly from institutional discourse or quality-assurance documentation.

1.1. Conceptual Background

1.1.1. Higher Education and Sustainability

The contemporary human-induced polycrisis—characterized by accelerating climate change, resource depletion, biodiversity loss, and deep socio-economic inequalities—demands a re-evaluation of the societal purpose and strategic direction of higher education institutions (HEIs). As humanity navigates complex ecological and social challenges, HEIs can function as important arenas for critical reflection, public debate, knowledge production, and transdisciplinary responses to socio-ecological challenges [1–5].

Because modern universities host large communities, maintain substantial physical infrastructures, and command significant material resources, they have important ecological and socio-economic footprints. Consequently, sustainability in higher education increasingly concerns not only campus operations but also governance, teaching, research, and community engagement [3–5].

Achieving this systemic orientation requires universities to address their physical environments, organizational structures, and core academic missions—specifically teaching, research, and community outreach—through Education for Sustainable Development (ESD). This reorientation places greater emphasis on competence-oriented and transformative approaches to sustainability education [5–7].

1.1.2. Institutional Translation, Governance, and Quality Assurance

The strategic and curricular transformation of higher education is not a neutral, friction-free administrative process; rather, it can involve struggles over power, resources, legitimacy, and institutional position that can be examined through the practice theory of Pierre Bourdieu [8]. Bourdieu's foundational practice equation:

$$[(\text{Habitus})\ (\text{Capital})] + \text{Field} = \text{Practice}$$

conceptually frames the modern university as an actor within a competitive field—a social space characterized by structural inequalities and struggles where individuals and organizations deploy specialized resources to secure position, distinction, and dominance [8].

Within this academic field, sustainability credentials, certifications, and related forms of institutional recognition may function as forms of symbolic capital when they are

mobilized for distinction and legitimacy. This interpretation is used here as a theoretical lens rather than as an empirically tested mechanism [8,9].

This institutional decoupling can become visible when universities adopt highly visible sustainability statements without equivalent changes in governance and everyday practices. From an institutional perspective, such gaps can be understood as tensions between formal commitments, legitimacy processes, and organizational routines [8–10].

1.1.3. Governance–Operations Tensions in Sustainability Institutionalization

This structural decoupling is most visible in the profound tension that exists between university governance and sustainable campus operations [10,11]. In many higher education institutions, a deep divide persists between academic cultures (responsible for teaching, research, and outreach) and operational cultures (responsible for facilities management, infrastructure, and financial procurement). This organizational fragmentation ignores the fact that the physical campus operates as a powerful "hidden curriculum"—an informal, material, and pedagogical environment that actively reinforces or directly contradicts formal classroom learning [11].

When a university's strategic plans declare a profound commitment to the United Nations Sustainable Development Goals (SDGs) while its physical facilities rely on carbon-intensive energy grids, unmitigated solid waste streams, and unsustainable procurement logistics, it inflicts a form of cognitive dissonance on the academic community, provoking scepticism and critical evaluations from students and faculty alike [10,11]. Previous higher education research has examined the relationships among institutional governance, campus management, curriculum, research, and community engagement from different organizational perspectives [11]. These studies suggest that sustainability-oriented quality assurance should be considered in relation to both formal governance arrangements and the organizational mechanisms through which institutional commitments are translated into practice. In the present study, however, these relationships are not empirically tested as causal or predictive pathways.

1.1.4. GreenComp and Sustainability Competence

To bridge this rhetoric-practice gap, international educational governance has advanced comprehensive, competence-based reference frameworks designed to translate abstract sustainability principles into actionable educational practices [6]. Chief among these is GreenComp, the European Sustainability Competence Framework developed by the European Commission's Joint Research Centre [6]. GreenComp defines sustainability competence as the dynamic combination of knowledge, skills, and attitudes required to value our planet and take action to protect it [6]. The framework is structured into four core, interrelated competence areas: [6,7].

a. Embodying sustainability values (including environmental justice, equity, and ecocentrism) [6];
b. Embracing complexity in sustainability (promoting systems thinking, critical framing, and problem-solving) [6];
c. Envisioning sustainable futures (fostering futures literacy, adaptability, and anticipatory thinking) [6];
d. Acting for sustainability (empowering political agency, collective action, and individual responsibility) [6].

Simultaneously, the European Higher Education Area (EHEA) is revising the Standards and Guidelines for Quality Assurance (ESG). The ESG 2027 revision follows the mandate issued by EHEA ministers in May 2024, with adoption expected at the 2027 ministerial conference [12].

Evidence from national policy contexts, including Ireland's Education for Sustainable Development to 2030 agenda, illustrates the growing role assigned to higher education institutions in sustainability policy, while broader research shows that institutional sustainability is addressed through diverse higher education governance and quality-assurance approaches [3,4,10,13].

1.1.5. Discursive Tensions and Institutional Translation

Despite the emergence of these frameworks, the integration of sustainability within higher education remains heterogeneous across institutional contexts. From a Critical Discourse Analysis perspective, terms such as "transformation" and "transition" can be examined for the meanings and organizational rationales they acquire in institutional texts, including possible managerial or market-oriented relexicalizations [13–15].

Institutional policy texts may represent responsibility through passive or impersonal constructions. In the present study, such forms are examined as instances of agent representation rather than interpreted as evidence of deliberate concealment. CDA can identify how agency is linguistically represented, but the documentary evidence alone cannot establish the intentions of institutional actors or the effects of such representations on sustainability practice [14,16].

1.2. Research Gap

Recent higher education research has expanded the study of sustainability through analyses of institutional policies, teaching practices, and quality-assurance processes. However, less attention has been given to how national policy discourse is translated into institution-level quality-assurance documentation and how documentary evidence can be combined with cautious exploratory quantitative analysis. This study addresses that gap through a documentary case analysis that distinguishes corpus units from statistical observational units and treats GreenComp as an interpretive framework rather than as a measurement instrument [3,4,13,17].

Existing studies often emphasize either qualitative interpretations of sustainability discourse or quantitative assessments of sustainability-related institutional or educational indicators. The present study brings these perspectives into a single documentary workflow while maintaining their different evidentiary roles: lexical and longitudinal analysis characterizes variation in the corpus; PCA explores the dimensional structure of derived indicators; CB-SEM is used only as an initial diagnostic specification; and CDA provides contextual interpretation of institutional narratives. The design therefore prioritizes analytical complementarity rather than statistical validation of a single latent model [11,18].

A further methodological gap concerns traceability between documentary evidence and exploratory institutional dimensions. Rather than claiming a validated measurement structure, the present study documents how lexical indicators, programme-level documentary indicators, exploratory PCA, initial CB-SEM diagnostics, and CDA can be combined to examine institutional sustainability conditions. This approach provides a transparent basis for subsequent interpretation through GreenComp while recognizing the limitations imposed by the nine-observation longitudinal structure.

1.3. Research Objectives, Scope, and Research Question

The study examines how environmental sustainability is represented and institutionally translated within higher education quality-assurance documents at the Universidad de la Amazonia, and identifies exploratory documentary dimensions associated with sustainability-oriented institutional conditions, using GreenComp as an interpretive framework. The specific objectives are (1) to characterize the evolution and configuration of environmental sustainability discourse in Colombian national development policies and

higher education quality-assurance documents; (2) to examine how sustainability-related orientations and institutional conditions are embedded in undergraduate programme documentation and self-evaluation processes at the Universidad de la Amazonia; and (3) to interpret the identified institutional dimensions in relation to the GreenComp competence framework and derive a preliminary quality-assurance framework for documenting sustainability-oriented institutional conditions. The research question is: "How is environmental sustainability represented and institutionally translated within higher education quality assurance documents at the Universidad de la Amazonia, and what institutional conditions relevant to sustainability-oriented educational change can be identified through an interpretive mapping to GreenComp?"

1. Methodologically, the study contributes a transparent documentary workflow that separates descriptive lexical analysis, exploratory dimensional analysis, initial SEM diagnostics, and qualitative discourse interpretation. The contribution is methodological and case-based rather than a claim of statistical generalization or model validation.
2. Theoretically, the study uses institutional and discourse perspectives to interpret how sustainability acquires normative and managerial visibility within quality-assurance documentation. These perspectives are used as interpretive resources rather than as independently tested causal mechanisms [8].
3. Practically, the study proposes a preliminary documentary quality-assurance framework that can help organize evidence concerning institutional sustainability orientation, organizational capacity, and readiness for transformation. The framework is not presented as a validated assessment instrument.

The analytical workflow was restricted to procedures that were actually conducted and for which corresponding outputs were available. The quantitative sequence comprised the longitudinal Friedman analysis, exploratory PCA with Promax rotation and Kaiser normalization, and an initial CB-SEM estimated using maximum likelihood in AMOS. Procedures without retained empirical outputs were not included in the final analytical claims.

2. Materials and Methods

The study does not constitute a direct assessment of individual sustainability competences. Instead, it examines documentary and institutional conditions through which sustainability is represented and articulated within higher education quality-assurance processes. Consequently, the empirically derived dimensions are interpreted as documentary and institutional dimensions rather than as measures of competence acquisition.

2.1. Research Design

This study employed a documentary analytical design integrating qualitative interpretation of sustainability discourse with quantitative analysis of documentary indicators [11,18]. The study focused on how environmental sustainability was represented and institutionally articulated within Colombian policy and higher education quality-assurance documentation.

The analytical strategy was structured in sequential stages. First, documentary sources were identified and organized according to their institutional and temporal context. Second, sustainability-related lexical indicators were extracted from the documentary corpus and organized longitudinally according to nine presidential periods. Third, the resulting documentary indicators were examined through principal component analysis (PCA) to identify recurrent dimensions within the empirical dataset [19]. Finally, the resulting dimensions were interpreted in relation to the European sustainability competence framework, GreenComp, as an interpretive rather than direct measurement framework.

The study therefore does not constitute a direct assessment of individual sustainability competences. Instead, it examines documentary and institutional conditions through which sustainability is articulated within higher education quality-assurance processes.

2.2. Study Area

The empirical phase of this study was conducted at the Universidad de la Amazonia (Florencia, Caquetá, Colombia), a public higher education institution located in the Colombian Amazon, one of the world's most biodiverse and socio-ecologically strategic regions. The Amazon biome plays a fundamental role in regulating the global climate, conserving biodiversity, maintaining freshwater resources, and sustaining ecosystem services essential for planetary resilience. At the same time, it is increasingly affected by deforestation, land-use change, biodiversity loss, climate variability, and complex socio-environmental transformations, positioning the region at the centre of contemporary sustainability debates [20].

Within this context, higher education institutions are increasingly recognized as actors in advancing sustainable development through governance, institutional management, knowledge production, stakeholder engagement, and regional innovation. Contemporary sustainability scholarship recognizes universities as important actors in advancing the Sustainable Development Goals by embedding sustainability across organizational structures, curricula, research agendas, and community engagement activities. Recent evidence further examines institutional sustainability in relation to university performance and stakeholder perceptions, including in Colombian higher education [4,5,7,21,22].

The Universidad de la Amazonia therefore constitutes a critical case for investigating how sustainability is institutionalized within a public university operating in an environmentally strategic territory of the Global South. Unlike universities located in highly industrialized contexts, Amazonian higher education institutions simultaneously respond to global sustainability agendas and to regional challenges associated with biodiversity conservation, environmental governance, social inclusion, and territorial development. This combination provides a unique opportunity to examine the interactions between international policy frameworks and locally embedded institutional practices.

Beyond its geographical relevance, the institution offers an appropriate analytical setting for exploring how global sustainability frameworks—particularly the United Nations Sustainable Development Goals [7] and the European Commission's GreenComp: European Sustainability Competence Framework [6]—are interpreted, translated, and operationalized through institutional quality assurance mechanisms, governance arrangements, organizational strategies, and educational policies. Rather than conceptualizing policy implementation as a linear process, this study adopts an institutional perspective in which sustainability is understood as a socially constructed organizational field shaped by competing interests, symbolic power, institutional logics, and legitimacy processes [8,9].

This perspective also responds to recent calls for more context-sensitive sustainability research in higher education, particularly in regions where ecological significance intersects with institutional complexity and uneven policy implementation. Although sustainability has become an increasingly prominent dimension of university evaluation worldwide, empirical evidence from biodiversity-rich territories of Latin America remains comparatively limited, especially regarding the relationship between environmental sustainability, institutional quality assurance, and organizational governance. Consequently, the Universidad de la Amazonia provides a theoretically and empirically robust setting for examining how global sustainability discourses are locally appropriated, negotiated, and institutionalized within higher education organizations located in one of the planet's most environmentally significant regions.

Finally, this case contributes to the broader international debate concerning the capacity of universities to act as institutional agents of socio-ecological transformation. Rather than offering findings that are only locally relevant, the study generates analytical insights that may be transferable to higher education institutions operating in other biodiversity hotspots and environmentally strategic territories across the Global South, thereby extending current discussions on sustainability governance, quality assurance, and organizational change in higher education.

2.3. Analytical Units, Observational Structure, and Indicator Construction

The study distinguished explicitly between the documentary corpus, the longitudinal observational structure, and the derived analytical indicators. The documentary corpus comprised 61 documents: nine Colombian National Development Plans (PNDs), 50 undergraduate programme registration documents, and two institutional self-evaluation reports. The 61 documents were documentary units for corpus construction and interpretation, not 61 independent statistical observations.

For longitudinal quantitative analysis, the documentary material was organized into nine presidential periods: Gaviria, Samper, Pastrana, Uribe I, Uribe II, Santos I, Santos II, Duque, and Petro. Each presidential period constituted one longitudinal statistical observation (N = 9).

Eight lexical indicators were constructed for each presidential period from the occurrence counts of sustentabilidad, sustento, sustentabilización, sustentar, sustentablemente, sustentable, sustentables, and transformación. The resulting longitudinal matrix contained nine observations and eight related lexical indicators.

The lexical indicators were derived from documentary occurrences aggregated within each presidential period. Documents within a period therefore contributed to the same period-level observation; they were not treated as statistically independent cases.

2.3.1. Lexical Identification and Selection

The lexical analysis used a predefined set of eight Spanish forms specified in the analytical protocol: sustentabilidad, sustento, sustentabilización, sustentar, sustentablemente, sustentable, sustentables, and transformación. These forms were retained as separate indicators rather than collapsed into a single frequency measure.

The initial lexical universe comprised 9505 occurrences, of which 5528 corresponded to the eight retained indicators, yielding 58.16% descriptive coverage of the initial retrieval. Absolute occurrence counts were organized by presidential period. Because the periods differed substantially in documentary and lexical volume, the counts are interpreted descriptively and are not treated as directly comparable measures of discourse intensity without reference to the underlying corpus volume.

The restricted lexical vocabulary is a methodological limitation. The available count records document the eight retained forms but do not independently provide a complete audit trail for every search expression, contextual retrieval rule, or exclusion decision. In particular, sostenibilidad and sostenible are not among the eight retained indicators. Their absence from the analytical matrix should therefore not be interpreted as evidence that these forms were absent from the documentary corpus.

The period-level matrix was subsequently transformed according to the normalization procedure used in the statistical workflow and served as the basis for the Friedman comparison and the derived exploratory dimensional analysis. The statistical observational unit remained the presidential period (N = 9), while the eight lexical indicators constituted repeated related measures within each period.

Throughout the manuscript, documents are treated as documentary units, presidential periods as longitudinal statistical observations, and lexical occurrences as the textual evidence from which the indicators were derived.

The institutional programme registration documents and self-evaluation reports complement the national policy corpus by providing documentary evidence of how sustainability-related orientations are represented within programme-level quality assurance and institutional self-evaluation processes [23–26].

2.3.2. Covariance-Based Structural Equation Model

An initial covariance-based structural equation model (CB-SEM) was estimated using maximum likelihood in IBM SPSS AMOS, version 22 to examine the empirical behaviour of the three exploratory dimensions. The model used the nine period-level observations (N = 9), three latent dimensions, and seven observed indicators. The first loading of each dimension was fixed at 1.00 for scale identification.

Because the number of observations was very small relative to the model complexity, the SEM was not used to validate the proposed dimensions. It was retained as an initial specification and diagnostic analysis intended to identify estimation behaviour and admissibility problems.

The model contained 25 free parameters, 28 covariance moments, and three degrees of freedom. Global fit indices were considered jointly with parameter estimates and admissibility diagnostics. No post hoc modifications were introduced to improve numerical fit.

The SEM reported here is exclusively covariance-based SEM estimated by maximum likelihood in AMOS. PLS-SEM was not performed. No PLS-specific procedures were used.

2.4. Inclusion and Exclusion Criteria

The documentary corpus was constructed using explicit inclusion and exclusion criteria intended to preserve documentary relevance and comparability. The criteria were applied to official national policy documents and higher education quality-assurance documents relevant to the study objectives [14,17,27–30].

2.4.1. Inclusion Criteria

1. Official status

Eligible documents had formal legal or institutional status. National Development Plans were treated as official national policy instruments, while institutional documents were included when they formed part of the university's formal quality-assurance or self-evaluation documentation [17,25,27,31].

2. Quality-assurance alignment

Institutional documents were required to provide evidence relevant to higher education quality assurance, including programme registration, institutional planning, self-evaluation, continuous improvement, or related quality processes [23–25,32].

3. Thematic affinity

Documents were included when they provided documentary evidence relevant to environmental sustainability, its institutional representation, or its translation into higher education quality-assurance processes. Lexical indicators were then derived from the predefined analytical vocabulary described above [30,33].

The analytical vocabulary comprised the eight lexical forms specified in the protocol: sustentabilidad, sustento, sustentabilización, sustentar, sustentablemente, sustentable, sustentables, and transformación.

The eight forms were treated as analytical indicators selected for the documentary study; their inclusion does not imply that they exhaust the Spanish lexical field of sustainability [14,15,33].

4. Digital completeness

Eligible documents had to be available in a sufficiently complete digital form to permit documentary reading and lexical extraction. The study does not claim a broader natural-language-processing workflow beyond the procedures for which corresponding analytical outputs were retained.

2.4.2. Exclusion Criteria

To preserve the conceptual coherence, institutional validity, and analytical reliability of the documentary corpus, documents meeting any of the following conditions were excluded:

1. Non-official or draft materials

Unapproved drafts, presentation materials, brochures, workshop materials, and other documents without formal institutional or policy status were excluded from the analytical corpus [17,27].

2. Postgraduate programme documents

Postgraduate programme documents were excluded because the study was restricted to undergraduate programme documentation in order to maintain a consistent educational level and quality-assurance context across the institutional corpus [24,25].

3. Contextually irrelevant lexical occurrences

Lexical occurrences were excluded from the retained environmental-sustainability count when their documented context was clearly unrelated to the analytical focus, such as references exclusively concerning financial viability or commercial sustainability without an identifiable connection to environmental sustainability, educational quality, territorial development, or institutional governance [14,30,33].

These criteria defined the final documentary corpus and the restricted lexical dataset used in the longitudinal analysis.

2.5. Data Processing and Analytical Strategy

Data processing followed a sequential documentary-to-quantitative-to-interpretive workflow. Documentary corpus construction and lexical identification preceded longitudinal testing; exploratory PCA was then used to examine dimensional structure; the initial CB-SEM was estimated only as a diagnostic specification; CDA provided qualitative contextualization; and GreenComp was applied after the empirical analyses as an interpretive framework.

The workflow comprised five analytical stages:

Stage 1. Documentary corpus construction and lexical identification

The documentary corpus was organized by document type, institutional context, and presidential period. The eight predefined lexical indicators were identified and counted within the documentary material, producing the period-level lexical matrix. No additional computational text-mining procedures were included in the final empirical workflow.

The resulting documentary inventory and lexical matrix provided the basis for the subsequent quantitative analyses.

Stage 2. Longitudinal non-parametric analysis

The eight lexical indicators were compared across the nine presidential periods using the Friedman procedure implemented in InfoStat, version 2020. The test was used to

characterize differences in the relative configuration of the repeated lexical indicators across periods.

The longitudinal matrix was transformed according to the analytical protocol before the Friedman procedure. The manuscript reports the software output using the statistic terminology provided by InfoStat and does not substitute an independently reconstructed statistic for the reported T* value [34].

No hierarchical clustering procedure was included in the final analysis.

The dimensional structure was examined subsequently through exploratory Principal Component Analysis (PCA) with Promax rotation and Kaiser normalization. The available output supports interpretation of the component pattern matrix and communalities; KMO and Bartlett's test are not reported because they were not part of the retained analytical output.

Longitudinal differences were evaluated using the Friedman procedure. Where the InfoStat output identified homogeneous groups, the reported minimum significant difference between rank sums was used to describe the grouping without interpreting rank position as environmental performance [34].

Stage 3. Exploratory dimensional analysis

PCA was used to summarize the derived documentary indicators. Three components were retained and interpreted provisionally according to their pattern coefficients and documentary meaning.

The PCA interpretation focused on pattern coefficients, communalities, and variance explained. No claim of psychometric validation was made [19].

Stage 4. Initial covariance-based SEM diagnostics

The initial CB-SEM was estimated in IBM SPSS AMOS using maximum likelihood. The model was examined for parameter estimates, covariance structure, variance admissibility, and global fit statistics, with the explicit understanding that N = 9 was insufficient for confirmatory interpretation.

Analytical software

1. InfoStat was used for the Friedman analysis. PCA and supporting data preparation were conducted in the available statistical workflow; IBM SPSS AMOS was used for the initial CB-SEM estimation. R Project version 4.6.0 and RStudio version 2026.04.0+526 ("Globemaster Allium") were used for supporting data organization where applicable.
2. The retained outputs were cross-checked against the reported tables and figures. Procedures for which no corresponding empirical output was available were not included in the final analytical claims.

2.6. Critical Discourse Analysis (CDA)

CDA was conducted as an interpretive documentary analysis of the institutional self-evaluation reports. The analysis used meaning-bearing textual segments in which sustainability was connected with institutional commitments, agency, quality assurance, managerial practices, participation, implementation, or organizational change.

Coding combined deductive sensitizing concepts derived from the study objectives with inductive identification of recurring discursive patterns. The categories were compared across the Biology and Veterinary Medicine and Animal Sciences (MVZ) self-evaluation documents.

1. The analysis considered how agency, responsibility, sustainability, quality, participation, and institutional improvement were represented in the text. Impersonal or passive constructions were coded as forms of agent representation; they were not interpreted as evidence of intentional concealment. The coding was informed by critical discourse approaches to the representation of social actors and actions [14,16,35].

2. Particular attention was given to managerial relexicalization, namely the incorporation of sustainability into vocabularies of quality, competitiveness, excellence, and organizational improvement. These patterns were interpreted in relation to the documentary context rather than as proof of a specific ideological intention [13–15].
3. The qualitative interpretation was informed by institutional and discourse perspectives, including concepts of field, habitus, and symbolic legitimacy. These concepts were used to contextualize documentary patterns and were not treated as empirically tested causal mechanisms [8,9].

2.7. Exploratory Principal Component Analysis

Principal Component Analysis (PCA) was applied to the derived nine-observation analytical matrix to explore the dimensional structure of the documentary indicators. Components were extracted using PCA and subjected to Promax rotation with Kaiser normalization. The rotation converged after five iterations, and three components were retained. The component structure was interpreted by examining the rotated pattern coefficients in conjunction with the documentary meaning of the indicators. On this basis, the components were provisionally labelled Institutional Sustainability Orientation, Institutional Sustainability Capacity, and Transformation Readiness. These labels represent exploratory interpretations rather than validated latent constructs.

The PCA and the subsequent covariance-based structural equation modeling (CB-SEM) were treated as distinct analytical stages. As summarized in Table 1, the FAC variables represent derived documentary indicators used in the exploratory dimensional analysis and the initial SEM specification. The indicators used to specify Transformation Readiness (F3) in the initial CB-SEM were FAC1_Biología and FAC1_MVZ, following the original AMOS specification. This specification was retained for transparent reporting of the estimated model and should not be interpreted as a direct re-estimation of PCA Component 3. Replacing these indicators with those associated with PCA Component 3 would define a different SEM and would not correspond to the reported AMOS output.

Table 1. Analytical variables and construction rules.

Variable	Source	Construction Rule	Analytical Role
Presidential period	Documentary corpus	Nine successive presidential periods represented in the corpus	Longitudinal observational unit
Sustentabilidad	Documentary lexical occurrences	Count of occurrences per presidential period	Lexical indicator
Sustento	Documentary lexical occurrences	Count of occurrences per presidential period	Lexical indicator
Sustentabilización	Documentary lexical occurrences	Count of occurrences per presidential period	Lexical indicator
Sustentar	Documentary lexical occurrences	Count of occurrences per presidential period	Lexical indicator
Sustentablemente	Documentary lexical occurrences	Count of occurrences per presidential period	Lexical indicator
Sustentable	Documentary lexical occurrences	Count of occurrences per presidential period	Lexical indicator
Sustentables	Documentary lexical occurrences	Count of occurrences per presidential period	Lexical indicator
Transformación	Documentary lexical occurrences	Derived documentary indicator retained in the analytical matrix; the FAC index identifies the indicator position used in the exploratory PCA.	Lexical indicator
FAC1_Discurso	Derived analytical matrix	Derived documentary indicator retained in the analytical matrix; the FAC index identifies the indicator position used in the exploratory PCA.	Exploratory dimensional indicator

Table 1. *Cont.*

Variable	Source	Construction Rule	Analytical Role
FAC2_Discurso	Derived analytical matrix	Derived documentary indicator retained in the analytical matrix; the FAC index identifies the indicator position used in the exploratory PCA.	Exploratory dimensional indicator
FAC3_Discurso	Derived analytical matrix	Component score derived from exploratory PCA with Promax rotation	Exploratory dimensional indicator
FAC1_Biología	Derived institutional documentation	Programme-level derived documentary indicator; the FAC index identifies the indicator position retained in the programme-level analytical matrix.	Exploratory institutional indicator
FAC2_Biología	Derived institutional documentation	Programme-level derived documentary indicator; the FAC index identifies the indicator position retained in the programme-level analytical matrix.	Exploratory institutional indicator
FAC3_Biología	Derived institutional documentation	Programme-level derived documentary indicator; the FAC index identifies the indicator position retained in the programme-level analytical matrix.	Exploratory institutional indicator
FAC1_MVZ	Derived institutional documentation	Programme-level derived documentary indicator; the FAC index identifies the indicator position retained in the programme-level analytical matrix.	Exploratory institutional indicator
FAC2_MVZ	Derived institutional documentation	Programme-level derived documentary indicator; the FAC index identifies the indicator position retained in the programme-level analytical matrix.	Exploratory institutional indicator
FAC3_MVZ	Derived institutional documentation	Programme-level derived documentary indicator; the FAC index identifies the indicator position retained in the programme-level analytical matrix.	Exploratory institutional indicator

Note: Presidential period is the longitudinal statistical observation (N = 9). Lexical indicators are occurrence counts by period. FAC variables are derived documentary indicators used in the exploratory dimensional and initial SEM analyses.

2.8. Structural Equation Modelling (SEM)

An initial covariance-based SEM was estimated in IBM SPSS AMOS using maximum likelihood. The model examined the empirical behaviour of three exploratory dimensions and was not specified or interpreted as a causal path model.

The three dimensions were specified from the documentary indicators as follows:

1. Institutional Sustainability Orientation (F1): FAC1_Discurso, FAC2_Discurso, and FAC3_Discurso.
2. Institutional Sustainability Capacity (F2): FAC2_Biología and FAC2_MVZ.
3. Transformation Readiness (F3): FAC1_Biología and FAC1_MVZ.

The F3 specification should not be read as a one-to-one reproduction of PCA Component 3. The PCA identifies Component 3 from FAC3_Biología and FAC3_MVZ, whereas the initial SEM retains FAC1_Biología and FAC1_MVZ as the observed indicators specified in the original AMOS model. Because the SEM is diagnostic and inadmissible, this distinction is reported explicitly rather than interpreted as evidence that the two specifications are statistically equivalent.

For identification, the first loading of each dimension was fixed at 1.00. The model contained 25 free parameters, 28 covariance moments, and three degrees of freedom.

1. No internal-consistency, convergent-validity, or discriminant-validity statistics were used to validate the SEM dimensions. These procedures were not part of the retained analytical workflow.
2. The model was evaluated through the reported maximum-likelihood parameter estimates, latent covariances, variance estimates, covariance-matrix admissibility, and global fit statistics.
3. The fixed loadings were treated solely as identification constraints; the freely estimated loadings were interpreted using their standard errors, critical ratios, and *p*-values.

Model estimation and diagnostic criteria

The SEM was estimated by maximum likelihood. PLS-SEM was not performed, and no variance-based predictive assessment was used.

Global fit statistics were reported for transparency but were interpreted only together with the admissibility diagnostics and the very small sample size.

1. The reported global statistics were CMIN = 0.414, df = 3, p = 0.937, CMIN/df = 0.138, GFI = 0.985, AGFI = 0.862, NFI = 0.993, RFI = 0.952, IFI = 1.045, TLI = 1.457, CFI = 1.000, and RMSEA = 0.000 (90% CI [0.000, 0.144]).

2.9. Interpretive Mapping to the GreenComp Competence Framework

GreenComp was applied after the documentary and exploratory quantitative analyses as a conceptual lens. The mapping links the three exploratory institutional dimensions to selected GreenComp competence areas on the basis of documentary meaning; it does not measure individual sustainability competences, validate the dimensions against GreenComp, or imply that documented institutional conditions produce competence acquisition.

3. Results

The results are presented according to the evidentiary status of each analytical procedure. The longitudinal Friedman analysis characterizes variation in the relative configuration of the eight lexical indicators; PCA provides the principal exploratory dimensional analysis; the initial CB-SEM is reported as a diagnostic specification because its solution is inadmissible; CDA contextualizes institutional narratives; and GreenComp is applied subsequently as an interpretive framework.

This sequence avoids treating the nine period-level observations as a basis for confirmatory latent-variable validation and keeps documentary evidence distinct from direct measures of sustainability competence.

3.1. Evolution of Environmental Sustainability Discourse Across National and Institutional Policy Documents

The longitudinal analysis revealed variation in the configuration of the selected sustainability-related lexical indicators across the nine presidential periods. Because the periods differed substantially in the volume of retrieved occurrences, the results are interpreted as descriptive evidence of longitudinal lexical variation rather than as a direct measure of increasing or decreasing sustainability performance.

The retained lexical sample comprised 5528 occurrences from an initial lexical universe of 9505 occurrences. The period-level retained counts ranged from 61 occurrences in Gaviria to 1755 in Petro, with retention percentages ranging from 45.3% to 80.2%. These differences reflect both the documentary corpus and the restricted lexical protocol and should not be interpreted independently of corpus size.

The lexical indicators were subsequently compared across periods using the Friedman procedure. The analysis therefore focuses on the relative configuration of the eight predefined indicators rather than on an undifferentiated measure of sustainability discourse intensity.

The longitudinal results were interpreted together with the institutional documentary analysis rather than as evidence of policy effectiveness or environmental outcomes.

Non-Parametric Friedman Test

To examine longitudinal variation, a non-parametric Friedman test was conducted in InfoStat. The analytical structure consisted of nine presidential periods × eight lexical indicators in Table 2. The eight indicators were the related measures within the Friedman

procedure; the reported n = 8 therefore refers to the number of lexical indicators and not to documents or independent observations.

Table 2. Initial lexical universe and retained lexical sample by presidential period.

Presidential Period	Initial Lexical Universe	Retained Lexical Sample	Retention (%)
Gaviria	128	61	47.7
Samper	229	130	56.8
Pastrana	449	256	57
Uribe I	249	124	49.8
Uribe II	899	407	45.3
Santos I	1086	496	45.7
Santos II	1280	643	50.2
Duque	2996	1656	55.3
Petro	2189	1755	80.2
Total	9505	5528	58.2

Note: The initial lexical universe represents all retrieved lexical occurrences at the initial stage, whereas the retained lexical sample comprises occurrences corresponding to the eight predefined indicators. Retention percentages are descriptive coverage measures; they are not probabilistic sampling rates and do not represent sampling error.

The Friedman test reported statistically significant differences in the relative configuration of the eight lexical indicators across the nine presidential periods ($T^* = 19.68$, $p \leq 0.0001$). InfoStat also reported a minimum significant difference between rank sums of 8.100, which was used for the post hoc grouping.

The mean ranks: Uribe I = 2.69, Gaviria = 3.69, Samper = 3.88, Pastrana = 4.50, Santos I = 5.69, Petro = 5.94, Santos II = 6.06, Duque = 6.13, and Uribe II = 6.44. The InfoStat grouping letters were A for Uribe I; AB for Gaviria; ABC for Samper; ABCD for Pastrana; BCD for Santos I, Petro, Santos II, and Duque; and D for Uribe II.

The distribution indicates a non-linear longitudinal configuration rather than a continuous progression across presidential periods. The result therefore identifies temporal variation in the selected lexical configuration rather than a uniform increase in sustainability discourse.

Mean Friedman ranks are relative statistical positions generated by the procedure. They should not be interpreted as measures of environmental performance, policy effectiveness, public perception, or institutional compliance. The rank direction is not assigned an independent substantive meaning here in Figure 1.

3.2. Institutional Translation of Sustainability into Higher Education Quality Assurance

The undergraduate programme registration documents and institutional self-evaluation reports provided evidence of how sustainability-related orientations were represented within higher education quality-assurance documentation at the Universidad de la Amazonia.

Across the documentary material, sustainability appeared in programme objectives, institutional commitments, curricular descriptions, planning, research, community engagement, and continuous-improvement language. The evidence therefore indicates institutional presence and documentary translation, but it does not establish the effectiveness of implementation in practice.

The degree and form of documentary integration varied across programme-level sources. Sustainability was visible in strategic and normative statements, while the documentation also identified needs concerning mechanisms, participation, evidence, and continuous improvement.

CDA further showed that sustainability could function simultaneously as a normative value, a managerial category, and an organizational aspiration. The documentary record

therefore contains both evidence of institutionalization and evidence of areas requiring further development.

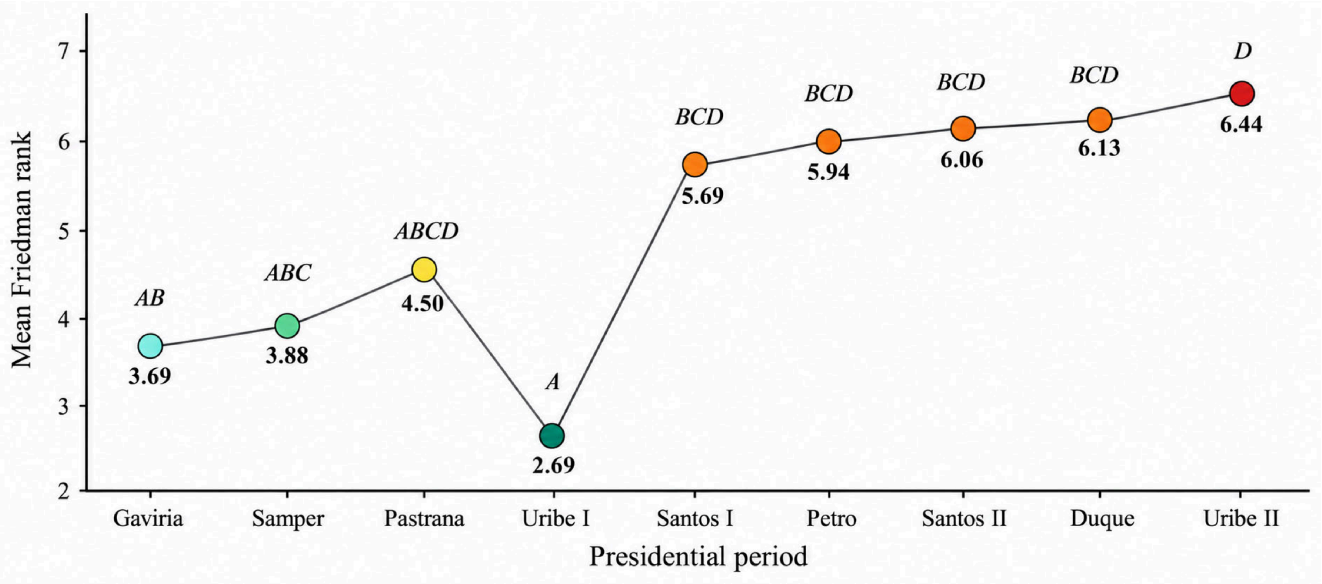


Figure 1. Evolution of institutional sustainability discourse across Colombian National Development Plans (1990–2026). Note: Mean Friedman ranks show the relative statistical positions of the eight lexical indicators across the nine presidential periods. They should not be interpreted as direct measures of environmental performance or policy effectiveness. Shared letters indicate statistically homogeneous groups reported by InfoStat. T* = 19.68, $p \leq 0.0001$; minimum significant difference between rank sums = 8.100.

Overall, the institutional documents support an interpretation of sustainability as an ongoing process of institutional translation within quality assurance rather than as a completed implementation outcome in Figure 2.

3.3. Exploratory Dimensional Structure of Sustainability Indicators

The exploratory PCA was conducted on the nine-observation analytical matrix using Principal Component extraction and Promax rotation with Kaiser normalization. The rotation converged after five iterations, and three components were retained.

The three-component extraction accounted for 72.795% of the total variance: 33.249% for Component 1, 20.174% for Component 2, and 19.371% for Component 3 in Table 3. Because the rotation was oblique, the cumulative percentage was taken from the extraction solution.

Table 3. Explained variance of the exploratory PCA solution.

Component	Eigenvalue	% Variance	Cumulative %
1	2.992	33.249	33.249
2	1.816	20.174	53.424
3	1.743	19.371	72.795

Note: Cumulative variance is based on the extraction solution. Because Promax rotation is oblique, rotated sums of squared loadings are not summed to obtain the cumulative percentage.

The pattern matrix showed strong loadings for the three discourse indicators on Component 1 (0.932, 0.920, 0.910), strong loadings for FAC2_Biología and FAC2_MVZ on Component 2 (0.979, 0.966), and opposite loadings for FAC3_Biología and FAC3_MVZ on Component 3 (−0.936, 0.934).

Communalities were high for most indicators but low for FAC1_Biología (0.128) and FAC1_MVZ (0.168). These low communalities limit the interpretation of those indicators and reinforce the exploratory status of the three-component solution in Table 4.

Table 4. Pattern coefficients and communalities from the exploratory PCA.

Indicator	Component 1	Component 2	Component 3	Communality
FAC1_Discurso	0.932	—	—	0.858
FAC2_Discurso	0.920	—	—	0.850
0FAC3_Discurso	0.910	—	—	0.827
FAC1_Biología	—	−0.284	0.202	0.128
FAC2_Biología	—	0.979	—	0.970
FAC3_Biología	—	—	−0.936	0.857
FAC1_MVZ	−0.267	−0.274	0.213	0.168
FAC2_MVZ	—	0.966	—	0.976
FAC3_MVZ	—	—	0.934	0.917

Cross-reference: Table 1 defines the FAC indicator construction rules. For the PCA, Component 3 is represented by FAC3_Biología and FAC3_MVZ; for the initial CB-SEM, F3 uses FAC1_Biología and FAC1_MVZ. These are distinct analytical specifications, and the SEM F3 is not treated as a re-estimation of PCA Component 3. Note: Values are pattern coefficients from the Promax-rotated PCA solution with Kaiser normalization. The component labels are interpretive and exploratory. Communalities indicate the proportion of each indicator's variance represented in the retained extraction.

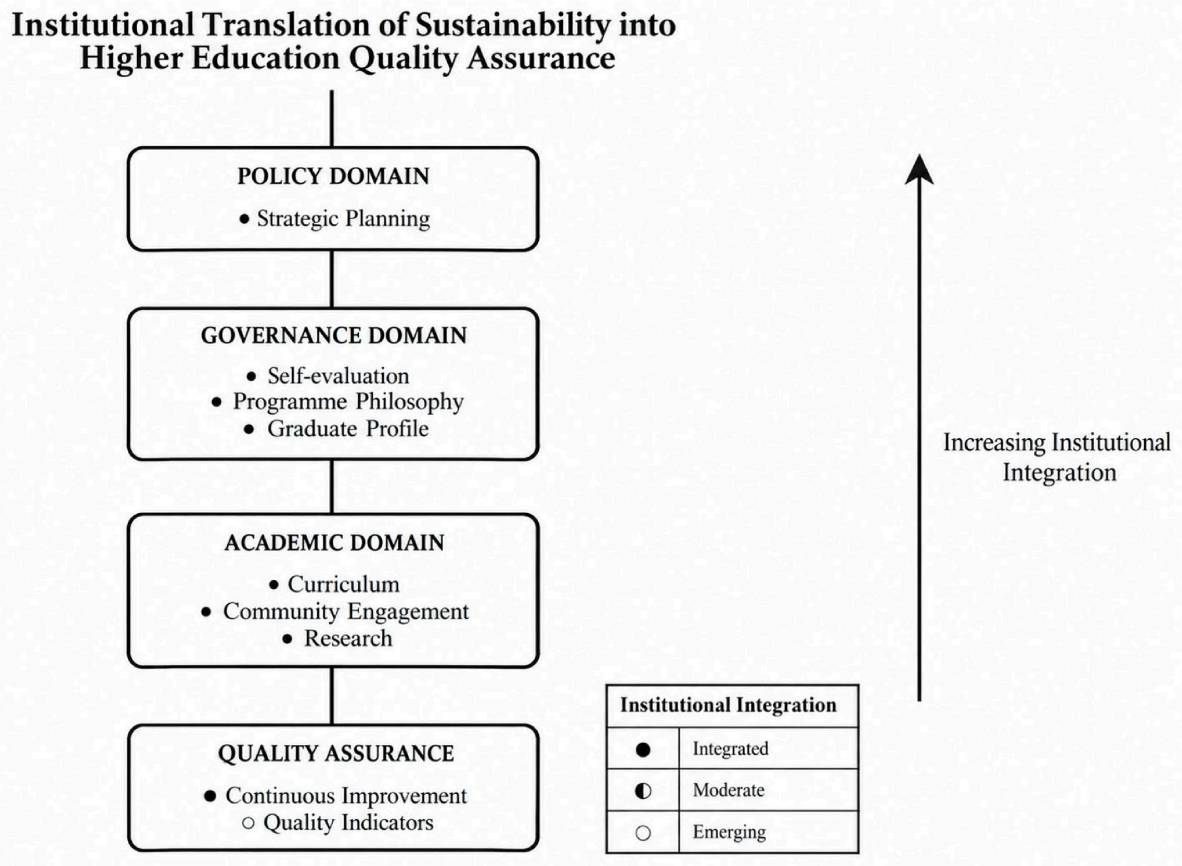


Figure 2. Conceptual framework for the institutional translation of sustainability into higher education quality assurance.

Component 1—Institutional Sustainability Orientation

Component 1 was characterized by high pattern coefficients for FAC1_Discurso, FAC2_Discurso, and FAC3_Discurso (0.932, 0.920, and 0.910). It was provisionally in-

terpreted as Institutional Sustainability Orientation because the component captures the common variation among the discourse-related indicators.

Component 2—Institutional Sustainability Capacity

Component 2 was characterized by high pattern coefficients for FAC2_Biología and FAC2_MVZ (0.979 and 0.966). It was provisionally interpreted as Institutional Sustainability Capacity because these indicators represent programme-level documentary conditions associated with institutional processes.

Component 3—Transformation Readiness

Component 3 was characterized by opposite pattern coefficients for FAC3_Biología (−0.936) and FAC3_MVZ (0.934). It was provisionally interpreted as Transformation Readiness, reflecting a differentiated pattern across the two programme-level indicators. The opposite signs are treated as part of the component orientation and not as evidence of a simple positive-versus-negative institutional effect.

The low communalities for FAC1_Biología (0.128) and FAC1_MVZ (0.168) indicate that these indicators are poorly represented by the retained component solution. Accordingly, the three components should be treated as exploratory documentary dimensions rather than validated latent constructs.

The transition from PCA to SEM is not a direct component-to-factor conversion. PCA Component 3 is defined by FAC3_Biología and FAC3_MVZ, whereas the diagnostic SEM factor F3 uses FAC1_Biología and FAC1_MVZ. The latter reflects the observed-indicator configuration retained in the AMOS model and is therefore reported as a separate diagnostic specification. No equivalence between PCA Component 3 and SEM F3 is claimed.

3.4. Initial Covariance-Based SEM Specification and Diagnostic Results

The initial CB-SEM was estimated to examine the empirical behaviour of the three exploratory dimensions. The model contained seven observed endogenous variables: FAC1_Discurso, FAC2_Discurso, FAC3_Discurso, FAC2_Biología, FAC2_MVZ, FAC1_Biología, and FAC1_MVZ. The first loading of each dimension was fixed at 1.00 for identification.

The model contained 25 free parameters and 28 covariance moments, resulting in three degrees of freedom. The relationships among the three dimensions were estimated as covariances rather than directional causal paths.

Given N = 9 and the model complexity, the SEM was retained only as an initial diagnostic specification. The estimated solution was assessed for parameter behaviour and admissibility; no confirmatory claim was based on the model.

SEM parameter estimates

The freely estimated loadings were not statistically significant: FAC2_Discurso on Sustainability Orientation = 0.424 (SE = 1.052, CR = 0.403, $p = 0.687$); FAC3_Discurso = 0.736 (SE = 1.523, CR = 0.483, $p = 0.629$); FAC2_MVZ on Sustainability Capacity = 1.395 (SE = 0.731, CR = 1.907, $p = 0.056$); and FAC1_MVZ on Transformation Readiness = 0.477 (SE = 1.339, CR = 0.356, $p = 0.722$) in Table 5.

None of the freely estimated loadings reached $\alpha = 0.05$. The fixed 1.00 loadings are identification constraints and were not significance tests.

The latent covariances were also non-significant: Sustainability Orientation–Sustainability Capacity = −0.243 (SE = 0.598, CR = −0.407, $p = 0.684$); Sustainability Orientation–Transformation Readiness = −0.293 (SE = 0.712, CR = −0.412, $p = 0.680$); and Sustainability Capacity–Transformation Readiness = −0.080 (SE = 0.273, CR = −0.294, $p = 0.769$) in Table 6.

These covariance estimates do not provide statistical evidence of association among the three dimensions. Because the solution was inadmissible, their signs should not be interpreted as substantive negative relationships.

Table 5. Maximum likelihood parameter estimates for the initial SEM specification.

Latent Construct	Observed Indicator	Estimate	S.E.	C.R.	*p*
Sustainability Orientation	FAC1_Discurso	1.000 †	—	—	—
	FAC2_Discurso	0.424	1.052	0.403	0.687
	FAC3_Discurso	0.736	1.523	0.483	0.629
Sustainability Capacity	FAC2_Biología	1.000 †	—	—	—
	FAC2_MVZ	1.395	0.731	1.907	0.056
Transformation Readiness	FAC1_Biología	1.000 †	—	—	—
	FAC1_MVZ	0.477	1.339	0.356	0.722

Note: † The first loading of each exploratory dimension was fixed at 1.00 for scale identification and was not tested for statistical significance. Estimates are unstandardized maximum-likelihood estimates.

Table 6. Covariances among the exploratory latent dimensions.

Latent Dimensions	Estimate	S.E.	C.R.	*p*
Sustainability Orientation ↔ Sustainability Capacity	−0.243	0.598	−0.407	0.684
Sustainability Orientation ↔ Transformation Readiness	−0.293	0.712	−0.412	0.680
Sustainability Capacity ↔ Transformation Readiness	−0.080	0.273	−0.294	0.769

Note: Covariances are unstandardized maximum-likelihood estimates. None was statistically significant at $\alpha = 0.05$.

The principal admissibility problem was a non-positive-definite covariance matrix. AMOS produced a negative latent variance for Transformation Readiness (−0.2934) and negative residual variances for e1 (−1.325), e3 (−0.308), and e5 (−0.2439). These are variance estimates, not negative relationships, and they render the estimated solution inadmissible in Table 7.

Table 7. Variance estimates and admissibility diagnostics for the initial SEM.

Parameter	Estimate	S.E.	C.R.	*p*	Diagnostic
Sustainability Orientation (F1)	2.214	9.730	0.228	0.820	Positive
Sustainability Capacity (F2)	0.772	0.621	1.244	0.214	Positive
Transformation Readiness (F3)	−0.284	1.147	−0.247	0.805	Negative variance
e1	−1.325	9.726	−0.136	0.892	Negative residual variance
e2	0.494	0.491	1.005	0.315	Positive
e3	−0.308	1.292	−0.238	0.812	Negative residual variance
e4	0.217	0.403	0.538	0.591	Positive
e5	−0.319	0.776	−0.412	0.681	Negative residual variance
e6	1.276	1.365	0.935	0.350	Positive
e7	1.245	0.699	1.782	0.075	Positive

Note: Negative variance estimates indicate an inadmissible estimation solution and are not interpreted as negative relationships.

The inadmissible variance estimates are important because they prevent the SEM from being interpreted as confirmatory evidence. The negative variance estimates should be understood as estimation diagnostics indicating that the specified model is not supported by the available nine-observation dataset.

The initial model nevertheless produced favourable numerical global fit indices: CMIN = 0.414, df = 3, $p = 0.937$; CMIN/df = 0.138; GFI = 0.985; AGFI = 0.862; NFI = 0.993; RFI = 0.952; IFI = 1.045; TLI = 1.457; CFI = 1.000; and RMSEA = 0.000 (90% CI [0.000, 0.144]) in Table 8. These values are reported for transparency but are not interpreted as evidence of model adequacy because the solution was inadmissible and was estimated from N = 9.

Table 8. Global fit statistics for the initial SEM specification.

Fit Index	Estimate
CMIN (χ^2)	0.414
df	3
p	0.937
CMIN/df	0.138
GFI	0.985
AGFI	0.862
NFI	0.993
RFI	0.952
IFI	1.045
TLI	1.457
CFI	1.000
RMSEA	0.000
RMSEA 90% CI	[0.000, 0.144]
PCLOSE	0.939
AIC	50.414

Note: Global fit statistics are reported for transparency only. They are not interpreted as evidence of model validity because the solution was inadmissible, the covariance matrix was not positive definite, N = 9, and the model had three degrees of freedom.

Global Fit Interpretation

The combination of a very small sample, 25 free parameters, three degrees of freedom, a non-positive-definite covariance matrix, and negative variance estimates substantially limits the inferential value of the SEM. The model is therefore retained as an initial diagnostic specification rather than a validated measurement or causal model in Figure 3.

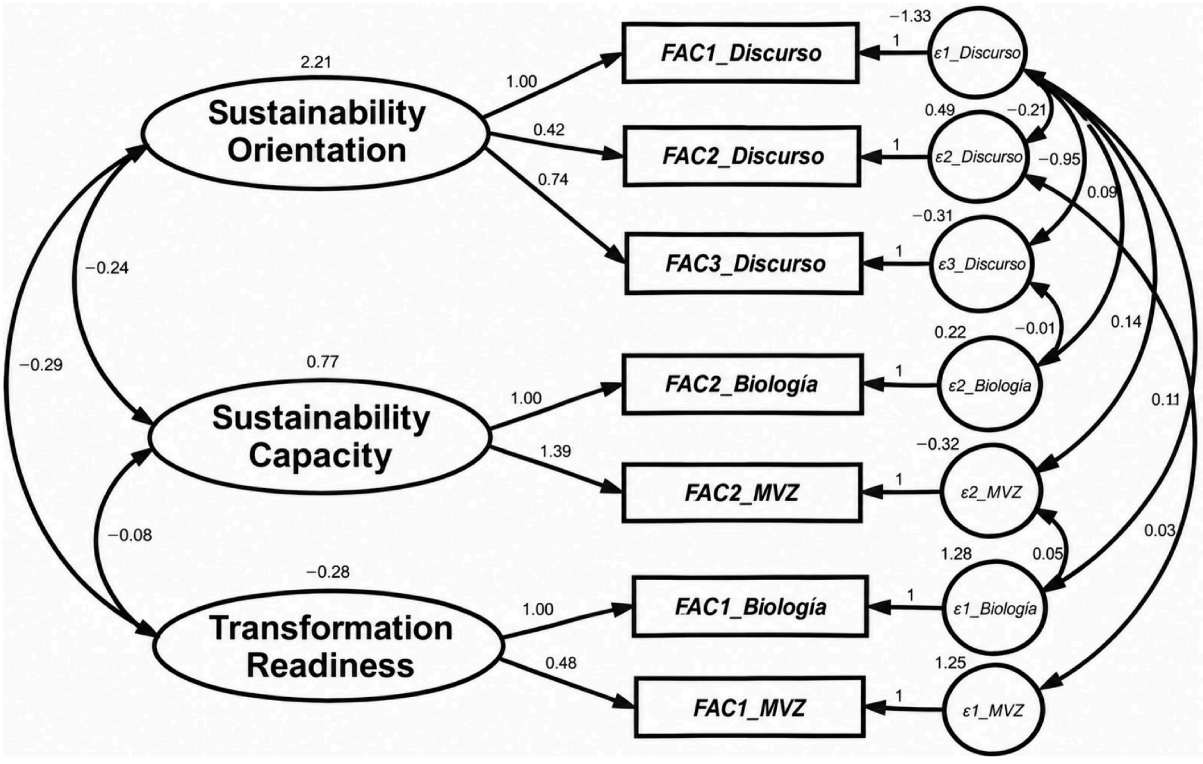


Figure 3. Initial covariance-based SEM specification and estimation diagnostics. Note: (1.00) Fixed loading for scale identification. Negative values shown for variance are estimation diagnostics, no negative relations. The solution was inadmissible (N = 9; non-positive-definite covariance matrix). The model represents the initial covariance-based SEM specification estimated using maximum likelihood. The three dimensions are Institutional Sustainability Orientation, Institutional Sustainability Capacity, and Transformation Readiness. The solution was inadmissible because the estimated covariance matrix was not positive definite and included negative variance estimates. The figure is therefore presented for transparency and diagnostic purposes, not as confirmatory evidence.

Taken together, the SEM results do not support confirmatory validation of the three-dimensional structure. The PCA, not the SEM, provides the exploratory dimensional basis for the subsequent interpretation. The SEM is retained to make the estimation behaviour and its limitations transparent.

3.5. Interpretive Correspondences Between Institutional Dimensions and GreenComp

Following the documentary analysis and exploratory quantitative analyses, the three institutional dimensions were interpreted in relation to the European GreenComp framework. GreenComp was used as a conceptual lens for examining how documentary evidence concerning institutional orientation, capacity, and transformation readiness can be discussed in relation to sustainability competence areas. This mapping is interpretive and does not measure competences.

Institutional Sustainability Orientation was interpreted in relation to Embodying Sustainability Values; Institutional Sustainability Capacity was interpreted in relation to Acting for Sustainability; and Transformation Readiness was interpreted in relation to Embracing Complexity in Sustainability in Table 9. The correspondence is based on documentary meaning and is not a psychometric alignment or validation exercise.

Table 9. Summarizes the interpretive correspondence between the three exploratory institutional dimensions, their principal documentary evidence, and the GreenComp areas considered in the analysis.

Institutional Dimension	GreenComp Area Interpreted in Relation to the Evidence	Institutional Evidence	Interpretation
Institutional Sustainability Orientation	Embodying Sustainability Values	Strategic vision; conceptual understanding; institutional sustainability commitments	Sustainability is incorporated as an institutional value and strategic orientation.
Institutional Sustainability Capacity	Acting for Sustainability	Operational integration; professional development; collaborative engagement	Institutional mechanisms provide documented conditions through which sustainability commitments may be translated into organizational practices.
Transformation Readiness	Embracing Complexity in Sustainability	Curriculum enhancement; strategic planning; institutional adaptation	Institutional structures provide documented conditions associated with responses to uncertainty, complexity, interconnectedness, and long-term organizational change.
—	Envisioning Sustainable Futures	No sufficiently explicit documentary evidence was separately mapped to this area in the original analysis.	The area was not separately represented in the empirical mapping; this should not be interpreted as evidence of its absence within the institution.

Note: The mapping is interpretive and documentary. It does not measure or validate GreenComp competences.

The fourth GreenComp area, Envisioning Sustainable Futures, was not separately represented in the original empirical mapping. This reflects the scope and coding of the documentary evidence rather than evidence that the area is absent from the institution. No additional correspondence was assigned without sufficient documentary support.

Importantly, this mapping does not constitute a direct measurement or validation of GreenComp competences. No GreenComp instrument was administered, and no data were collected from students, faculty, graduates, or other members of the university community to assess competence development. The mapping provides a conceptual bridge between documentary institutional conditions and the GreenComp framework.

GreenComp therefore functions in this study as an interpretive framework for organizing documentary evidence relevant to sustainability-oriented institutional conditions. The proposed correspondence should be understood as conceptual rather than psychometric or confirmatory.

3.6. Critical Discourse Analysis: Institutional Narratives and Organizational Tensions

Critical Discourse Analysis (CDA)

CDA was conducted at the level of meaning-bearing textual segments within the institutional self-evaluation documents. The analysis focused on passages in which sustainability was related to institutional commitments, agency, quality assurance, managerial practices, participation, implementation, or institutional change. Coding combined deductive sensitizing concepts derived from the study objectives with inductive identification of recurring discursive patterns. The analysis was interpretive and documentary and was not intended to infer actor intentions or causal relationships.

The analysis identified four recurring discursive patterns: normative institutionalization of sustainability, agent representation, managerial relexicalization, and institutional improvement needs in Table 10. These patterns were compared across the Biology and MVZ self-evaluation reports and were interpreted as documentary evidence rather than as direct measures of institutional behaviour.

Table 10. Discursive patterns identified in institutional self-evaluation documents.

Discursive Pattern	Documentary Evidence	Interpretive Meaning
Normative institutionalization of sustainability	"...contribuyendo a la sostenibilidad ambiental y la conservación de los recursos naturales..." (Biology, 2019)	Sustainability is embedded in institutional missions and programmatic commitments, establishing normative legitimacy within the academic discourse.
Agent representation	"Se pretende [...] crear sentido de pertenencia desde su ingreso." [36]	The impersonal construction reduces the explicit attribution of institutional agency in the representation of organizational action.
Managerial relexicalization	"...con criterios de calidad, competitividad, sostenibilidad y excelencia..." [37]	Sustainability is incorporated into a managerial vocabulary associated with quality, competitiveness, and organizational performance.
Institutional improvement needs	"Es necesario establecer mecanismos participativos permanentes y vinculantes..." [36]	Institutional commitments coexist with documented requirements for mechanisms, evidence, participation, and strengthening, indicating areas in which institutional translation remains to be consolidated.

Note: The table presents illustrative excerpts from the institutional self-evaluation documents. The excerpts are documentary evidence of recurring linguistic and organizational patterns and do not represent direct measures of institutional behaviour or sustainability competence.

First, normative institutionalization was evident in the incorporation of sustainability into programme and institutional commitments. The Biology documentation refers to "sostenibilidad ambiental y la conservación de los recursos naturales," illustrating how sustainability is represented as a normative institutional concern.

Second, agent representation appeared through impersonal constructions such as "Se pretende [...] crear sentido de pertenencia desde su ingreso." The formulation does not explicitly identify an actor responsible for the action. The finding is interpreted as a pattern of linguistic agency representation, not as evidence of deliberate concealment.

Third, managerial relexicalization appeared where sustainability was incorporated into vocabularies of quality, competitiveness, excellence, and organizational improvement. The Biology documentation places sustainability alongside "calidad, competitividad, sostenibilidad y excelencia," illustrating the incorporation of environmental concerns into a broader quality-assurance vocabulary.

Fourth, institutional improvement needs were documented where formal sustainability commitments coexisted with statements calling for stronger mechanisms and participation. The MVZ report, for example, calls for "establecer mecanismos participativos permanentes y vinculantes." This coexistence indicates areas in which institutional translation remains to be consolidated.

Taken together, the CDA findings indicate that sustainability operates within institutional quality-assurance discourse as a normative commitment, a managerial category, and an organizational aspiration whose translation remains under development. The qualitative categories contextualize the exploratory dimensions without implying one-to-one correspondence between CDA codes and PCA components.

The qualitative findings therefore provide contextual evidence for the exploratory dimensions but do not independently validate them. Normative institutionalization is relevant to Institutional Sustainability Orientation; managerial relexicalization provides context for Institutional Sustainability Capacity; and agent representation and improvement needs contextualize Transformation Readiness.

The integrated interpretation indicates that institutional sustainability is not adequately characterized as a linear transition from discourse to practice. Instead, the documentary evidence points to interactions among discursive legitimacy, institutional capacity, and readiness for organizational change, which are subsequently interpreted through GreenComp.

3.7. Integrated Results

Taken together, the analyses identify three exploratory institutional dimensions—Institutional Sustainability Orientation, Institutional Sustainability Capacity, and Transformation Readiness. The longitudinal analysis demonstrates variation in the selected lexical configuration across presidential periods; the PCA provides the principal exploratory dimensional structure; the initial SEM reveals substantial estimation limitations and is not used for validation; and CDA contextualizes how sustainability is represented in institutional self-evaluation documents. GreenComp is then used as an interpretive framework to organize these documentary dimensions in relation to selected competence areas. The resulting framework is preliminary and documentary: it identifies conditions and representations that can be examined within quality assurance, but it does not measure individual competences or demonstrate implementation effectiveness.

4. Discussion

4.1. Longitudinal Sustainability Discourse and Institutional Context

The Friedman analysis shows statistically detectable differences in the relative configuration of the eight selected lexical indicators across the nine presidential periods. The result should be read as longitudinal lexical variation rather than as a measure of policy quality or environmental performance. The institutional documents provide a second level of interpretation: sustainability appears within programme objectives, quality-assurance language, planning, and self-evaluation, while the same documents identify needs concerning mechanisms, participation, and evidence. Together, these findings support an interpretation of sustainability as an evolving institutional discourse whose translation is unevenly documented across organizational processes.

4.2. Exploratory Institutional Dimensions

The PCA provides the main exploratory dimensional structure of the study. Institutional Sustainability Orientation is defined by the strong common pattern among the three discourse indicators; Institutional Sustainability Capacity is characterized by the strong association of the second Biology and MVZ indicators; and Transformation Readiness is

characterized by the contrasting pattern of FAC3_Biología and FAC3_MVZ. The subsequent SEM used a separate observed-indicator configuration (FAC1_Biología and FAC1_MVZ) for its diagnostic F3 specification and should not be read as a direct replication of PCA Component 3. The explained variance should not be interpreted as evidence of a validated measurement structure, particularly because Biology Factor 1 and MVZ Factor 1 have low communalities and the subsequent SEM was inadmissible.

4.3. Institutional Translation and Discursive Tensions

The CDA findings help explain how sustainability is translated within institutional quality-assurance discourse. Sustainability is represented as a normative commitment, incorporated into managerial vocabularies of quality and excellence, and accompanied by statements identifying needs for participation and institutional strengthening. The pattern of agent representation further shows that institutional action is sometimes expressed without explicit identification of responsible actors. These findings indicate that documentary institutionalization and operational specification can coexist without implying that implementation is complete.

4.4. GreenComp as an Interpretive Framework

The GreenComp mapping connects documentary institutional conditions with three competence areas: Embodying Sustainability Values, Acting for Sustainability, and Embracing Complexity in Sustainability. This correspondence is conceptual. The analysis does not establish that the institutional dimensions are equivalent to GreenComp competences, nor that their documentary presence produces competence development. The fourth GreenComp area, Envisioning Sustainable Futures, was not separately represented in the original empirical mapping and remains an area for future documentary coding.

4.5. Implications for Higher Education Quality Assurance

The findings suggest that quality assurance can provide a useful documentary interface for organizing evidence of sustainability-oriented institutional conditions. The proposed framework distinguishes institutional orientation, capacity, and readiness for transformation so that quality processes can examine not only whether sustainability is mentioned, but also whether documents identify mechanisms, resources, participation, improvement processes, and evidence of implementation. Because the present study does not measure effectiveness, the framework should be used as a documentary structure for evidence organization rather than as a performance score.

4.6. Limitations and Future Research

The study has several limitations. First, the longitudinal statistical structure contains only nine presidential-period observations, which restricts inferential power and precludes treating the CB-SEM as confirmatory. Second, the lexical analysis is based on eight predefined forms; common alternatives such as sostenibilidad and sostenible were not included in the retained indicator set. Third, absolute lexical counts are sensitive to differences in documentary volume across periods. Fourth, the institutional analysis is based on documentary evidence from undergraduate programme registration and self-evaluation materials at one university and therefore cannot be generalized to Colombian higher education as a whole. Finally, GreenComp was used interpretively rather than as a competence assessment instrument. Future research should triangulate documentary findings with interviews, surveys, observations, and educational outcomes and should test the preliminary framework across institutions and programmes.

5. Conclusions

This study examined how environmental sustainability is represented and institutionally translated within higher education quality-assurance documentation at the Universidad de la Amazonia. The documentary corpus comprised 61 documents, while the longitudinal statistical structure comprised nine presidential-period observations and eight predefined lexical indicators. This distinction is central to the interpretation of the quantitative evidence.

The Friedman analysis identified statistically significant differences in the relative configuration of the eight lexical indicators across presidential periods ($T^* = 19.68$, $p \leq 0.0001$). The result demonstrates longitudinal variation in the selected lexical configuration, not a direct measure of environmental performance, policy effectiveness, or institutional sustainability achievement.

Within the limited nine-observation analytical matrix, the PCA suggested three provisional patterns of documentary indicators—Institutional Sustainability Orientation, Institutional Sustainability Capacity, and Transformation Readiness—accounting for 72.795% of the extracted variance. The solution is exploratory, and low communalities for Biology Factor 1 and MVZ Factor 1 require cautious interpretation.

The initial CB-SEM did not provide confirmatory evidence. Although several global fit statistics were numerically favourable, the estimated solution was inadmissible because the covariance matrix was not positive definite and included negative variance estimates. None of the freely estimated loadings or latent covariances was statistically significant. The SEM is therefore retained only as a transparent diagnostic specification.

CDA showed that sustainability operates in institutional quality-assurance discourse as a normative commitment, a managerial category, and an organizational aspiration. Agent representation and documented improvement needs indicate that formal sustainability commitments can coexist with incomplete specification of mechanisms, participation, and responsibility.

The GreenComp mapping provides an interpretive bridge between these documentary institutional dimensions and selected sustainability competence areas. It does not measure individual competences or demonstrate competence development. The resulting quality-assurance framework should therefore be understood as a preliminary documentary framework for organizing evidence of sustainability-oriented institutional conditions, to be tested and refined through broader comparative and empirical research.

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Abbreviations

The following abbreviations are used in this manuscript:

Abbreviation	Definition
CDA	Critical Discourse Analysis
QA	Quality Assurance
SEM	Structural Equation Modelling
SDGs	Sustainable Development Goals
ESD	Education for Sustainable Development
MVZ	Veterinary Medicine and Animal Science
HEIs	Higher Education Institutions
RMSEA	Root Mean Square Error of Approximation
CFI	Comparative Fit Index
TLI	Tucker–Lewis Index

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