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Gender Equity, Internationalization, and the Quintuple Helix: Comparative NLP Analysis of University Strategies in Japan and Türkiye

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ABSTRACT: *As higher education institutions (HEIs) seek to align with Sustainable Development Goals (SDGs), integrating diversity, equity, and inclusion (DEI) into internationalization strategies has become increasingly central. In this study, we analyze 209 university strategic plans, 86 from Japan (2022–2027) and 123 from Türkiye (2019–2023), to examine how institutional discourse frames gender equity, with a particular focus on SDG 5, gender equality. We identify clear and distinct national patterns using natural language processing (NLP) techniques (e.g., keyword frequency analysis, named entity recognition, and syntactic parsing) and are guided by the quintuple helix model (QHM). Japanese universities tend to emphasize societal engagement and forward-looking commitments through abstract language. In contrast, Turkish universities adopt a more bureaucratic and retrospective tone, often referring explicitly to named target groups. We find that both countries show limited engagement with intersectional identities and marginalized populations such as female faculty, migrants, and refugees, and both underutilize the civil society and environmental dimensions of the QHM. Although inclusive values frequently appear, strategic plans rarely include clear details on how to reach these goals.*

Based on our analysis, we propose a scalable, reproducible framework for evaluating inclusive internationalization. Our findings underscore the importance of moving beyond symbolic discourse and calling for more accountable, stakeholder-driven planning processes that embed DEI into the structural, curricular, and governance systems of HEIs.

Keywords: comparative higher education, diversity, equity, and inclusion, higher education institutions, inclusive internationalization, natural language processing, SDG 5, Quintuple Helix Model

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INTRODUCTION

Universities increasingly seek global relevance through transnational collaborations, international students, and global research activities. The internationalization of higher education (IoHE) is shaped by a combination of national and international forces. At the national level, universities navigate domestic policy reforms, political priorities, and labor market needs. On the global level, they face pressure from international competition, the expansion of knowledge-based economies, and the drive for worldwide recognition and visibility (Knight, 2004; Altbach & Knight, 2007; de Wit, 2024). These pressures have pushed universities to adapt, with internationalization increasingly understood as a holistic, institution-wide commitment and responsibility.

As global actors, higher education leaders play a strategic role in shaping institutional strategies that navigate both national priorities and global aspirations, balancing performance metrics with inclusive educational outcomes. Recognizing these demands, global frameworks such as UNESCO's Education 2030 Agenda and the Sustainable Development Goals (SDGs) now frame higher education as a transformative force for inclusive, equitable, and sustainable societies. In this evolving context, universities are expected to build education systems that reflect these principles and expand access for diverse learners (Beelen & Jones, 2020; UNESCO, 2015).

In this context, SDG 5 (Gender Equality) provides a critical lens for evaluating how institutional strategies address gender equity. Together, SDG 4 (Quality Education), SDG 5 (Gender Equality), and SDG 16 (Peace, Justice and Strong Institutions) highlight the importance of strong and inclusive institutions in expanding access to education, promoting lifelong learning, and ensuring equitable opportunities across gender and social groups.

To meet the goals set by UNESCO and national governments, institutions are implementing gender equity initiatives and redesign programs to meet the needs of diverse social groups, thereby enabling all students to access high-quality education and develop intercultural competence. Therefore, this study focuses on SDG 5, investigating how universities in Japan and Türkiye incorporate gender equity into their institutional strategies and policy frameworks.

Internationalization of higher education: A call for more inclusive practices

Historically, internationalization in higher education centered on student and staff mobility, institutional partnerships, and global branding (Knight, 2004). Over time, this mobility-centric model has been criticized for its exclusivity and limited reach (de Wit, 2024) and has fuelled a growing emphasis on “internationalization at home,” which seeks to make global learning accessible to all students (Robson & Wihlborg, 2019; Beelen & Jones, 2020). Beelen and Jones (2015) advocate for “internationalization at home” not only as a strategy to expand access but also to embed global perspectives across curricula and to align internationalization with institutional commitments to diversity, equity, and inclusion (DEI) and the SDGs. This aligns with a broader understanding of diversity and equity as integral — not optional — to the mission of international education. To effectively embed global perspectives and DEI within curricula, specific pedagogical approaches are crucial. For instance, Bi (2025) emphasizes the role of culturally responsive pedagogy in fostering inclusive learning environments for international students.

DEI encompasses three interrelated yet distinct principles that are often used interchangeably. Understanding their differences is essential for analyzing how DEIs intersect with internationalization strategies. While DEI has long been part of the institutions' missions, its explicit integration into the internationalization agenda, particularly concerning SDG 5, is a relatively recent development (Bustamante-Mora et al., 2024).

In the context of higher education, diversity refers to the presence of differences within a given institutional setting. This includes variations in race, ethnicity, gender, sexual orientation, socioeconomic status, nationality, disability, and language, as well as variations in thought, experience, and worldview (Abrams, 2022). While diversity is often measured through demographic composition, its significance lies in how institutions intentionally acknowledge, value, and engage with those differences.

DEI encompasses three principles: diversity (representation), equity (removing barriers) (Fox Tree & Vaid, 2022; Ferrero, 2023), and inclusion (belonging) (Abrams, 2022). While many studies look at how international students feel or behave, our study focuses specifically on institutional discourse. We analyze strategic plans because these documents show the formal priorities of a university. For our analysis, we look for “inclusive internationalization” by identifying specific keywords in the plans. These include explicit reference to SDG 5 (Gender Equality), the naming of gender or equity-relevant social groups, and language that attributes responsibility or commitment to the institution.

The Implementation of DEI into the Internationalization of Higher Education

Although DEI has long appeared in institutional mission statements, its integration into internationalization efforts—particularly through SDG 5—remains uneven (Bustamante-Mora, et al., 2024). Women and other underrepresented groups continue to face systemic barriers such as discrimination, exclusion, and a lack of institutional support (Alzukari & Wei, 2024; Clarke, 2023). Similarly, Bustamante-Mora et al. (2024) stress that deeply embedded gendered assumptions should be critically examined through targeted DEI policies and pedagogical reform.

As women increasingly assume leadership roles in academia, their experiences reveal both expanded opportunities and enduring systematic constraints. Research indicates that women—particularly those from marginalized and underrepresented backgrounds—continue to experience isolation and limited advancement in global academic settings (Ballarino & Panichella, 2018; Fox Tree & Vaid, 2022). Without this support, there is a potential risk that DEI discourse remains superficial. This symbolic approach may fail to address the real inequities that international students encounter, suggesting a need for future research to examine how these texts impact actual student experiences.

Therefore, institutions have an ethical responsibility to embed DEI within strategic frameworks, not only as a compliance requirement but also as a foundation for academic environments in which all individuals can thrive. The ACE Framing Guide (ACE, 2021) emphasizes the importance of coordinating DEI and internationalization offices to ensure that equity, access, intercultural competence, and inclusive governance are structurally embedded across institutional systems. While institutional discourse increasingly references intercultural competence, gender justice, and inclusive learning environments, the translation of these values into practice remains inconsistent. As Ferrero (2023) notes, the lack of gender-sensitive policy implementation continues to hinder genuine systematic change. Similarly, Castaneda (2022) voices equity concerns, noting that “the narrative is that higher education and particularly international education provide people opportunities to improve their position in a stratified society. The reality is that the international education system itself is stratified and is often reserved only for exclusive groups; those who can afford it and possess the needed cultural capital” (p. 175). These inequities intersect with nationality, class, and linguistic background, underscoring the need for systemic rather than symbolic approaches to inclusion.

To strengthen this translation from rhetoric to practice, Correa et al. (2025) and Misra and Bhat (2025) emphasize that DEI must become an integral dimension of educator preparation, highlighting inclusive pedagogy and systemic awareness as prerequisites for internationalization. In other words, DEI needs to be understood as an institutional responsibility rather than an individual one. This shift requires universities to embed equity and belonging into their structures

rather than relying on students' personal resilience or networks to fill systemic gaps.

The national contexts of Japan and Türkiye illustrate these challenges in distinct ways. In Japan, recent empirical research has indicated that international students' university entrance decisions are shaped by institutional transparency, financial accessibility, and cultural expectations. Using exploratory factor analysis and structural equation modeling, Wu and Ishii (2025) demonstrate how students navigate limited information and competing priorities when evaluating study opportunities. These findings underscore the importance of transparent communication, equitable recruitment practices, and culturally responsive support as core components of inclusive internationalization.

Against this backdrop, we examine the national cases of Japan and Türkiye—two countries whose institutional structures and sociocultural norms shape the ways in which DEI and internationalization intersect. In both contexts, university strategic plans function not only as symbolic statements but also as instruments of governance. In Japan, strategic plans are directly linked to government funding allocations. In Türkiye, the Council of Higher Education (YÖK) and the Higher Education Quality Council of Türkiye (YÖKAK) use these documents to assess institutional performance. Because strategic plans influence funding decisions and formal evaluations, the language in which they employ signals concrete institutional priorities and intended actions. To systematically analyze how these dynamics manifest across contexts, this study adopts the quintuple helix model, which conceptualizes the interactions among academia, government, industry, civil society, and the natural environment. This framework captures how universities in Japan and Türkiye position DEIs within their institutional strategies in relation to these broader institutional and sociocultural dynamics.

The Quintuple Helix Model

In recent years, the increasing complexity of internationalization in higher education has prompted the development of new models that more accurately reflect the evolving role of institutions in society. One such model is the Quintuple Helix Model, which builds open earlier frameworks—such as the Triple Helix (academia, government, industry) and the Quadruple Helix (which adds civil society)—by introducing a fifth component: the natural environment (Carayannis, et al., 2021). In the context of internationalization and DEI, this model provides a powerful lens through which to examine how universities both influence and are influenced by these five sectors:

Academia: HEIs produce and disseminate knowledge through global curricula, international research collaborations, and mobility programs. They play a central role in developing students' global competencies while also responding to external demands and constraints such as accreditation requirements or international ranking pressures.

Government: State agencies such as Japan's Ministry of Education, Culture, Sports, Science and Technology (MEXT) and Türkiye's Council of Higher Education (YÖK) define policy priorities, allocate funding, and establish

accountability mechanisms. These can either support or hinder DEI through visa regulations, scholarship schemes, or program accreditation, which can expand or limit equitable access to international education.

Industry: Employers increasingly seek graduates with international experience, intercultural skills, and global literacy. While this demand incentivizes internationalization, it may also perpetuate performance-based models that marginalize equity concerns.

Civil Society: NGOs, advocacy organizations, and local communities foster accountability and promote inclusive practices. They support initiatives such as community-based learning, intercultural dialog, and anti-discrimination campaigns while challenging institutions to go beyond symbolic gestures.

Natural Environment: Climate change, environmental justice, and sustainability concerns now directly influence education policy. Universities are increasingly encouraged to consider the environmental impact of international activities, especially travel. They must also recognize how ecological vulnerabilities intersect with social inequalities.

By incorporating all five dimensions, the quintuple helix model promotes a holistic and systematic understanding of how universities craft and implement internationalization in their strategies. It highlights the importance of embedding DEI across all institutional layers—from governance and curriculum to operations and partnerships—to cultivate learning environments designed to address existing inequalities and prepare students to navigate a globalized, multicultural world. This integration is particularly urgent in an era of increased mobility, rapid technological change, and growing social polarization. Without intentional DEI efforts, internationalization risks becoming exclusionary, primarily benefiting those already positioned to succeed.

To apply this model to our data, we use a dictionary-based approach by mapping specific keywords to each helix. This method is appropriate for large-scale analysis because it allows for a consistent and objective comparison of how often different sectors are mentioned in strategic plans. However, we acknowledge that this approach has limitations, such as polysemy, where a word may have multiple meanings. For example, 'environment' might refer to the 'campus environment' rather than 'ecological sustainability.' To ensure transparency, the full list of keywords used for each helix is available from the corresponding author upon reasonable request.

RESEARCH PURPOSE AND QUESTIONS

Despite universities' growing efforts to integrate DEI into their daily operations, systemic barriers persist—particularly for international scholars, women, and marginalized groups. Universities have been called to adopt not only DEI policies but also to cultivate institutional cultures that value diversity and foster inclusive academic environments. These changes are necessary for higher education to contribute meaningfully to a global framework grounded in inclusion, equity, and sustainability (Ghosh & Barber, 2021; Fox Tree & Vaid, 2022). While DEI can drive more meaningful forms of internationalization, it also challenges

conventional assumptions about what internationalization entails and how it should be practiced. Through the involvement of various stakeholders, this study explores how Japan and Türkiye align their internationalization strategies with DEI values.

The study addresses the following questions:

1. How do Japanese and Turkish HEIs integrate DEIs into their strategies?
2. What thematic and linguistic patterns exist in institutional strategies regarding DEI and gender equity?
3. How are different stakeholder domains represented in these strategies through the lens of the quintuple helix model?

METHOD

Research Design

We conducted a comparative NLP approach across Japanese and Turkish corpora of publicly available university strategic plans to investigate how higher education institutions (HEIs) in Japan and Türkiye incorporate gender-related discourse and broader DEI themes, particularly with internationalization, into their strategic planning. Using NLP for this cross-national comparison extends earlier internationalization studies beyond manual document analysis by enabling scalable and reproducible mapping of institutional discourse.

These strategic plans were treated as expressions of institutional missions, reflecting how the governance level's internationalization, DEI, and gender-related priorities are articulated. Examining DEI as integral to internationalization reframes how global engagement agendas can serve as a mechanism for advancing equity, social responsibility, and institutional accountability. This connection highlights that internationalization is not only about expanding global presence but also about embedding inclusive values to transform how institutions define and enact their missions. We therefore assess whether inclusion principles appear merely as rhetorical markers or as elements that reframe institutional missions and responsibilities.

These documents, as the formal goals of these universities, provide a rich dataset for analyzing discursive patterns at scale. Our methodological approach was guided by aiming to detect both explicit and implicit signals of equity, inclusion, and institutional positioning through textual analysis. While computational in technique, the study follows an interpretive and critical orientation. Therefore, the study uses quantitative text analysis as a lens to examine how institutional discourse is constructed and how it reproduces meaning around equity and internationalization.

Data Source and Selection Criteria

Although some institutions may publish standalone internationalization strategies, such documents are not always publicly available or inconsistently structured across institutions. Therefore, this study focuses on general

institutional strategic plans as the primary data source. These documents outline core institutional priorities and offer insight into how DEI and gender equity are framed in relation to internationalization. By examining these plans, we aim to understand how inclusive values are embedded at the strategic level, even when a standalone policy does not address internationalization. Strategic plans were collected from publicly available sources, including MEXT and YÖK.

With respect to Japan, the corpus consists of the full set of national universities listed by the MEXT; private institutions do not appear in the MEXT's centralized repository. For Türkiye, we used all public universities whose strategic plans are archived through YÖK. Foundation universities are not included because their plans are not stored in a comparable national repository. In both cases, the datasets reflect the institutions for which complete and systematic accessible strategic plans are publicly available.

Data collection and translation protocol

We analyzed 209 documents, 86 from Japanese national universities and 123 from Turkish public universities, retrieved using Python code from institutional and governmental websites. Japanese plans corresponded to the Fourth Mid-Term Goals cycle (2022–2027), while Turkish plans corresponded to the Eleventh Development Plan period (2019–2023), with some extending to 2027. While these different time periods may influence the language used (such as verb tenses), we believe that the differences also reflect the distinct governance cultures in each country. Japan's plans are future-oriented national goals, whereas Turkish plans are more detailed institutional reports. To account for this, our analysis focuses on high-level thematic keywords that remain consistent across different planning cycles.

All the documents were translated into English using the Google Translate API to enable consistent English-language text mining across corpora. Both the API and the R text-mining packages process text in UTF-8 encoding by default, ensuring compatibility across Latin and non-Latin scripts for subsequent analysis. All word counts and tokenization were performed after translation to maintain consistency across corpora. To ensure translation accuracy and data consistency, both Japanese and Turkish documents were selectively reviewed by native-speaking coauthors, and the preprocessing rules were refined on the basis of their feedback before the full analysis was conducted.

Although machine translation may introduce semantic distortions, this step was necessary to ensure consistent analysis across both language corpora. The translation process followed a standardized protocol to maintain uniformity in parsing and preprocessing the data. The data, translation, and scrape codes are available upon reasonable request. While automated translation and tokenization ensured consistency across corpora, we acknowledge that such tools can reproduce linguistic hierarchies and subtle semantic distortions, which we interpret with caution when analyzing discourse on equity and inclusion. To verify the quality of the automated translations, native-speaking coauthors reviewed a random sample of 10% of the documents from both countries. They looked for

common translation errors in technical terms related to higher education. This check confirmed that the main themes and keywords used in the NLP analysis were accurate.

Corpus Overview and Descriptive Statistics

Table 1 presents the breakdown of the corpus by country, showing document counts and general characteristics. This overview provides a baseline for understanding the scope and representativeness of the strategic plans included in the analysis.

Table 1: Descriptive Overview of the Corpus by Country

| <i>Country</i> | <i>Number of Documents</i> | <i>Total Words</i> | <i>Average Words per Document</i> |
|----------------|----------------------------|--------------------|-----------------------------------|
| Japan | 86 | 866,733 | 10,078 |
| Türkiye | 125 | 2,844,439 | 22,756 |

It is important to note that Japanese strategic plans are typically “mid-term plans” created in response to national objectives set by MEXT. The MEXT Evaluation Committee evaluates these six-year plans and tends to emphasize future-oriented goals, often avoiding highly specific or retrospective content. In contrast, Turkish university strategies are developed with greater institutional autonomy and frequently reflect the presidential vision, incorporating more detailed goals and measurable outcomes.

Preprocessing and analytical tools

Text preprocessing and analysis were conducted in R (R Core Team, 2024) using the tidytext package (Silge & Robinson, 2017) for tokenization, dplyr (Wickham et al., 2023) for data transformation, and ggplot2 (Wickham, 2023) for visualization. Named entity recognition and syntactic parsing were performed using spaCy (Honnibal et al., 2020) via the spacyr and Python interface. The output tables were formatted using gt (Pedersen, 2023). Documents were tokenized, and common English stop words such as “the,” “in,” and “of” were removed to isolate semantically meaningful content. Tokens were segmented by whitespace and punctuation, and single-character and numeric tokens were excluded from the analysis.

Following preprocessing, several complementary NLP techniques were applied to capture different dimensions of strategic discourse, each aligned with the study’s research questions. All non-English strategic plans were translated using the Google Translate API and verified for keyword accuracy by the native-speaking coauthors. The R and Python scripts used for data scraping,

preprocessing, and NLP analysis, as well as the specific keyword dictionaries for the Quintuple Helix mapping, are available from the corresponding author upon reasonable request.

Analytical Techniques

Keywords frequency analysis. This technique identifies dominant lexical patterns by calculating the raw and proportional frequency for key terms in each corpus. These measures allowed us to compare which concepts were most emphasized in the Japanese and Turkish institutional discourse. Latent Dirichlet allocation (LDA) topic modeling was used to uncover latent thematic structures that extend beyond surface-level keyword patterns. This probabilistic approach identifies clusters of cooccurring terms, allowing us to infer conceptual themes within and across documents. We used separate models for each country to examine how institutions group ideas concerning their own policy environments. We selected six topics per country on the basis of topic coherence scores, which indicated that this number best captured distinct thematic clusters without excessive overlap.

Keyword density analysis was used to assess the depth of DEI integration, targeting sex- and inclusion-related terms (e.g., “gender,” “diversity,” “female,” “empowerment”). We expressed these as a proportion of total word counts and used Welch’s t tests to compare their prevalence between the two countries statistically. This allowed us to evaluate not only whether DEI terms appeared but also how thoroughly they were embedded in institutional strategy. We also examined how DEI-related keywords were framed in relation to nearby modal and evaluative expressions in strategic plans, categorizing framing as obligation, aspiration, or value oriented on the basis of the co-occurrence of a predefined lexicon (e.g., “must,” “should,” “aim,” “plan,” “important,” “committed”). Terms were considered cooccurring if they appeared within a five-token window; this range was chosen to capture immediate semantic relationships while minimizing noise. To handle modal ambiguity, we manually reviewed the most frequent modal-DEI pairs to ensure that they reflected assertive intent rather than negation.

In addition to gender-related terms, we also assessed whether the strategic plans referenced intersectional identity groups that experience various forms of marginalization. A targeted keyword set was also constructed to include terms related to sexual orientation and gender identity (e.g., “LGBTQI +,” “transgender”), race and migration (e.g., “ethnic minority,” “migrant,” “refugee”), and socioeconomic or neurodivergent status (e.g., “first-generation,” “low-income,” “autism,” and “ADHD”). We scanned the tokenized corpus to determine the presence and distribution of these terms across strategic plans in both countries.

To assess the visibility of institutional leadership in strategic discourse, we analyzed the frequency of leadership-related role titles. We searched for terms such as “president,” “rector,” “provost,” “dean,” and “director” in the tokenized corpus. These counts were aggregated by country to examine whether and how leadership was discursively centered across institutions. To further evaluate how

leadership figures were framed as agents of change, we filtered subject–verb pairs in which the subject referred to a leadership role. Using our predefined verb strength lexicon, we categorized the accompanying verbs as strong (e.g., “implement,” “ensure”), moderate (e.g., “support,” “promote”), or weak (e.g., “plan,” “aim”). This allowed us to assess the rhetorical intensity of leadership action within strategic plans.

Named entity recognition (NER) was used to identify the named actors, organizations, and locations mentioned in the plans. This step served to examine the geopolitical and institutional networks referenced by universities, highlighting whether plans referenced national governance structures, global organizations, or local communities.

Syntactic dependency analysis was conducted to understand who is discursively constructed as the agent of change. By extracting subject–verb pairs and filtering out ambiguous or nonagentive subjects (e.g., “this,” “that,” “it”), we focused on interpretable actors such as universities, administrators, or collectives (e.g., “we”). This analysis helps reveal how institutions position themselves in terms of strategic responsibility.

Verb tense analysis was applied to determine how temporality is encoded in strategic discourse. This included parsing all verbs for morphological tense (Past, Present, Future), with future orientation further identified through modal auxiliaries such as “will” and “shall.” Unclassified verbs include those in infinitive or imperative form without a tense marker. This approach allowed us to assess whether institutional language is oriented toward retrospection, current action, or forward-looking planning.

We conducted a targeted analysis of subject–verb construction within gender-related contexts to assess how assertively universities express their commitments to gender equality. We first tokenized strategic plans into sentences and identified those containing relevant SDG 5 keywords (e.g., “gender,” “equality,” “female,” “empowerment”). We then matched these sentences with their corresponding subject–verb pairs and categorized the verbs on the basis of commitment strength: strong (e.g., “implement,” “ensure,” “commit”), moderate (e.g., “promote,” “support”), or weak (e.g., “aim,” “plan,” “mention”). This algorithm allows us to calculate the rhetorical force behind institutional references to gender equality and compare their distribution across countries.

A collocation analysis was conducted around the term “international.” We extracted cooccurring terms within a five-token window to assess how internationalization was discursively framed—whether through a lens of global competitiveness, access, collaboration, or societal relevance. This analysis was crucial for understanding how strategic language aligns with international engagement goals.

Finally, we performed **Quintuple Helix mapping** to analyze how universities referenced the five institutional domains in their strategic plans. This approach operationalizes the quintuple helix model (QHM) by categorizing language into five sectors: academia, government, industry, civil society, and the environment. Using a dictionary-based method, we defined a curated keyword list for each helix (e.g., “research” for academic, “entrepreneurship” for industry, “climate” for

environment). Strategic plans were tokenized, and all matched keywords were aggregated by country to compare the relative emphasis on each helix in the national higher education discourse.

The quintuple helix model guided both the design and interpretation of our analysis. We used these keyword lists to shape how we organized the data and interpreted the results. For example, frequent mentions of academic and government terms revealed that these areas were central to university strategies, while fewer references to civil society or the environment pointed to their weaker roles. In this way, the model connected the analytical process to the interpretation, helping us view university strategies from a multistakeholder perspective.

By integrating these techniques, our methodology offers a robust, multilayered view of institutional discourse. Each technique addresses a distinct analytical dimension, comprehensively comparing how Japanese and Turkish universities construct their strategic futures concerning equity, agency, and global engagement. Table 2 presents the research questions, the relevant NLP technique(s) and the quintuple helix dimensions.

Table 2: Integration of Research Questions, Analytical Techniques and Quintuple Helix Dimensions

| <i>Research Question</i> | <i>NLP Technique(s) Used</i> | <i>Analytical Focus</i> | <i>Quintuple Helix Dimension(s)</i> |
|---|---|---|--|
| RQ1. How do Japanese and Turkish universities integrate DEI into their strategic plans? | Keyword frequency; Keyword density; Verb tense analysis | Identify main DEI related terms and clusters to reveal overall visibility and framing | All helices (focus on academia and government dominance) |
| RQ2. What thematic and linguistic patterns exist in institutional strategies regarding DEI and gender equity | LDA topic modeling; Collocation analysis; Syntactic dependency analysis | Examine how institutions express responsibility and temporality | All helices (focus on leadership, governance, and organizational agency) |
| RQ3. How does the Quintuple Helix Model explain stakeholder roles in these strategies? | LDA topic modeling; Collocation analysis; Syntactic dependency analysis | Examine how institutions express responsibility and temporality | All helices (focus on leadership, governance, and organizational agency) |

RESULTS AND INTERPRETATION

Consistent with the study’s exploratory and mixed-methods design, this section integrates quantitative NLP findings with qualitative insights. This structure allows statistical patterns to be contextualized through examples from institutional discourse. Each analytical layer is presented in relation to the corresponding research question to maintain a clear connection between method, results, and interpretation.

To identify differences in the explicit integration of gender- and inclusion-related concepts, we first analyzed DEI keyword density across the two national corpora. The results revealed that Japanese university plans had significantly higher DEI keyword density ($M = .00065$, $SD = .00059$) than Turkish plans did ($M = .00047$, $SD = .00044$), Welch’s $t(148.30) = 2.47$, $p = .015$, 95% CI [.00004, .00033]. Because this test was conducted for descriptive comparison with an exploratory design, the p value was interpreted cautiously. Therefore, the result serves as an indicator of relative rather than hypothesis-testing evidence. Visually, Figure 1 displays this difference, showing that the keyword density values for Japanese universities are both higher on average and more dispersed than those for Turkish universities are.

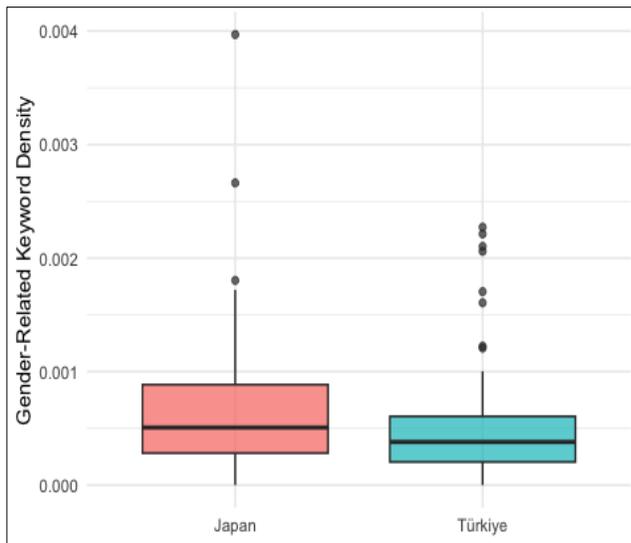


Figure 1: Keyword density of DEIs in HEIs across Japan and Türkiye

We next examined co-occurrence patterns between DEI keywords and nearby modal or evaluative terms to assess how DEI-related concepts were rhetorically positioned. As shown in Table 3, both Japanese and Turkish universities predominantly employed aspirational framing (71% in Japan and 65% in Türkiye). Value-oriented framing (e.g., important, committed) was less common (21% in Japan, 17% in Türkiye), and obligation-based framing (e.g., must, should)

was rare—particularly in Japanese strategic plans (8%) compared to Turkish strategic plans (17%). These results suggest that institutional references to DEIs are generally articulated as visionary or symbolic ideals rather than operational mandates or embedded institutional values.

Table 3: Framing of DEI Terms by Country

| <i>Country</i> | <i>Framing Type</i> | <i>Proportion</i> |
|----------------|---------------------|-------------------|
| Japan | Aspiration | .71 |
| Japan | Value | .21 |
| Japan | Obligation | .08 |
| Türkiye | Aspiration | .65 |
| Türkiye | Value | .17 |
| Türkiye | Obligation | .17 |

We further examined strategic plans addressing intersectional identities beyond gender by scanning keywords related to sexual orientation, migration, ethnicity, socioeconomic status, and neurodivergence. The results revealed extremely limited engagement with these categories. Only a small number of Turkish universities referenced “disadvantaged” (n = 426), “autism” (n = 13), “immigrant” (n = 4), or “refugee” (n = 1). Japanese universities’ strategic plans contained no references to refugee, immigrant, or LGBTQ+ identities and included only 11 mentions of “multicultural.” The absence of terms such as “LGBTQ,” “first-generation,” or “ethnic minority” across both corpora suggests that institutional discourse largely omits the intersectional dimensions of equity. These findings reinforce the idea that inclusion in strategic plans remains narrowly defined and fails to include the diverse identities of students and faculty. However, these findings should be interpreted with caution. The apparent absence of certain terms may be influenced by translation limitations or the use of localized synonyms that are not captured by a standard English DEI lexicon.

Focusing specifically on gender equality discourse, we analyzed the strength of the verbs used in sentences that contained SDG 5-relevant keywords. As seen in Figure 2, in both Japan and Türkiye, the majority of verbs used in gender-related sentences were of moderate strength, indicating a tone of institutional support (e.g., “promote,” “support”). Moderate verbs accounted for 52.3% of such constructions in Japan and 52.5% in Türkiye. Strong verbs indicating assertive institutional action (e.g., “implement,” “ensure”) appeared in 32.3% of sentences in Japanese strategic plans and 30.3% of those in Turkish ones. Weak verbs (e.g., “aim,” “plan”) were least common, although they were still present in both

corpora (15.4% in Japan, 17.1% in Türkiye). These results suggest that while both countries reference gender equality in supportive terms, compared with their Turkish counterparts, Japanese universities express these commitments slightly more assertively.

Proportion of subject–verb constructions by strength category and country

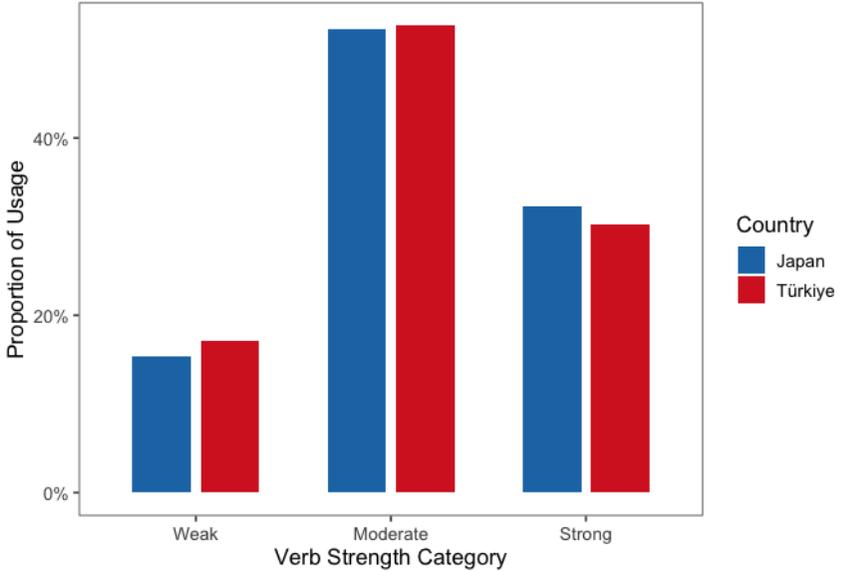


Figure 2: Verb Strength in Gender Equality (SDG 5) Sentences

To further explore who is discursively addressed in these plans, we examined the presence of specific target groups, particularly those historically associated with inclusion initiatives (e.g., international students and disabled students). Turkish universities more frequently referenced specific populations, whereas Japanese plans showed less lexical diversity in target groups and did not mention refugee or migrant students. This difference may reflect different national priorities in addressing specific student populations. The target groups are shown in Table 4 for both Japan and Türkiye.

Next, we investigated which institutional or geopolitical actors are foregrounded in each country’s discourse by applying named entity recognition (NER). This analysis focused on identifying frequently mentioned organizations (ORGs), geopolitical entities (GPE), and nationalities or religious/political groups (NORP). Japanese plans prominently referenced global and cultural actors such as “UNESCO,” “Asia-Pacific,” and “Tokyo,” suggesting a broader regional and societal orientation. In contrast, Turkish plans repeatedly referenced national institutions, including “YÖK,” “Ministry of Education,” and “TÜBİTAK,” reflecting more substantial alignment with internal governance structures (Figure 3).

Table 4: Target Group Mentions by Country

| <i>Group</i> | <i>Türkiye</i> (Mentions/Docs) | <i>Japan</i> (Mentions/Docs) |
|------------------------|-----------------------------------|------------------------------|
| Foreign students | 486/117 | 71/39 |
| International students | 125/54 | 30/25 |
| Disabled students | 45/22 | 0/0 |
| International faculty | 10/4 | 0/0 |
| Female faculty | 0/0 | 0/0 |
| Migrant students | 0/0 | 0/0 |
| Refugee students | 0/0 | 0/0 |
| Women academics | 0/0 | 0/0 |

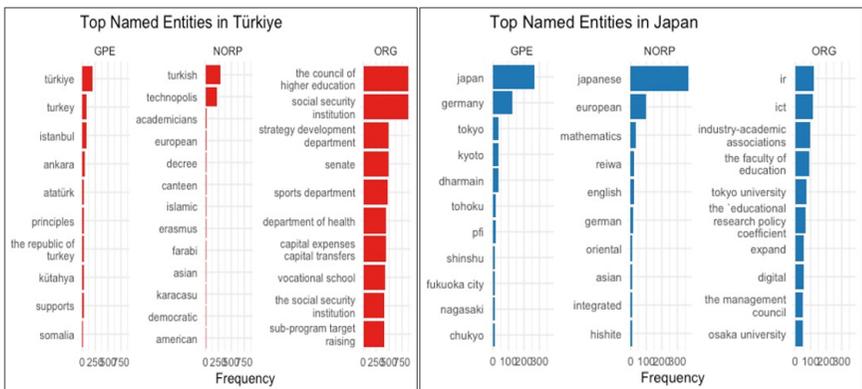


Figure 3: Results of the NER Analysis

To understand how internationalization is discursively framed, we conducted a collocation analysis centered on the “international.” This allowed us to examine whether internationalization was constructed as an access-oriented, competitive, or collaborative strategy. As seen in Figure 4, in Turkish plans, “international” frequently cooccurred with “student,” “education,” and “university,” suggesting

a discourse of international access and recruitment. In Japanese plans, collocates such as “society,” “relations,” and “collaboration” pointed to a broader view of internationalization as a societal and institutional value rather than a market function.

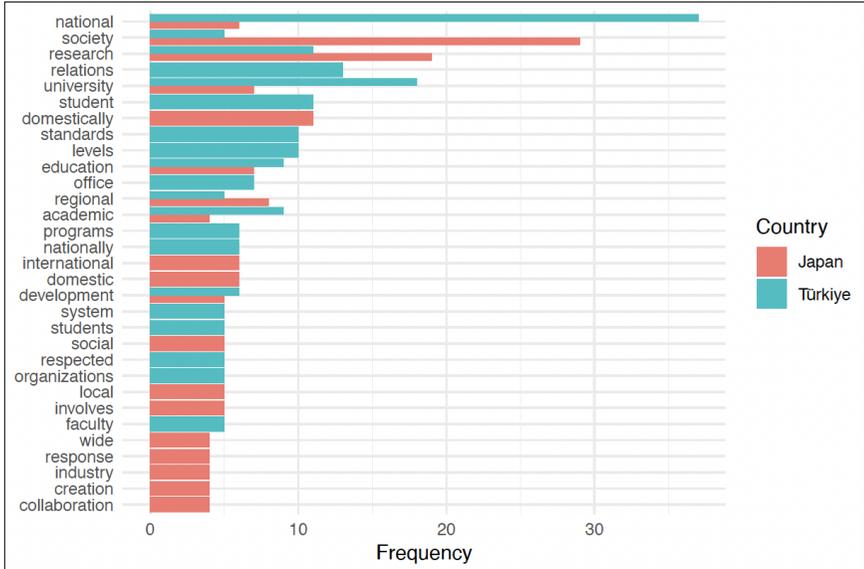


Figure 4: Collocates of Internationalization across Japan and Türkiye

We then turned to syntactic framing to understand who is positioned as the agent of strategic action. We extracted subject–verb pairs through dependency parsing and filtered out non-agentive or ambiguous subjects. Japanese universities overwhelmingly used “we” as the subject (e.g., “we promote,” “we implement”), signaling an assertive institutional voice and sense of agency. Notably, the high frequency of the pronoun ‘we’ in the Japanese corpus may be partly a translation artifact, as automated engines often insert ‘we’ to normalize Japanese sentences that omit a subject. Therefore, these results represent a provisional interpretation of institutional agencies. Turkish plans, on the other hand, featured impersonal subjects such as “machine,” “services,” and “expenses,” which suggest a more bureaucratic, system-oriented framing of institutional action. The top 10 most frequent subject–verb constructions for each country are presented in Table 5.

We analyzed verb tense across all plans to explore how institutional language reflects orientation toward the past, present, or future. In addition to standard morphological parsing, we included rule-based detection of modal constructions to better capture future intent. Japanese plans contained more future-oriented verbs (9.7%) than Turkish plans did (4.9%), whereas Türkiye had greater use of past-tense constructions (45.1% vs. 31.9%). Present-tense use was comparable between the two (Japan: 34.5%, Türkiye: 33.0%).

Table 5: Top Subject–Verb Pairs in Strategic Plans by Country

| <i>Japan</i> | <i>Freq</i> | <i>Türkiye</i> | <i>Freq</i> |
|------------------|-------------|---------------------|-------------|
| we → provide | 615 | machine → translate | 1,385 |
| we → promote | 560 | services → provide | 624 |
| we → aim | 479 | activity → cost | 500 |
| we → work | 305 | activities → carry | 455 |
| we → implement | 289 | expenses → monitor | 374 |
| we → develop | 255 | guess → estimate | 364 |
| we → train | 236 | they → need | 321 |
| we → prepare | 214 | unit → estimate | 300 |
| expenses → grant | 205 | indicator → aim | 282 |
| we → continue | 203 | data → obtain | 273 |

These patterns suggest that Japanese universities more frequently position their strategies toward future aims, whereas Turkish institutions frame their discourse more retrospectively (see Table 6). The future-oriented orientation in Japanese plans likely reflects the timing of the 4th mid-term goal cycle, which requires forward-looking statements. Conversely, the retrospective tone in Turkish plans may be linked to their role as performance reports for the 11th Development Plan period. This temporal difference reflects broader contrasts in higher education governance. Japan’s forward-looking language emphasizes long-term goals and gradual improvement, whereas Türkiye’s retrospective tone aligns with a system centered on accountability and reporting past achievements. These contrasts show how national policy approaches shape the way in which institutions communicate their strategies.

Table 6: Distribution of Verb Tenses in Strategic Plans by Country

| <i>Verb Tense</i> | <i>Japan Frequency</i> | <i>Japan% of Verbs</i> | <i>Türkiye Frequency</i> | <i>Türkiye% of Verbs</i> |
|-------------------|----------------------------|----------------------------|------------------------------|------------------------------|
| Future | 8,467 | 9.7% | 8,614 | 4.9% |
| Past | 27,929 | 31.9% | 79,872 | 45.1% |
| Present | 30,194 | 34.5% | 58,492 | 33.0% |
| Unclassified | 21,026 | 24.0% | 30,023 | 17.0% |

As part of our exploration of institutional agency, we conducted a keyword frequency analysis targeting references to leadership roles (e.g., “president,” “rector,” “director”) across the strategic plans. This allowed us to assess whether responsibility for equity and governance is discursively attributed to specific figures or framed more abstractly. The results revealed a pronounced difference between countries. Turkish plans included frequent mentions of hierarchical leadership terms, including “administration” (n = 9360), “rector” (n = 1617), and “director” (n = 595), suggesting a role-driven institutional discourse where responsibility is linked to named positions. In contrast, Japanese plans featured lower frequency but more abstract references, such as “president” (n = 169), “leadership” (n = 160), and “governance” (n = 217). This pattern indicated that Japanese universities tend to invoke institutional change as a systemic priority rather than explicitly linking it to individual roles. These differences reflect distinct models of institutional agency in the strategic discourse surrounding gender and equity.

While explicit mentions of leadership figures were more frequent in Turkish plans, we further examined how these roles were framed grammatically when used as subjects. Despite the relatively low number of subject–verb constructions involving leadership roles, patterns of verb strength were informative. In both countries, leadership figures were often paired with strong verbs such as “implement” and “ensure,” suggesting a rhetorical emphasis on decisive institutional action. In Türkiye, 60% of leadership subjects were linked to strong verbs, compared to 66.7% in Japan. Weak and moderate verbs were less frequent, indicating that when university leaders are discursively centered, they are generally framed as agents of high-commitment action rather than passive or symbolic actors.

To identify broad thematic emphases, we conducted a keyword frequency analysis. This provided insight into dominant content areas and allowed us to detect convergences and divergences in lexical priorities. Shared terms across both corpora included “education,” “research,” and “university,” reflecting core academic concerns. Japanese plans more often emphasized words such as “society,” “collaboration,” and “medical,” whereas Turkish plans highlighted “quality,” “access,” “budget,” and “services.” This contrast suggests that Japanese

discourse leans toward external engagement and social integration, whereas Turkish discourse focuses more on institutional performance and service provision. For detailed lexical frequency, including the top 50 content words by country, see Table A1 in Appendix A.

To explore the latent thematic architecture of institutional strategy, we applied topic modeling using LDA. This allowed us to group documents into clusters of cooccurring terms that reflected underlying strategic concerns. Both countries exhibited six topics (see Table 7). Japanese topics included terms associated with students, medicine, and business, pointing to societal interface and sectoral integration. Turkish topics focused on budgeting, implementation, and program delivery, indicating an administrative, performance-driven focus.

Table 7: Top Five Topic Terms and Thematic Interpretation by Country

| Topic | Thematic Label | Top Terms (Japan) | Top Terms (Türkiye) |
|-------|--|---|--|
| 1 | Institutional Infrastructure & Finance | research, university, expenses, business, education | education, budget, services, guess, research |
| 2 | Academic Programming & Development | research, period, term, business, university | university, education, research, development, activities |
| 3 | Student-Focused Strategic Planning | research, university, term, period, students | education, university, budget, guess, program |
| 4 | Health, Budgeting & Service Management | research, medical, period, expenses, term | education, expenses, total, program, budget |
| 5 | Resource Allocation & Institutional Planning | research, expenses, business, period, term | education, research, university, services, budget |
| 6 | Core Academic Administration | expenses, research, education, business, university | education, university, budget, services, program |

Finally, we applied Quintuple Helix mapping to assess how universities position themselves in broader societal systems. Strategic plans from both countries overwhelmingly emphasized academic functions, with Türkiye having the highest proportion of helix references related to academics (81%) and Japan

slightly lower (66%). However, Japan showed substantially greater engagement with industry-related discourse (20% vs. 3.8% in Türkiye), suggesting a more substantial alignment between universities and innovation ecosystems. Civil society and government were more prominent in Turkish plans, while environmental references were minimal in both countries. These patterns reflect distinct national emphases in how universities articulate their institutional positioning, with Türkiye centered on internal academic and administrative priorities and Japan more actively referencing cross-sectoral collaboration.

Together, these findings provide a multidimensional picture of how Japanese and Turkish universities structure their strategic narratives around equity, internationalization, and institutional responsibility, as well as the quintuple helix model. The following section reflects the broader implications of our findings and outlines conclusions and future directions.

DISCUSSION

This comparative NLP study examined how higher education institutions (HEIs) in Japan and Türkiye express their commitments to diversity, equity, and inclusion (DEI) within the context of internationalization. Drawing on the quintuple helix model, we analyzed 209 institutional strategy documents through keyword analysis, topic modeling, named entity recognition, and syntactic parsing. The analysis revealed three overarching patterns: (1) Japanese universities frame DEI in aspirational and value-oriented language, emphasizing collaboration and social engagement; (2) Turkish universities reference concrete equity-related groups, such as international or disabled students, through more bureaucratic and procedural expressions; and (3) both countries exhibit limited engagement with civil society, industry, and environmental stakeholders. Collectively, these findings reveal a pattern of discursive inclusivity without structural depth, showing how universities appear globally aligned with SDG 5 while maintaining local hierarchies of exclusion.

Japan's strategic language is generally future oriented and socially embedded, positioning universities as proactive contributors to societal well-being through partnerships and community engagement. In contrast, Türkiye's discourse is more administrative and retrospective, emphasizing institutional structures and past achievements. Despite increased rhetorical commitments to DEI, both Japanese and Turkish strategies display significant gaps. Such as gender equity appears but often lacks contextual elaboration. Groups such as refugee students, migrant academics, and female faculty are nearly mentioned particularly in the Japanese data. This pattern reflects what Byrd (2019) calls 'the vagueness of diversity,' which enables tolerance for some without a commitment to all.

Our findings extend these critiques by showing, through computational evidence, how the language of strategy itself may reproduce systemic exclusions. The absence of clearly named student populations suggests that universities may not fully recognize the differentiated needs that shape international student experiences. When institutional language remains aspirational and nonspecific, it is difficult to translate DEI principles into practices such as transparent

recruitment communication, coordinated advising systems, or culturally responsive pedagogy. Taken together, these findings indicate that the symbolic nature of DEI discourse not only limits institutional capacity for structural reform but also risks reinforcing the very inequities international students encounter in accessing support, navigating academic systems, and feeling included in the classroom. As a result, these discursive tendencies have concrete implications for international students, whose recruitment, support, and classroom participation are directly shaped by the institutional practices outlined in strategic plans.

The analysis also reveals uneven engagement with the stakeholders identified in the quintuple helix model, particularly civil society and the environment. This pattern is evident in our keyword and NER analyses. Japanese strategies include more DEI-related terms overall but seldom name-specific populations. Turkish documents more directly reference international or disabled students but still omit others, particularly refugee students, migrant academics, and female faculty. This lack of differentiation allows institutions to use inclusive language without clear accountability. These symbolic commitments can create an illusion of progress. As Stein (2021) suggests, universities sometimes use this discourse to follow international trends while maintaining their existing structures. In both Japan and Türkiye, aligning with SDG 5 may be more about institutional branding than deep structural change. In this context, symbolic alignment with SDG 5 risk obscuring the deeper political and structural reforms needed to address systemic exclusion. Ultimately, this may foster a culture of institutional self-affirmation, where surface-level DEI commitments are used to reassure decision makers of their inclusiveness, even as deeper structural exclusions remain unaddressed. Additionally, from a theoretical standpoint, the application of the quintuple helix model illuminates how universities privilege certain helices—academia and government—while marginalizing civil society, industry and environmental sustainability. These imbalances reveal how strategic discourse operationalizes power both within and across helices, suggesting the need to extend the model through a discursive accountability domination that examines how institutional language constructs or conceals stakeholder relationships. This addition helps align sustainability and equity discourse within measurable communicative practices in higher education governance.

These findings also resonate with recent research highlighting the gap between institutional discourse and inclusive practices. Almadadha et al. (2025) reported that international students' coping and belonging during COVID-19 depended on tangible institutional action rather than rhetorical empathy, mirroring our observations that values alone are insufficient. Similarly, Mai et al. (2025) reported that disconnected institutional support systems undermine equity for international graduate students, aligning with our observation that both Japanese and Turkish strategies prioritize values over mechanisms. However, unlike the decision-strategy study (2025), which identified financial and informational barriers at the point of entry, our analysis focuses on the discursive level—showing that institutional communication itself can reproduce inequality. Similarly, Wu and Ishii (2025) emphasize the importance of institutional transparency, which our analysis also found to be lacking. Together, these studies

confirm that the absence of operational detail in DEI language reflects not cultural nuance but organizational rigidity.

In this context, symbolic alignment with SDG 5 risk obscuring the deeper political and structural reforms needed to address systemic exclusion. Ultimately, this may foster a culture of institutional self-affirmation, where surface-level DEI commitments are used to reassure decision makers of their inclusiveness, even as deeper structural exclusions remain unaddressed.

Although SDG 5 provides a global framework for gender equality, our findings show that its translation into institutional strategies is inconsistent. Japanese and Turkish universities reference SDG 5 frequently, but its translation into actionable steps remains limited. This highlights the mismatch between global SDG frameworks and the practical realities of institutional planning.

Translating these findings into practice requires moving from aspiration to accountability. To operationalize inclusive internationalization, universities and policymakers should (a) specify target groups such as refugee students, female faculty, and migrant academics; (b) adopt new initiatives to integrate mentorship, advising and immigration support; (c) embed participatory planning processes involving students, civil society actors, and local communities; (d) implement gender and diversity audits to identify institutional gaps; and (e) develop new performance indicators that value inclusion and social responsibility alongside publication or ranking metrics. This measure would move the institution from symbolic compliance toward systematic transformation.

CONCLUSION AND FUTURE DIRECTIONS

Our findings indicate that while inclusive language and references to SDG 5 are increasingly present in universities' strategies, these commitments often remain symbolic and lack an explicit mechanism for accountability or implementation. Future strategic plans should embed DEI within structural, curricular, and relational dimensions by allocating clear responsibilities, resources, and measurable outcomes. Although DEI terminology appears prominently, the persistent gap between discourse and practice reveals that institutional rhetoric continues to exceed substantive change.

This study also demonstrated methodological potential for further studies by suggesting the use of NLP as a data-driven tool for examining policy discourse and cross-national tendencies in higher education. The proposed NLP-Quintuple Helix framework can also inform institutional self-assessment and policy review. For example, DEI keyword density metrics could help international offices monitor the visibility of inclusion commitments across planning cycles, whereas verb-strength patterns may reveal whether leadership discourse reflects aspirational intent or operational responsibility. The low representation of the 'environment' and 'civil society' helices likely reflects a mix of factors. This may indicate that these are not yet high priorities for university leaders. However, it also highlights a limitation of dictionary-based measurement; if an institution uses unique local terms for 'sustainability' that are not in our dictionary, they may not be counted. Ministries and accreditation bodies could adapt these metrics as

accountability indicators to benchmark inclusiveness and sustainability discourse across institutions. Moreover, combining computational text analysis with qualitative insights—such as interviews with policy makers, university leaders, and community stakeholders—would provide a richer contextual understanding. Comparative research across additional countries could reveal whether the discursive patterns identified here are unique to Japan and Türkiye or are part of broader global trends.

While this study focuses on Japanese and Turkish cases, the combined use of NLP techniques and quintuple helix mapping offers a transferable model for institutions in other regions. The contrast observed between aspirational (Japan) and procedural (Türkiye) forms can provide a useful lens for examining how different systems articulate inclusion, assign responsibility, and indicate measurable progress. By adopting these methods, institutions, ministries and researchers on other continents and regions can also analyze additional strategic priorities, such as sustainability, governance accountability, community engagement and internationalization quality. This framework offers a versatile tool for identifying discursive blind spots and strengthening strategies toward more accountable, equity-oriented planning.

Future studies might analyze specialized internationalization strategies rather than only general plans to explore how national priorities align or diverge within institutional hierarchies. Future research could also build on this study by combining NLP-based analysis with qualitative methods such as interviews or focus groups with university leaders, policymakers, and international office staff. Such triangulation helps explain the motivations, constraints, and institutional logic behind the linguistic patterns observed in strategic plans. Extending this approach across additional national systems would further clarify how policy environments shape universities' use of equity and inclusion-related language, offering a fuller picture of the dynamics of linking language and institutional practice.

Additionally, the evolving shift from DEI to EDI (emphasizing equity first) warrants closer examination, as it reflects a conceptual repositioning that foregrounds systematic change. Pursuing these lines of inquiry will help reconcile rhetorical inclusion with tangible transformation, ensuring that the language of diversity becomes a driver—not a substitute—of structural change. Researchers in other countries can follow this transferable blueprint in three steps: first, by collecting public strategic documents; second, by applying our open-source R/Python scripts for automated translation and cleaning; and third, by using our provided keyword dictionaries to map text into the Quintuple Helix categories. This allows for an objective, large-scale comparison across different national systems.

More broadly, higher education institutions could benefit from reimagining internationalization in ways that are both globally engaged and locally responsive, embedding inclusive practices into teaching, leadership, and community collaboration. Such an approach may strengthen alignment with the transformative goals outlined in the SDGs, particularly SDG 4, SDG 5, and SDG 16, while preparing students to address complex social and environmental

challenges. Building on our comparative analysis of Japan and Türkiye, this study emphasizes that integrating DEI into internationalization requires both conceptual expansion of the quintuple helix and empirical attention to discourse. By bridging computational text analysis with critical policy interpretation, it offers a scalable model for assessing how universities articulate—and enact—equity within global higher education.

Limitations

This study provides comparative insights into how DEI and internationalization are addressed in Japanese and Turkish university strategies, but several limitations should be acknowledged. First, the translation of Japanese and Turkish documents into English may have reduced nuance or altered the meaning of policy-specific terminology. Second, we focused on general institutional strategic plans for comparability, excluding dedicated international strategies that may contain additional insights. This exclusion was necessary because the availability and format of standalone internationalization strategies varied across institutions. However, it may introduce a bias toward institution-wide priorities and underrepresent institution-specific initiatives—such as international partnership strategies, campus development or mobility programs—that are articulated only in independent strategy documents. Third, while NLP enables large-scale text analysis, it cannot capture the institutional intent or political dynamics shaping these documents. Fourth, Turkish plans were treated as a uniform dataset, although internal authorship differences (top-down vs. participatory drafting) may influence framing. Addressing this limitation through multilingual corpora, qualitative triangulation, and temporal comparison would enhance validity and interpretive depth in future research. Fifth, we must also acknowledge a limitation regarding epistemic hierarchies. By using machine translation and English-centric NLP tools, our analysis may unintentionally favor English-language definitions of equity and inclusion. This could overlook the unique cultural meanings of these concepts in the original Japanese and Turkish contexts. We have tried to mitigate this through validation by native-speaking coauthors, but the tension between global English-centric tools and local meanings remains a challenge for cross-national research.

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