Chapter

From Goals to Action: A Targeted Framework for Sustainable Development Goals in Higher Education

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Abstract

In recent years, the accelerating trend of digital transformation has compelled Higher Education Institutions (HEIs) to redefine their role and contribution to individual learners' lives. This study builds on our previous work undertaken on Widening Participation (WP) and international students under current *education 4.0* paradigms and ongoing digital transformation. We propose a practical framework to make the integration of Sustainable Development Goals (SDGs) more targeted and actionable for effective accessibility, inclusivity, and sustainability within the UK Higher Education sector. Critical inquiries have established a clear aim for HEIs to meet these indicators, although obstacles were identified within the subsequent gap analysis of the "2015 UN SDG Agenda" in their execution. Our chapter focuses primarily on the strategic alignment of SDG 4 (Quality Education), SDG 5 (Gender Equality), SDG 10 (Reduced Inequalities), and SDG 17 (Partnerships for the Goals) with institutional practices and graduate employability pathways. Furthermore, the discourse responds to criticisms that SDG implementation has been too broad or perceived as a "box-ticking" exercise, rather than a thoughtfully designed initiative that delivers measurable outcomes. The SDG Prism Framework essentially transforms the broad ambitions of SDGs through the process of "refraction" for realistic implementation. These processes generate targeted outputs through leveraging quantitative tools to provide significant value for educators, policymakers, and senior institutional leaders. Its design imperative adopts a decolonial perspective, exploring what truly constitutes inclusivity while avoiding the reduction of SDG efforts to ambiguous goals.

Keywords: sustainable development goals, higher education, equity, inclusivity, decolonialism, digital transformation

1. Introduction

In recent years, the accelerating trend of digital transformation has compelled Higher Education Institutions (HEIs) to redefine their role and contribution to individual learners' lives [1–3]. This encompasses the ability to connect with graduate attributes and fully grasp the implications for faculty to extend their influence on wider communities [3, 4].

Koseda et al. [1] assert that infrastructure development should aim to transform core institutional visions for upcoming digital transformation. Their works urge HEIs to anticipate future scenarios through strategic foresight, informed by pre-emptive planning to navigate digital conception by 2030 [2, 3]. Central to this process is the engagement of effective change agents and key stakeholders to ensure that objectives are not only met but sustained [5, 6]. To achieve economic indicators set through the Sustainable Development Goals (SDGs), Koseda et al. [1] determined that integration should be within a threshold of exponential digital uptake of technologies and innovative pedagogical practices. Alongside this, however, emerges a re-evaluation of execution by HEIs to integrate SDGs effectively. Today, the concept of technology and pedagogical innovation in HEIs are prevalent in literature [7–9]. Senior faculty interpret technology from a management perspective and as a significant factor for analogous investigations into operational efficiency [10–12].

What makes this singular focus so elusive from indicator achievement is that senior faculty overlook embedment into HEI operational ethos [12–14]. We theorise that perspectives are well recognised as opposed to implied in institutional frameworks, curricular, and governance models [15]. So why is SDG embedment still considered problematic? Simply put, it does not account for the complexities associated with genuine wider access. This generates the proposition for alternatives [4, 16, 17], contrary to prevailing knowledge on SDG integration for SDG (4 and 10) in institutional adherence.

To help identify suggestions for strategic application, our study endorses changes to existing routines and systems in SDG implementation.

Dominant research streams on effective SDG integration stress the need for HEIs to address the interconnectedness of goals, and to balance synergies and trade-offs [18]. Strong governance is associated with accomplished policy frameworks and compatible with stakeholder engagement to strengthen accountability [2, 18]. Whereas Capacity Building in Higher Education (CBHE) further adds to the HEI's repertoire, activating both instructional and socially assembled practices [19].

Underlying these practices is the principle of collaboration to enhance the integration of diverse, evidence-based decision making for indicator decoding and facilitating effective embedment [20]. Therefore, this research re-evaluates the relationship between issues with SDG broadness and ineffective techniques to drive improved embedment. Literature supports developing a new framework through a kaleidoscopic-type lens that could potentially reduce anomalies in integration [21].

2. Search strategy

The applied search strategy evaluated SDG integration in HEIs and their respective gaps against Creswell's [22] criterion for higher educational research.

2.1 Creswell framework for research design

Epistemological perspectives → Inquiry pathways → Research methods

This study's methodology is informed by a contextualised approach to effective practice in education [22]. Unlike a systematic review, Integrative Literature Reviews

(ILRs) critically analyse primary research studies, along with atypical data stores [22, 23].

Adhering to academically accepted practices, the review explores dimensions related to:

- Content (alignment with SDG priorities);

- response processes (institutional stakeholder engagement);

- internal structure (supportive organisational frameworks);

- relationships with other variables (link to measurable SDG impacts);

- consequences (effects on equity, inclusivity and sustainability) [1, 23].

Of particular relevance, our methods reaffirm the importance of decolonisation perspectives in educational research and conventional narratives [24]. The deliberate inclusion of marginalised voices and opinion pieces helps investigate inadequate SDG implementation and circumvent the oversaturation of colonial ideologies in higher education research [25].

2.2 Information of sources

The bibliography search was conducted in three phases. First, an exploratory search was carried out to capture education trends in SDG integration. This was followed by an appraisal of literature against predefined inclusion-exclusion criteria. Finally, an annual review was conducted to assess the quality and literary relevance of the selected sources [22].

2.3 Search parameters

The literature search spanned from January 2024 to October 2024, covering publications from 2000 to 2024. It used databases such as Google Scholar, Scopus, and institutional repositories, which provides access to extensive peer-reviewed articles, policy documents, and decolonial opinion pieces or perspectives. The review prioritised sustainability research aligned with the review objectives, access frameworks, and reliable contributions to understanding SDG integration in HEIs.

2.4 Inclusion and exclusion criteria

Studies were included if they contained empirical evidence or theoretical analyses on SDG-related integration in HEIs, used any research design, and were published in peer-reviewed journals, opinion pieces, or policy documents. Exclusions applied to systematic reviews, meta-analyses, and editorials lacking direct relevance to SDG integration. Due to the flexible nature of ILRs, the study was able to maintain a high level of rigour while accommodating exploratory investigations from critical perspectives [23, 26].

Selected items were recorded in a Microsoft Excel spreadsheet to manage duplicates and track the review process. A total of 100 documents were reviewed on SDG integration in HEIs [27]. Extracted data included publication details, study focus, and findings related to institutional strategies and SDG implementation [28]. The search

	SO	Inclusion	Exclusion
Explicitly discusses SDGs in HEIs through policies, strategies or practices.	(SO1)	✓	
Studies lacking direct focus on SDG integration in HEIS—omits unrelated opinion pieces or editorials.			✓
Empirical evidence, case studies, opinion pieces, policy documents, or theoretical analysis.	(SO1; SO2; SO3)	✓	
Systematic reviews, meta-analyses, or studies without original insights.			✓
Highlight critical and decolonial perspectives.	(SO3)	✓	
Studies published before 2023.	(SO1; SO2; SO3)	✓	
Studies published after 2024.			✓
Accepts any research design (qualitative, quantitative, or mixed methods) and narrative discussions.	(SO1; SO2; SO3)	✓	

Table 1.
Eligibility criteria matrix—ILR boundaries.

objectives are outlined in the eligibility criteria matrix—ILR boundaries (**Table 1**)—S1, S2, and S3.

3. SDG integration in HEI contexts

The 2020 Agenda for Sustainable Development, adopted by all United Nation Member States in 2015, provides a shared blueprint for peace and prosperity for people and the planet, now and into the future [23]. The goals were developed based on decades of global efforts and Agenda 21 (1992), the Millennium Development Goals (2000), and outcomes from key summits like Rio + 20, 2012 [29]. Crucially, the 17-SDGs were constructed to address global challenges, such as poverty, inequality, health, education, climate change, and environmental protection through collaborative partnerships [30]. As such, the 17 SDGs were developed as a call to action, united in their commitment to eradicating poverty and other forms of deprivation. All UN member states acknowledge that broader strategies go hand-in-hand with improving health, education, reduction of inequalities, and spurring economic growth [23].

3.1 SDGs criticism and the tyranny of KPI

Higher education is at the forefront in advancing the SDGs through the means of research, innovation, and equipping institutional leaders with the skills to develop sustainable and technological solutions [30, 31]. While the SDGs are an improvement over the MDGs, they face criticism for being overly ambitious, lacking precise definitions and neglecting social issues [32]. Critics highlight issues with inadequate funding, limited support for developing countries, insufficient political will, and a lack of binding responsibility [13, 30, 32–34]. Their vagueness praises everything but focuses on nothing, exacerbating global inequality through the reliance on voluntary

national contributions [32]. This places a burden on poorer countries while wealthier nations claim credit for minimal advancements [32]. Its sheer scale risks developing public apathy as the world struggles to align fragmented global cooperation with the SDGs [32]. In contrast, the MDGs had the advantage of being more concise over the expansive scope and challenges SDGs bring to HEI implementation [30, 35].

David Boyle alludes to a "tickbox culture" that has striking parallels in educational institutions, where Key Performance Indicators (KPIs) and technocratic management increasingly dominate [36]. His work examines systems that favour measuring outcomes, and, ultimately, distort their purpose [36].

Schools and universities are pressured to embed rigid frameworks to meet KPIs at the expense of progressive learning experiences [32]. KPIs may reduce genuine progress to distinct metrics related to exam results, attendance rates and institutional rankings [36].

3.2 Critical and decolonial perspectives in higher education

The SDGs have faced substantial criticism for perpetuating a growth centred development model that undermines sustainability by preferencing economic expansion over systemic transformation [30, 32, 34]. Critics argue that the framework reinforced global equality and colonial dynamics, although they tend to sideline local communities or non-state actors in favour of top-down, technocratic approaches [30, 32, 34]. These shortcomings have left some educators resisting adherence, citing tensions with curricula in social justice [30, 32, 34].

Decolonial thinking is effective for critically engaging with the SDGs and demonstrates its feasibility for direct impact in preventing colonial-style exploitation [37, 38]. Communal optimism in place-based learning, as a means to counter the technocratic tendencies of the SDGs, is evident in some of the authors' opinion pieces. This idea is explored through the application of relational and democratic methods that encourage collective action over top-down intervention [32].

3.3 Alternative frameworks for sustainability

Studies further reveal the SDGs' reliance on free-market capitalism and economic growth, which has intensified environmental degradation and prompted critics to advocate for alternative models including degrowth, regenerative economics, and buen vivir ("good living") [34, 39]. These models question the viability of decoupling growth from economic harm alongside offering new paradigms for organising economies and societies [34, 39]. Integrating these perspectives through Problem-Based Learning (PBL) and other pedagogical approaches has inspired innovative, interdisciplinary responses to sustainability challenges [1, 30].

Alternative frameworks for sustainability critique the dominant development paradigm that prioritises economic growth at the expense of ecological balance and social equity. Advocates of these models argue that the relentless pursuit of GDP growth under free-market capitalism has not only accelerated environmental degradation but also exacerbated social inequalities and undermined community well-being [16, 32].

One notable alternative to conventional growth-based models is degrowth, a perspective that rejects the assumption that endless economic expansion is inherently beneficial [39, 40]. Proponents of degrowth models contend that a deliberate scaling

down of production and consumption is essential for restoring ecological balance and redistributing wealth more equitably [40].

The concept of degrowth elevates the primacy of life quality over the mere pursuit of quantitative economic metrics. Value is placed on societies that thrive within the finite ecological parameters of the planet [39]. On the other hand, regenerative economics scrutinises the imperative to devise economic systems that rejuvenate capital, instead of contributing to its depletion [39, 40].

Critical discussions underscore a shift from transient, linear models to more circular frameworks [39, 40]. As a result, diverse perspectives act as a catalyst for the development of unconventional, perhaps even non-traditional, strategies for sustainability within HE [41]. These perspectives prompt reflection on how societies conceive progress and well-being, or, alternatively, reform policies to align more coherently with environmental and social justice initiatives [42, 43]. Incidentally, we find that transformative frameworks have the potential to profoundly alter public policy, instilling principles that place importance on inclusivity over short-term profit maximisation [25, 37, 43]. This growing consensus signals a gradual, yet undeniable interest toward alternative visions of progress.

4. Methodology

A pragmatic approach was adopted to engage more effectively with practical and context-responsive solutions. Critical realism informed the analysis of systemic barriers and structural conditions shaping observed outcomes [44, 45].

Exploratory methods were prioritised over experimental procedures and reductionist statistical analysis. Grounded in interpretivist philosophy, the research aimed to investigate the underlying "how" and "why" of social phenomena [46]. Critical realism problematises the notion of objective reality, emphasising that knowledge is always mediated by socio-cultural and historical contexts [47, 48]. Its stratified ontology distinguishes between the empirical (experiential observations), the actual (events that occur regardless of observation), and the real (causal mechanisms and underlying structures) [39]. Research designs centred exclusively on metrics risk excluding decolonial perspectives and disregarding the power dynamics embedded in processes of knowledge production [25, 49]. Such designs contribute to the narrowing of epistemological and communal ontologies, limiting the capacity for critical engagement with the foundational assumptions of both epistemic and interpretive frameworks [49].

4.1 Research design

Our research design adopts a sequential Qual → Qual → Quan mixed methods approach.

The analysis was divided into two parts: Part 1 — a deductive, framework-based thematic analysis — investigated the intersection of internationalisation and digital transformation in HEIs. Categories were derived from research conducted by others [1–3, 43, 50]. Part 2 of the analysis utilised predefined frameworks and the targets of the SDGs as benchmarks, comparing the current state with intended graduate outcomes [3, 23, 50]. Aspects of qualitative research methods were necessary for identifying integral and distinctive patterns in issues specific to the HEI domain [28]. Additionally, a gap analysis was

conducted to clarify the independent effects of selected SDGs (4, 5, 10, and 17) in relation to widening participation and international student cohorts [2, 23, 39].

5. Part 1. Thematic framework analysis

5.1 Education 4.0 paradigm and SDG integration

Data were categorised into five core themes from the sources detailed in **Table 2** and **Figure 1** [1–3, 42, 50].

1. Digital transformation, 2. Impact of Education 4.0, 3. Internationalisation of HEIs, 4. Higher education, and 5. Social aspects were identified as the most prevalent themes. Investigations highlighted tensions hindering effective and appropriate SDG integration—specifically in relation to SDGs 4 and 10—such as employability, global standardisation, digital adoption, and equity. These findings illustrate how theoretical pedagogical models and reflective frameworks are important for HEIs to overcome

Source	Title	Themes
McIntosh et al. [43]	Reflections: An Examination of Comparative Approaches in the Context of Action Learning.	• Reflective models in education and action. • Learning as part of innovative teaching practice. • Globalisation. • New paradigm in teaching.
Koseda et al. [2]	Internationalisation and digital transformation in HEIs: The impact of education 4.0 on teaching, learning and assessment.	• Education 4.0 and its impact on digital transformation, and hybrid learning in HEIs. • Employability integration. • Aligning curriculum design with SDG 4 (quality education) and Education 4.0 goals.
Koseda et al. [1]	Embedding employability into curriculum design: The impact of education 4.0.	• Graduate competencies • Curriculum design and embedment. • Applied framework/toolkit for instructor. • Constructive Alignment (CA).
Koseda et al. [3]	Globalisation, Education, Policy, and Curricular Issues: Education 4.0: Digital Disruption and Innovative Solutions as Pedagogical Drivers in Higher Education.	• Globalisation, policy, and curricular innovation as drivers of digital transformation. • Digital disruption. • Adaptive methods. • Brookfield's lenses.
Koseda et al. [50]	A Critical Analysis of Universal Employability Skills for International Students in Higher Education.	• Universal Employability Skills critical for internationalisation and SDG 10 (reduced inequalities). • Connecting critical reflective practice with employability outcomes.

Table 2.
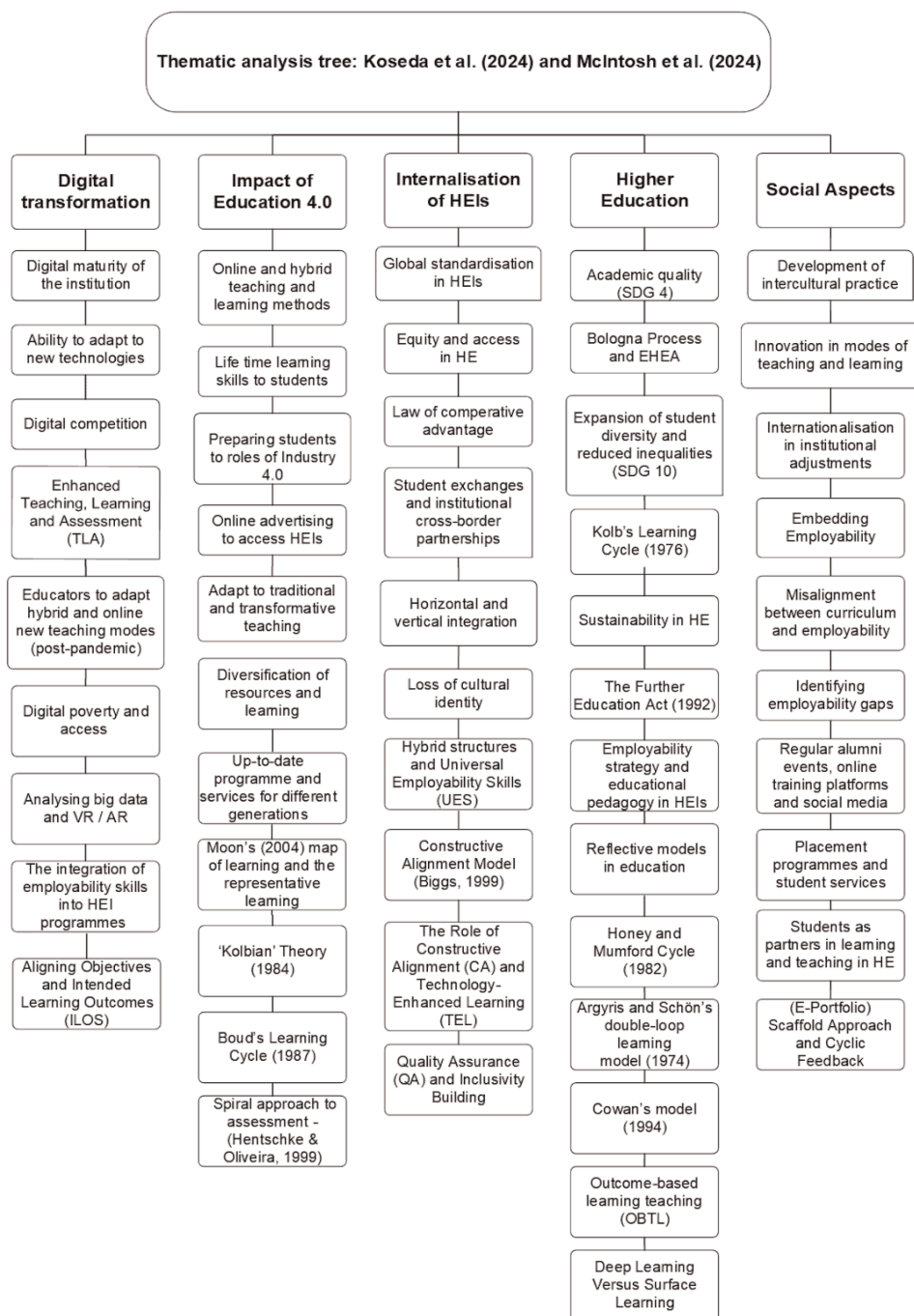*Analysis of themes Koseda et al. [1–3, 50] and McIntosh et al. [43].*

Figure 1.
Thematic analysis tree: Koseda et al. [1–3, 50] and McIntosh et al. [43].

digital inequality, cultural diversity, and curriculum misalignment. Themes related to these concepts resurfaced in efforts to define connections between sustainable and innovative educational practices within HEIs.
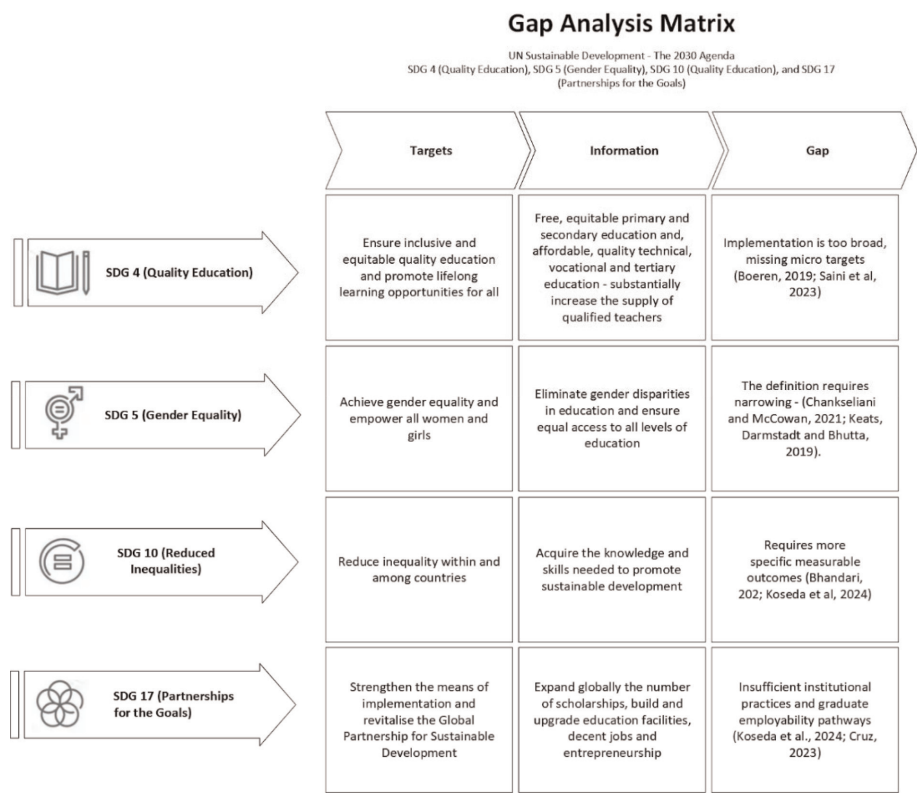
Gap Analysis Matrix

UN Sustainable Development - The 2030 Agenda
SDG 4 (Quality Education), SDG 5 (Gender Equality), SDG 10 (Quality Education), and SDG 17
(Partnerships for the Goals)

	Targets	Information	Gap
SDG 4 (Quality Education)	Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all	Free, equitable primary and secondary education and, affordable, quality technical, vocational and tertiary education - substantially increase the supply of qualified teachers	Implementation is too broad, missing micro targets (Boeren, 2019; Saini et al, 2023)
SDG 5 (Gender Equality)	Achieve gender equality and empower all women and girls	Eliminate gender disparities in education and ensure equal access to all levels of education	The definition requires narrowing - (Chankseliani and McCowan, 2021; Keats, Darmstadt and Bhutta, 2019).
SDG 10 (Reduced Inequalities)	Reduce inequality within and among countries	Acquire the knowledge and skills needed to promote sustainable development	Requires more specific measurable outcomes (Bhandari, 202; Koseda et al, 2024)
SDG 17 (Partnerships for the Goals)	Strengthen the means of implementation and revitalise the Global Partnership for Sustainable Development	Expand globally the number of scholarships, build and upgrade education facilities, decent jobs and entrepreneurship	Insufficient institutional practices and graduate employability pathways (Koseda et al., 2024; Cruz, 2023)

Figure 2.
Gap analysis matrix of the UN Sustainable Development Goals (SDGs—4, 5, 10 and 17).

5.2 2015 UN SDG agenda gap analysis SDG: (4, 5, 10, and 17)

To complement the thematic analysis, we applied a qualitative gap analysis to isolate the interrelated effects between SDG (4, 5, 10, and 17) for WP and international student groups [2, 23, 39]. This strengthened the notion that these student archetypes benefit from knowledge transfer processes, which rely on nuanced factors that incorporate "real-world" values and the imposed limitations of broader SDG goals (**Figure 2**).

6. Findings

6.1 Micro-level targets and components

The goals' construction is logically premature and does not account for the diversity in socio-economic, cultural, or political contexts across countries [32]. Expanding tertiary education in low-income countries with limited infrastructure and resources differs significantly from those in high-income nations [32]. Components of SDG 4 should ideally account for efforts in defining an affordability criterion. Efforts to

define an affordability criterion ought to be integrated into the framework of SDG 4 components. A new requirement emerges for quality assurance standards to correspond with audits aligned to global benchmarks, while also tracking both access and specific outcome measures [51, 52]. Alternative education routes, digital learning, and linkages with labour market needs form the foundation for micro-level targets within HEIs.

6.2 Specificity and ambiguities in HEI execution

For SDG 5, the analysis indicated that the targets aimed at achieving gender equality and empowering all women and girls require more precise definitions and frameworks to overcome gender disparities in education. Current definitions are overly broad, leading to ambiguities in the design and execution [53, 54]. As a consequence, the effectiveness of interventions aimed at ensuring equitable access to education for women and girls under SDG 5 is significantly reduced. Additional concerns regarding the absence of precise indicators are reflected in the findings related to SDG 10, which highlight an urgent need for more specific and measurable outcomes.

Acquiring the knowledge and competencies required to advance sustainable development is essential; however, the pathway towards achieving this objective remains insufficiently articulated. These gaps reveal a pressing imperative for empirically grounded, actionable frameworks to rigorously evaluate and promote progress in addressing educational inequalities.

6.3 Graduate employability pathways

In the case for SDG 17, gaps were found in institutional practices and graduate employability pathways. SDG 17 emphasises the formation of global partnerships for sustainable development, although HEI endeavours to expand research, upgrade educational facilities, and foster entrepreneurship globally are hindered by insufficient institutional frameworks [3, 50, 55].

Overall, these issues underline the necessity of developing partnerships and reforms to bridge these gaps, illuminating some of the criticisms outlined in earlier discussions.

Our qualitative analyses revealed that the SDG agenda provides an ambitious and holistic vision, however, a thorough re-evaluation of the gaps in specificity, measurement, and HEI capacity is paramount for the progression of SDG attainment. We espouse the need for a more targeted approach for WP and international students to track tangible, evidence-based progress [56–58].

7. The SDG Prism Framework

We propose a new SDG Prism Framework to essentially "refract" the broadness of SDGs into specific, actionable pathways for HEIs. Each dimension breaks down SDG goals into targeted integrations for overcoming cognitive dispositions of acumen, critical thinking, emotional intelligence (EI), cultural fluidity, and digital literacy gaps observed in more vulnerable student groups/archetypes (**Figure 3**).
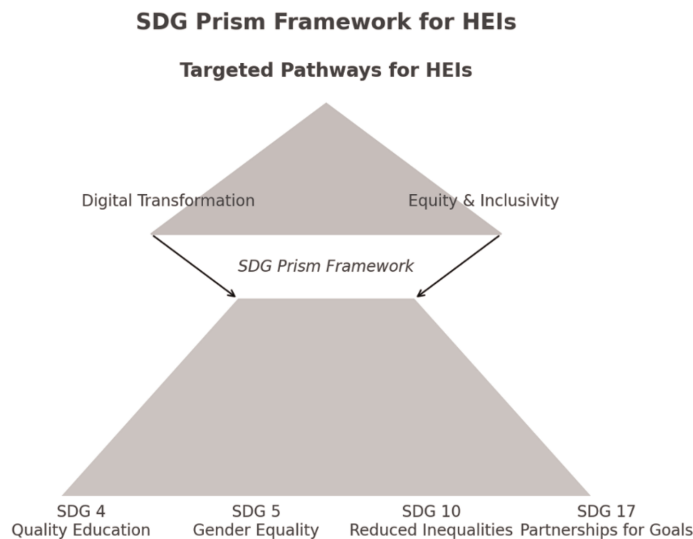
SDG Prism Framework for HEIs

Targeted Pathways for HEIs

Digital Transformation   Equity & Inclusivity

SDG Prism Framework

SDG 4   SDG 5   SDG 10   SDG 17
Quality Education   Gender Equality   Reduced Inequalities Partnerships for Goals

Figure 3.
SDG Prism Framework for HEIs.

Output	Description
Digital Transformation	The role of technology adoption, innovative pedagogies, and reducing digital inequality within HEIs.
Equity and Inclusion	Systemic barriers to access and ensuring fair opportunities for marginalised and underrepresented groups.
Graduate Employability (GO)	Aligning education outcomes with labour market demands by embedding core or Universal Employability Skills into curricula as well as industry partnerships.

Table 3.
Selected outputs for the SDG Prism Framework.

7.1 Applicability of SDG Prism Framework

Fundamentally, the SDG Prism Framework is a conceptual model that refines the goals to remove ambiguity. Using the prism metaphor, we have taken the idea of a kaleidoscope effect by selecting SDG (4, 5, 10 and 17) for this example to be refracted into targeted outputs found within the thematic analysis of Koseda et al. [1–3, 50] and McIntosh et al. [43].

The design of this framework is made deliberately applicable for strategic planning in HEIs to drive effective SDG embedment in curriculum design, governance, and student support services.

This framework aims to benefit WP and international student groups, as well as support HEI development of measurable benchmarks for progress monitorisation. We considered how these actionable steps build digital infrastructure in low-income countries or propel initiatives for inclusivity in high-income countries (**Table 3**).

7.2 Selected outputs for the SDG Prism Framework

Inputs are applicable to all goals, however for this framework, the refraction phase focused predominantly on SDG—(4, 5, 10, 17) entering the prism, which processes and splits them into targeted outputs.

We targeted three core areas (1. digital transformation, 2. equity and inclusivity, and 3. graduate employability) to develop strategies for practical HEI implementation. These components were subsequently built off key themes identified in both Part 1 and Part 2. The SDG Prism Framework transform functions as a processing mechanism, converting broad-scale SDG objectives into more bespoke strategies that align with the specialised needs, resources, and priorities of institutions. Our framework is hybrid and can incorporate quantitative approaches. Through this, our methodology attempts to integrate seven mathematical models for effective SDG implementation in HEIs.

The framework's design also considers decolonial perspectives to resolve the saturation of colonial inputs while simultaneously controlling for the tyranny of KPIs and their potential to oversimplify complex issues in HE [36]. Part 1 of the analysis found gaps in measurable micro-targets. Abandoning progress tracking entirely would risk undermining accountability structures within HEIs [33].

8. Part 2. Mathematical models within the SDG Prism Framework

Our methods outline the strategic adaption of mathematical models within the SDG Prism Framework. Each model is drawn from multiple disciplines, including statistics, eco-metrics, decision theory, and sustainability science, with their direct application to SDG implementation in HEIs [59–61]. An example of this in the "The Weighted Priority" function, which is influenced by the Multi-Criteria Decision Analysis (MCDA) and resource allocation to ensure efficient allocation of resources based on strategic SDG priorities [62]. Additionally, the "Opportunity Gap Index" (OGI) enhances inequality measurement tools e.g., the Gini Coefficient to educational access disparities, making it suitable for tracking gender, digital, and financial inequality in HEIs [63].

More importantly, for the tracking of Digital Transformation, our (DES) formula is derived from return on investment (ROI) and technology adoption (TAM) models. The purpose of their design centres on evaluating the effectiveness of digital investments in achieving SDG-related outcomes, diverging from the traditional approaches outlined in existing literature [2, 21, 30, 32]. Assessments related to synergies of conflicts between SDGs for HEIs were used to optimise impact across intersected goals through the application of the "SDG Interaction Coefficient" [18].

This can be concurrently applied with the "Sustainability Progress Index" (SPI) to track SDG progress, initially derived from composite indices i.e., the Human Development Index [64].

Lastly, the "Partnership Model" (PES) operationalises principles from network theory and public–private partnership evaluation frameworks to quantify the effectiveness of collaborative mechanisms [65]. Methodologically, these models utilise quantitative weighting, ratio-based efficiency techniques, statistical comparisons, and composite indices to embed data-driven, context-sensitive, and measurable strategies directly within the architecture of the SDGs [63–65].

8.1 SDG inputs → SDG Prism Framework (processing) → targeted outputs (pathways)

Where SDG inputs include:
SDG 4 (quality education), SDG 5 (gender equality), SDG 10 (reduced inequalities), and SDG 17 (partnerships for the goals).
Prism framework (processing) phase to transforms inputs through:

- Strategic alignment

- Localised implementation

- Integration of theoretical and practical considerations

- Target outputs/pathways

The outputs isolated include: (1. digital transformation, 2. equity and 3. inclusion, and graduate employability).
Formula notation is integrated into the prism framework's process of refracting broad SDG goals into specific, practical and actionable strategies for the needs of measuring micro-targets.

8.2 Prism transformation

The mathematical formula below represents how HEIs could use the SDG Prism Framework to process broad goals of SDGs into specific actions related to digital learning, inclusive policies, and employability programmes. HEI focus is redirected toward targeted, measurable outcomes that are both practical and realistic.

$$\left(\sum_{i=4,\,5,\,10,\,17} SDG_i \right) \frac{SDG\ Prism\ Framework}{}$$
$$\rightarrow \{Digital\ Transformation, Equity\ and\ Inclusivity, GO\}$$

Prism transformation formula:

This transformation process is facilitated by the SDG Prism Framework. To simplify this process, we use {Digital Transformation, Equity and Inclusion, Graduate Employability} to represent the refined, actionable HEI outputs.

- *Step 1*. The HEI would extrapolate the components in the above formula to transform a collection of SDG goals. For this example, we maintain isolation on SDGs 4, 5, 10, and 17. The second step requires HEIs to enable the "refraction" process.

- *Step 2*. Outputs can be changed according to HEI priorities and pathways from the broad goals. In this case, we used {Digital Transformation, Equity and Inclusion, Graduate Employability} as outputs.

The SDG Prism Framework allows for the integration of measures and benchmarks as part of the HEI's digital transformation process. These benchmarks ensure that the broad SDG goals evolve into defined pathways to track progress, evaluate effectiveness and guide embedment/implementation.

Associated measures for input could differ e.g.,

• Percentage of women in STEM programmes (SDG 5).

• Enrolment rates for marginalised groups (SDG 10).

• Number of partnerships established with international HEIs.

To mathematically represent measures and benchmarks, we have added a hypothetical HEI scenario with numerical targets and metrics tied to SDG pathways.

8.3 Prism transformation with measures and benchmarks

$$\left(\sum_{i=4,\,5,\,10,\,17} SDG_i \right) \underline{SDG\ Prism\ Framework}$$

$$\rightarrow \{Digital\ Transformation, Equity\ and\ Inclusivity, Graduate\ Employability\}$$

Where input (SDG goals):
SDG (4) → Increase access to inclusive education.
SDG (5) → Achieve gender parity in higher education.
SDG (10) → Reduce inequalities in access to education.
SDG (17) → Strengthen partnerships to support education initiatives.

$$SDG4 + SDG5 + SDG10 + SDG17 = Broad\ SDG\ Inputs.$$

Associated measures are broken down:

• SDG 4 — 80% of all HEI programmes offer digital access by 2026.

• SDG 5 — Achieve a 50:50 gender ratio in STEM fields by 2030.

• SDG 10 — Provide scholarships to 20% of enrolled students from underprivileged groups by 2027.

• SDG 17 — Establish partnerships with at least 10 global institutions by 2026.

Therefore, the prism framework is applied to these goals and defined metrics against HEI benchmarks.

Overlayed outputs with HEI benchmarks and targets:
O1. Digital transformation

$$Benchmark: P_{Digital} = \frac{Programmes\ with\ digital\ access}{Total\ programmes} \times 100$$

$$Target: P_{Digital} \geq 80\%\ by\ 2026$$

O2. Equity and inclusion

$$Benchmark: G_{STEM} = \frac{Female\ STEM\ students}{Total\ STEM\ students} \times 100$$

$$Target: G_{STEM} = 50\%\ by\ 2030$$

O3. Graduate employability

$$\text{Benchmark}: E_{Internships} = \tfrac{Female\ STEM\ students}{Totaak\ STEM\ students} \times 100$$

$$\text{Target}: E_{Internships} \geq 80\%\ by\ 2026$$

O4. Global partnerships

$$\text{Benchmark}: P_{Partners} = (x)\ number\ of\ active\ partnerships$$

$$\text{Target}: P_{Partners} \geq 10\ by\ 2026$$

In respect to real world HEI application, the Prism Framework could integrate multiple variables for tracking measures and benchmarks as part of its transformation process [1, 2]. HEIs can expand this formula and model SDG implementation to incorporate advanced concepts that quantify outcomes, correlations, and efficiency in ways previous studies have not explored.

8.4 Weighted priority function for SDG goals

Not all SDGs may have equal priority within specific institutional contexts. HEIs should be able to distribute resources and efforts proportionally.

$$W_{SDG} = \sum_{i=1}^{n}(P_i \times R_i)$$

Where:
W_{SDG} denotes weighted priority for a specific SDG.
P_i defines the priority assigned to SDG 'i' (scale of 0–1, based on HEI importance in context.
R_i represents the resources allocated to SDG 'i' (e.g., budget, time, or labour force required).
n = total (x) number of SDGs being analysed.
If, for example, a HEI's SDG 4 (education) has $P4 = 0.6$ and $R4 = £500{,}000$ while SDG 5 (gender equality) has 0.4 and $R5 = £300{,}000$:

$$W_{SDG} = (0.6 \times 500{,}000) + (0.4 \times 300{,}000)$$

This function helps institutions prioritise efforts mathematically, without falling victim to superficial evaluations that are either overly unrealistic or insufficiently tailored to HEI needs.

8.5 Opportunity gap index

This variation of the formula is appropriate for measuring inequality in SDG-related opportunities (e.g., within educational access, outcomes and employment).

$$OGI = 1 - \frac{Access\ for\ marginalised\ groups}{Access\ for\ privileged\ groups}$$

$$OGI > 0 : Perfect\ equality\ (equal\ access\ for\ both\ groups)$$

If an HEI report statistics of 70% for marginalised groups and privileged groups in terms of access, the calculation would be:

$$OGI = 1 - \frac{70}{90} = 0.22$$

An OGI of 0.22 indicates a moderate opportunity gap that requires intervention.

8.6 Digital transformation efficiency

To evaluate the efficiency of digital transformation in HEIs, a digital efficiency score (DES) can measure the impact of digital resources on outcomes. We took the unique needs that relate to individual levels of digital maturity in HEIs. Effective digital transformation is a difficult problem to crack in any sector, although HE is a few steps behind other sectors. We consider the impact of digital leadership and resources on outcomes in the SDG Prism Framework.

$$DES = -\frac{Impact\ metric\ (x)}{Digital\ investment\ (cost)} = 0.0003$$

We use metrics of average grades, retention rates and employability outcomes as data for the formula outlined below:

Student performance improvement is 15%.

Investment in digital infrastructure yields £50,000

$$DES = -\frac{15}{50,000} = 0.0003$$

This value keeps institutions informed regarding financial comparisons and return on investment (ROI) of digital initiatives.

8.7 SDG interaction coefficient

However, for direct measures of SDG interaction in HEIs, we propose analysing the SDG integration co-efficient (SIC) to measure the synergy or trade-off between two goals. This method assesses how the efforts for SDG 4 impact SDG 10 as input measures.

$$SIC\Delta_{i,j} = -\frac{\Delta SDG_j}{\Delta SDG_i}$$

Where:
$SIC\Delta i$: Improvement in SDG "i" could be a percentage increase in access to education.
$SIC\Delta j$: Change in SDG "j" may observe a reduction in inequality.
Therefore, the HEI aims to improve SDG 4 by 10% to reduce inequality in SDG 5 by 5%.

$$SIC\Delta_{4,10} = \frac{5}{10} = 0.5$$

To interpret the results, a positive SIC indicates synergy, while a negative SIC indicates a trade-off. This formula observes the interaction effects and explicitly

quantifies the relationship between two SDGs in HEI implementation. We noted that while trade-offs and synergies are frequently discussed conceptually in SDG literature, a precise formula is rarely applied. This raised the question: what if HEIs wanted to assess progress across multiple SDGs simultaneously? This led to the development of the SPI calculation incorporating a composite measure of progress across multiple SDGs, weighted according to institutional goals.

8.8 Sustainability progress index

$$SPI = \frac{\sum_{i=1}^{n}(P_i \times S_i)}{\sum_{i=1}^{n} P_i}$$

Where:

- P_i is the priority SDG

- S_i measures the success of SDG i (in this case we used percentage achieved)

- n is the total number of SDGs

If SDG 4 has $P4,= 0.5$, $S4,= 80\%$, and SDG 10 has $P10,= 0.5$, $S10 = 60\%$. With the formula expanded,

$$SPI = \frac{(0.5 \times 80) + (0.5 \times 60)}{0.5 + 0.5} = \frac{40 + 30}{1} = 70\%$$

An SPI of 70% shows overall progress toward institutional sustainability goals.

8.9 Partnership model

Partnership effectiveness should be tracked to examine whether their contribution has an impact on HEI outcomes. International higher education partnerships contribute significantly to the SDGs. The onus is on HEIs to measure the effectiveness of SDG 17 in action to monitor outcomes delivered by partnerships.

Partnership models are discussed extensively in SDG 17 implementation, although their effectiveness is typically assessed qualitatively or through case studies. Thus, we introduce using the PES formula to measure partnership effectiveness in a replicable way for tracking partnerships' contributions to SDG-related goals in HEIs.

This can be done by using the partnership model below:

The PES applies a metric to outcomes delivered by partnerships (40) and outcomes without partnerships (25).

$$PES = \frac{40}{25} = 1.6 \tag{1}$$

A PES of >1 indicates that partnerships are highly effective in delivering results.

9. Discussion

Findings from Part 1 and Part 2 of the analysis suggest that a hybrid approach is more suitable for HEI application of the SDG Prism Framework. Several strategic recommendations should be adopted by HEIs alongside measurable micro-targets to ensure broader SDG goals are translated into actionable outcomes. These outcomes can be effectively tracked using the SPI formula described in Part 2. In this regard, the OGI methods further support the quantification of disparities and the design of targeted interventions that are better aligned with specific institutional realities [14, 30, 32].

HEI tracking of the SDGS is quite challenging due to their broad and ambitious scope overshadowing accurate measurement [14, 32]. The goals lack in availability, reliability, and completeness of data, particularly in developing regions [14, 16, 19, 30, 32]. Moreover, the interlinkages between goals further complicate progress assessment, as advancements in one area can influence or be influenced by other areas. These challenges are compounded by resource constraints and varying local contexts.

Based on the outcome of our study, we recommend that these obstacles can be mitigated by breaking down the overarching goals into smaller, more management targets to optimise the data collection mechanisms through strategic formats and tools for HEI-specific SDG tracking.

9.1 The role of digital leadership in HEIs

Importantly, integrating quantitative models with qualitative insights is needed to avoid oversimplifying metrics. Senior leaders overseeing HEI processes in these turbulent times should be trained to understand what it means to effect change [66]. Although everyone in HEIs will be impacted by digital transformation, it falls to senior leaders, governors, managers and change agents to create, lead and implement them [2, 3, 64]. Digital leadership in HEIs is about creating a vision for digital transformation to seize opportunities [2, 60].

What differs in our recommendations is the call for HEIs to catalyse digital transformation in support of their core missions and institutional objectives [2, 66]. Coordination plays a role across a range of different roles and departments, where HEI senior leadership teams are expected to model effective digital leadership and engage stakeholders accordingly [5, 6, 59]. For digital transformation strategies to be realised, we suggest using the DES to calculate investments in digital infrastructure and avoid exacerbating inequalities by assessing measures in a manner that is not myopic. Digital leaders in HEIs must subject their institutional partnerships to assessments and measure whether these collaborations produce an observable impact [60].

9.2 The SDG Prism Framework in action

Evidence extracted from the analysis makes developing quantitative measures in partnership effectiveness imperative for guiding HEI outcome. What HEIs define as a measure of effectiveness is calculated using the PES formula in conjunction with the trade-offs between SDGs through the SIC, as some initiatives may inadvertently conflict with others. We advocate a decolonial approach to SDG strategisation to prevent western-centric frameworks from detracting away from knowledge systems. Therefore, reforming KPI structures is necessary to progress beyond superficial "tick-box"

approaches reviewed in the literature, and prioritise impact-driven assessment models [36]. These models developed and/or adapted in Part 2 help HEIs empirically measure whether the goals truly have a lasting and transformative impact.

We acknowledge that emerging models and frameworks have sought to incorporate SDG-related metrics into the evaluation of digital transformation as they remain largely fragmented and underdeveloped in their scope and execution [64, 65]. Existing digital transformation frameworks, impact evaluation frameworks, and Sustainability Progress Index adaptations offer some merit in the alignment of digital initiatives within specific SDG targets [4, 65]. However, these models tend to lack the requisite depth, precision, and systematic applicability relevant for integration [4]. Despite their potential, they fail to holistically account for the multifaceted nature of digital transformation [4, 67]. Our contributions aim to dismantle the "one-size-fits-all" mentality imposed by traditional KPIs [32, 36, 68].

10. Conclusion

Our work introduces a framework that decisively confronts the inadequacies dominating current mainstream approaches. It refines nebulous SDG targets into actionable and measurable objectives that resonate with contemporary education. Digital transformation initiatives are intricately connected with SDG outcomes to inform institutional directives from the ground up. The incorporation of decolonial perspectives narrows an impact-oriented approach. In essence, this study challenged the conventional reliance on reductive KPIs and promotes the need for real, substantive change.

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